SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION. ART. SCIENCE. MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLVI.—No. 21. [NEW SERIES.] NEW YORK, MAY 27, 1882. [$3.20 per Annum. [POSTAGE PREPAID.]

Preparation of Lactic Acid.

Kiliani uses inverted sugar for making lactic acid. His method is as follows: 500 grammes of cane or beet sugar are dissolved in 250 grammes of water and 10 c. c. of dilute sulphuric acid added, and the sugar inverted by heating it to 50° C. (122° Fahr.) for three hours; neutralized with 400 c. c. soda solution (1 solid caustic soda to 1 water) added in portions of 50 c.c. each and cooled; warmed for a long time to 60° or 70° C. (140° to 158° Fahr.), until Febling's solution is turned to faint green. Sulphuric acid (3 acid to 4 water) is run into the mixture when cold. After it cools again, a few crystals of Glauber salt are thrown in to make it crystallize. After 24 hours 93 p.c alcohol is poured over it, and the liquor exhausted with a filter pump. The alcoholic solution is put on a water bath and neutralized with carbonate of zinc, and after filtering is added to the other half. The lactate of zinc crystallizes out rapidly, and is purified by pressing or sucking out and recrystallizing. The yield is 30 or 40 per cent. of the weight of the sugar used. —*Chem. Zeit.*

LIFE-SAVING APPARATUS AT THE RECENT NAVAL AND SUBMARINE EXHIBITION.

We give engravings (for which we are indebted to the *Engineer*) of a variety of life-saving apparatus, shown at the recent Naval and Submarine Exhibition, London, England.

Figure 1 shows a "bridge life-boat," by John White, Medina Dock, Cowes. This life-boat is held on the bridge athwart ship, which consists of a launching way pivoting horizontally at the center, so that either end can be tipped down to the gunwale on either side when, the dog shores being struck, the lifeboat shoots into the water. Any water shipped is discharged through valves, and the boat is easily launched. The Orontes has long been fitted with this boat bridge, which has been so highly approved of that the system has been now adopted for the Tamar and Himalaya. This boat carries from 150 to 200 men Filled with water she would support 100.

Fig. 2 is Roper's life raft, forming a captain's bridge. Its weight is given as 5¼ tons, floating power 80 tons. It is intended to be self-launching on its fastenings being released. Mr. Roper has also self-floating raft decks for river boats. These simply rest by their weight in their place. If a vessel settled down in smooth water they are designed to float off with the passengers. A model of the ill-fated Princess Alice is fitted with decks which are calculated to support

(*Continued on page 332.*)

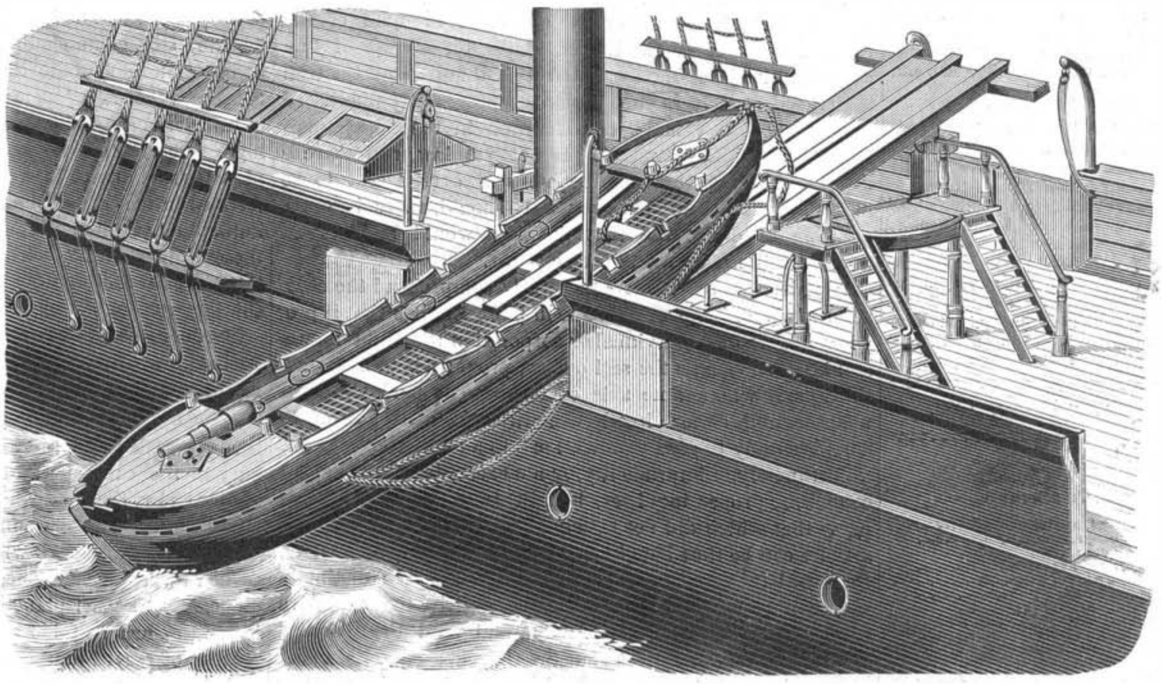
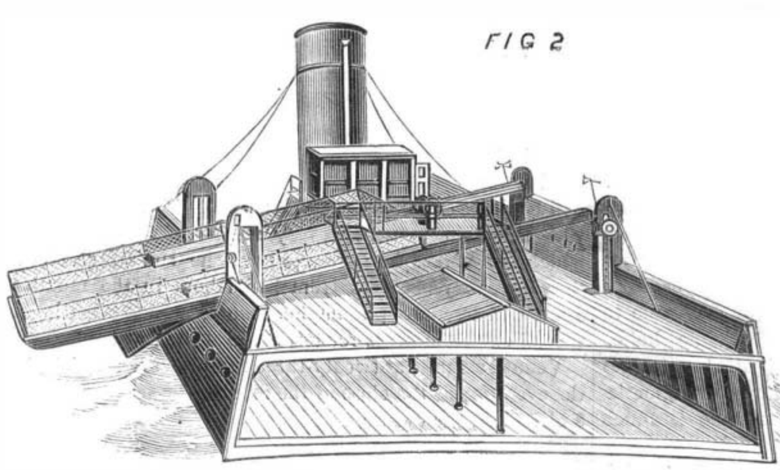
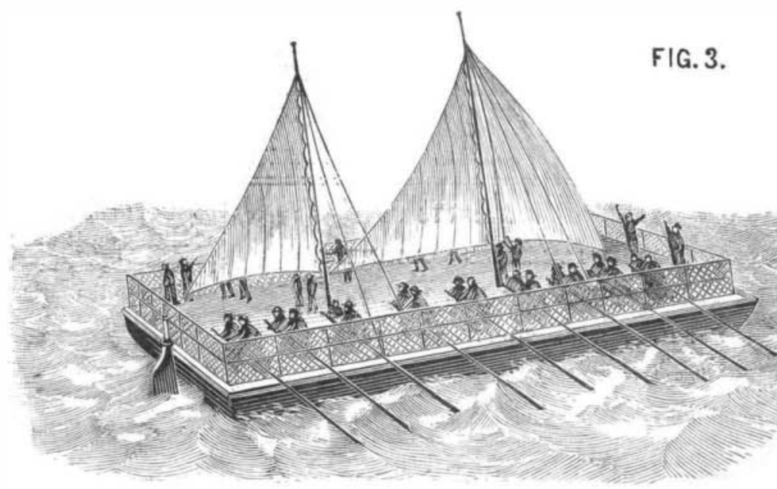


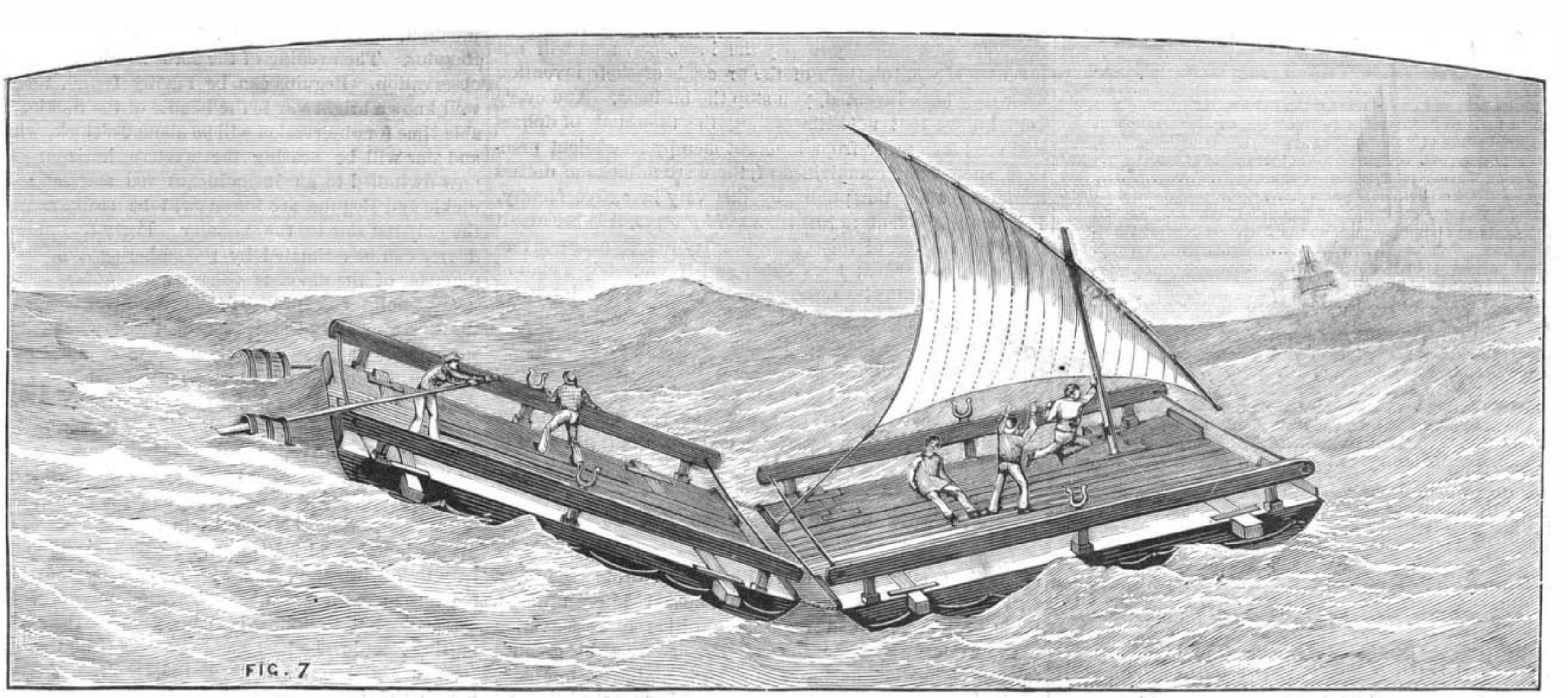
Fig. 1.—WHITE'S BRIDGE LIFE BOAT.



ROPER'S LIFE RAFT.



ROSE'S LIFE BUOY SEAT.



COPEMAN'S SEAT RAFT.

LIFE-SAVING APPLIANCES AT THE NAVAL AND SUBMARINE EXHIBITION, LONDON.

LIFE-SAVING APPARATUS AT THE RECENT NAVAL AND SUBMARINE EXHIBITION.

(Continued from first page.)

900 passengers. The decks proposed are fore and main and fore and aft saloon decks, and sponson house tops. The design took a first prize at the aquarium. Figs. 2 and 3 show the raft on deck and afloat. This raft took the 100 guinea prize at Islington.

Rose's life-buoy seat, shown in Fig. 3, consists of two thin iron buckets screwed together at the bottom, with tops closed. They may be used as buckets, or a buoy, or to render a hencoop seat buoyant—*vide* Figs. 4, 5, and 6. The cushions of the hencoop seats are life belts. A specimen made for Sir T. Brassey's yacht, the Sunbeam, was shown.

Copeman, of Downham Market, exhibited a raft constructed of seats by means of connecting rods, spars, and grating seats. This was put together by two men in less than two minutes repeatedly at the Exhibition (see Fig. 7). It is a very serviceable, strong, and simple arrangement. The inventor claims that the expense is small—about $25 extra on each seat; that the space occupied is no more than that of ordinary seats; that it is always ready for use, and when in the water cannot be upset. Masts and oars are carried. The strength and simplicity of this will probably commend it. It is to be tried shortly for the Prince of Wales.

The wreck escape, shown in Figs. 8, 9, and 10, is the work of Mr. Hodgson, another practical man eminently qualified to judge as to what may be done in a moment of danger, having earned eight or nine medals for saving life himself, and also so ready to point out anything good in designs of others, that one must respect the honesty of his opinions. Two wreck escapes, one of wood tubes and cells, the other steel, weight 7 to 17 cwt., supporting twenty to seventy-five men; rope bottom reversible; may be used as an ordinary boat, the resistance being brought down to much less than is usual in bottomless boats. It is stated that it has been actually tried and obtained good speed. The form appears to be a very good one for a bottomless boat. It was tried with success before Admiral Mends in 1869. It is, we believe, the first and also the best reversible boat. It is possible for a man under it to open the ropes asunder and creep through the bottom.

PREPARATION OF ALUMINUM.—Aluminum sulphide is obtained from powdered cryolite; and it is then decomposed by heating to redness with iron turnings. The cryolite is first dissolved in water, which dissolves out the sodium fluoride. The residue, aluminum fluoride, is calcined with calcium sulphide, the results being aluminum sulphide and calcium fluoride.

Inspection of Locomotive Boilers.

The following regulations for the inspection and test of locomotive boilers have been adopted and published by the Massachusetts Railroad Commissioners under the provisions of chapter 73 of the acts of 1882:

1. All boilers for locomotives, before going into service, must be subjected to a hydraulic pressure of 150 pounds per square inch. 2. The water must be heated to near the boiling point. 3. This test must be repeated at least once a year. 4. The superintendent of motive power, master mechanic, or other proper agent of the company will attend in person. He will remain outside, while an assistant will examine the fire box from the inside. 5. A record of all tests will be made, giving dates and anything worthy of mention, and communicated to the board. 6. Special examination of the stay bolts of locomotives in service should be made not less frequently than once in three months. 7. When these examinations are made, all the water must be drawn from the boiler, so that the vibration of the sheet may indicate any unsoundness of the stay bolt when it is struck with the hammer. The board urgently recommends, in addition to these regulations, that the four upper rows of stay bolts shall be drilled from the outside three-fourths of an inch in depth and three-sixteenths of an inch in diameter.

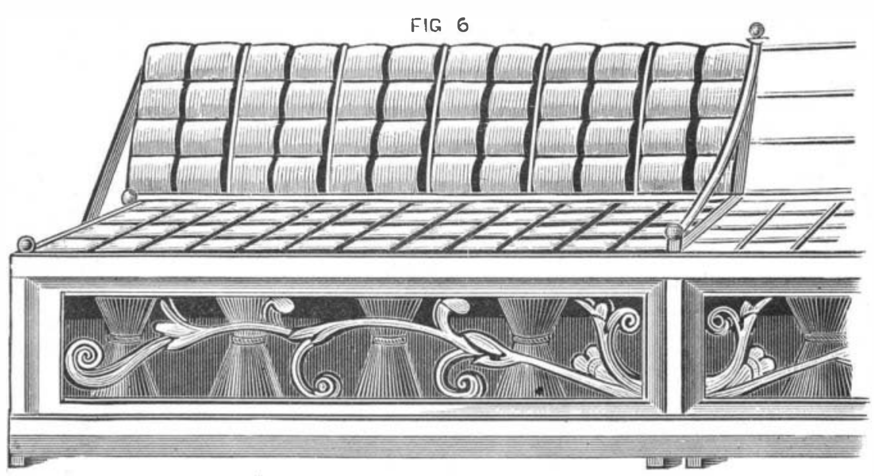
Coal by Wire.

The proposal of Sir Henry Bessemer to bring coal by wire, instead of by rail, is very simple. Although coal is still our great agent in the production of motive power, it must not be forgotten that Sir William Thomson has clearly shown that by the use of dynamo-electric machines, worked by the Falls of Niagara, motive power could be generated to an almost unlimited extent, and that no less than 26,250 horse-power so obtained could be conveyed to a distance of 300 miles by means of a single copper wire of half an inch in diameter, with a loss in transmission of not more than 20 per cent., and hence delivering at the other end of the wire 21,000 horse-power. Sir Henry exclaims, "What a magnificent vista of legitimate mercantile enterprise this simple fact opens up for our own country! Why should we not at once connect London with one of our nearest coal-fields by means of a copper road of one inch in diameter and capable of transmitting 84,000 horse power to London, and thus practically bring up the coal by wire instead of by rail?" He supplies the equivalent in coal of this amount of motive power. Assuming that each horse-power can be generated by the consumption of 3 lb. of coal per hour, and that the engines work six days and a half per week, we should require an annual consumption of coal equal to 1,012,600 tons to produce such a result. Now, all this coal would, in the case assumed, be burned at the pit's mouth at the cost of 6s. per ton for large and 2s. per ton for small coal—that is, at less than one-fourth the cost of coal in London. This would immensely reduce the cost of electric light, and of the motive power now used in London for such a vast variety of purposes, and at the same time save us from the enormous volumes of smoke and foul gases which this million of tons of coal would make if burned in our midst. A 1-inch diameter copper rod would cost about £533 per mile, and, if laid to a colliery 120 miles away, the interest at 5 per cent. on its first cost would be less than 1d. per ton on the coal practically conveyed by it direct into the house of the consumer.—*Iron.*

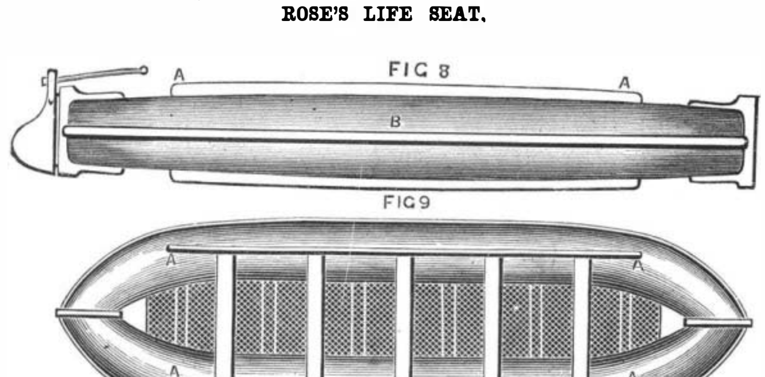
Furniture Polish.

A. Messer, of Berlin, dissolves 3 kilos of shellac in about 15 to 20 liters of pure spirits (alcohol), and then mixes this with another obtained by dissolving 100 grammes of gun cotton in 100 grammes of high-grade sulphuric ether to which is added 50 grammes camphor and enough 96 per cent. alcohol to completely dissolve the mass. This polish is finally rubbed up with pure linseed oil. To 100 parts of it, 5 parts of a saturated solution of camphor in oil of rosemary are then added. A very dilute solution of benzole in alcohol is used for polishing off.

Figs. 4 and 5.—ROSE'S LIFE BUOYS.



ROSE'S LIFE SEAT.



HODGSON'S WRECK ESCAPE.

The Lamson Case.

Among the affidavits bearing on the case of Dr. Lamson received by Mr. A. W. Mills, the prisoner's solicitor, was one by Dr. H. H. Kane, who has charge of a hospital in New York devoted to the treatment of persons habituated to the use of opium and other drugs. He is described as author of the following works on the subject: "The Hypodermic Injection of Morphia; its History, Advantages, and Dangers," New York, 1879; "Drugs that Enslave; a Study of the Opium, Morphine, Chloral, and Hashisch Habits," Philadelphia, 1881; and "Opium Smoking in America and China," New York, 1882. Aftermentioning that the majority of his patients are and have been physicians or druggists, and dwelling upon the tendency to carelessness in prescribing morphia and other drugs which he had noticed in the case of those who had become accustomed to use such large doses of such drugs themselves, Dr. Kane remarks that, as regards the question of insanity from the habitual use of opium or its alkaloids, more especially morphia, but little definite is known. Insane asylum reports every year record from one to eight or nine cases of insanity attributed to the prolonged use of opiates, and physicians in general practice recognize the use of narcotics as a rare, though well-established, cause of insanity. A person with a hereditary tendency to insanity, or with a mind weakened from any combination of circumstances, or from actual bodily disease, using this drug in large amount for a considerable time, could hardly escape some unsettling of his mental and moral powers. In the majority of instances the insanity thus produced is chiefly marked by weakening of the will power, entire change of the moral tone, loss of business ability, sundering of family ties, and carelessness about the ordinary duties of life. Actual mania, melancholia, and dementia are probably rare, but have undoubtedly occurred from this cause. Some persons inherit or acquire in after life an idiosyncrasy which renders them more susceptible to the physical, mental, and moral ill effects of opium than obtains in the ordinary individual, and a like idiosyncrasy has been known to lead to death from doses previously considered safe. This is especially true with reference to the hypodermic use of morphia. Certain persons can take large doses of opium for years with impunity, while others, of a peculiarly nervous temperament, are injured out of all proportion to the time the drug has been used or the amount taken. In the majority of cases, habitual users stop short of actual insanity as ordinarily classed, although they manifest marked deterioration or total abolition of will power and memory. A tendency to lie with reference to their habit, inattention to family and business, and the manifestation of a very decided change in moral tone may be marked. Dr. Kane would say, in conclusion, that of all forms of the opium habit, that of hypodermic injection as a rule works the most harm in the shortest time.—*London Times.*

The Loess of North America.

The distribution of the loess formation in the Central basin of the United States is summed up as follows by Mr. R. E. Call, in a recent issue of the *American Naturalist:*

It is found in the States of Ohio, Indiana, Michigan, Iowa, Kansas, Nebraska, Illinois, Tennessee, Alabama, Mississippi, Louisiana, Arkansas, Missouri, Kentucky, and in the Indian Territory; but *in every instance* is apparently confined to the higher lands along the larger streams. Its superficial extent is greatest in Nebraska, where, according to Aughey, its area is three-fourths that of the State, or 56,994 square miles. In Iowa its superficial area is estimated by White at about 5,000 square miles, but his calculations included only those sections along the Missouri, inasmuch as he was evidently unacquainted with its existence in Central Iowa, and in the eastern portion of the State. Its area appears to be next greater in Missouri, which is, indeed, but the southern extension of the Iowa and Nebraska deposit. In most of the other States where it occurs its area is comparatively small. It is not found outside of the central basin. Its material is exceedingly fine, very silicious as proven by numerous analyses, ashy color with slight yellowish tinge—normally; and often highly calcareous. In all these repects it agrees entirely with published descriptions of foreign loess. *In situ* it presents a remarkably homogeneous structure, usually appearing in massive walls without, or with but faint lamellation, the latter feature being purely local. So perfect is the homogeneity that very careful examinations of specimens of soil from the Missouri valley and the valleys of the Des Moines and Iowa rivers failed to reveal even slightly marked physical differences.

SOAPSTONE ground fine can be moulded into different shapes by mixing with water-glass, and when dried closely resembles the natural stone.

The Rabbit Pest in Australia.

The Chief Inspector of Stock of Victoria, Australia, gives in a recent official report the following account of the rabbit pest in that colony:

Rabbits are to be found, less or more, all over the western and northwestern portions of Victoria, and as far up the Murray as the Owens River, but in no great numbers as yet, and from Echuca upward they are principally confined to the banks of the river. In the western districts they are very numerous and destructive, and in the Wimmera, where the country is comparatively scrubby and poor, it may be said they have all but taken possession of the crown lands, and to a large extent also of the alienated land. On one property alone in the Colac district it is said that between $150,000 and $200,000 have been spent in destroying rabbits, while some owners are paying as much as $10,000 a year to keep them down, many $5,000 a year, and almost every holder of land is year by year put to a considerable expense in protecting his pasture and crops from these pests.

A great many modes of dealing with this evil have been tried in Victoria, viz., fencing the rabbits out, shooting, hunting with dogs, ferreting and netting, snaring and trapping, digging out and blocking up the burrows, and destroying the rabbits with noxious gas and poison. In all these modes, again, the work is at times done by the owner's own men, sometimes by contract, and at other times under the bonus system. When the rabbits are to be fenced out a wire netting, 4 feet broad, with 2½ inch mesh, is put on an ordinary wire fence, the netting to the extent of one foot being bent and put in the ground at an angle to prevent the rabbits from burrowing. They try to do so close at the foot of the fence, but stop when they come upon the netting. The cost of the netting for a fence rabbit-proof of this sort is about $250 a mile; and if it is found that rabbits cross the Murray after our land is cleared, and Victoria continues to be infested, it may be necessary to run a rabbit-proof fence along the river to keep them from again obtaining a footing in this colony. Dogs (terriers, cockers, and other dogs which hunt by scent) and guns are generally used together, though sometimes kangaroo dogs and greyhounds are taken out with the terriers to kill the rabbits they put up. Where the rabbits have made a settlement the most effective, but the most expensive, way is to dig them out, or, where it can be done (in rocky and stony ground) to block up the burrows and starve the rabbits in their holes. Ferreting and netting is also a very successful mode of destroying them; but ferrets are comparatively scarce, they are liable to be lost, and every one cannot manage them. A good many have also been taken in traps and snares, but these appliances are also expensive and comparatively slow.

The exterminator (the machine employed to charge the burrows with noxious gas) is also in some cases an effective mode, but it is expensive, and the machine is cumbersome and unwieldy to take about, while the holes at times in the warrens are of such a sort (as in the case of bilbee and wombat holes, of which the rabbits take possession) as to render the gas inoperative; and in other cases there are fissures in the ground which allow it to escape. A good many different sorts of poison have been laid, and in a great many different vehicles.

(1.) *The Poison.*—The poisons most frequently used have been arsenic and phosphorus, and in a few cases strychnine. Arsenic has been longest used, generally in conjunction with sugar and bran. Phosphorus, again, has been more recently tried, and is now far more generally laid than any other poison.

(2.) *The Vehicle.*—A mixture of crushed wheat and sugar, or bran and sugar, has been found an excellent vehicle, so far as destroying the rabbits is concerned, but the mixture is dangerous for stock, more especially sheep. Whole wheat has been used successfully, with arsenic, and latterly with phosphorus, but does not seem to retain the poison so long as the oats, and is more liable to be eaten by sheep. Oats have within the last few years been employed very successfully and extensively as a vehicle for phosphorus. Carrots have also been tried with good results as a vehicle for arsenic. This is what was to be expected, as all animals are fond of carrots, but the supply is comparatively limited, and in many cases they cannot be laid without endangering the stock; they are poisoned by bruising the outside and strewing it with arsenic. Potatoes have been used successfully as a vehicle for strychnine, and could of course also be used for other poisons, especially arsenic. Turnips, pumpkins, and melons could be used in the same way as carrots; and cabbage leaves, turnip tops, green corn, and sorghum could also be made vehicles by slitting or opening them, where there is room, and laying the poison in slits or openings. But all these, like carrots and potatoes, can only be used where the stock can be removed from the paddock, or where these vehicles can be laid where the stock cannot get them. In cases, however, where the rabbits have been reduced in number, and it is of course of great importance to complete their destruction, sufficient precautions could be taken by laying down hollow logs, digging holes in the ground, fencing off small patches, and in other ways to keep the stock from reaching the poisoned vehicle.

Oil of rhodium has been employed successfully in conjunction with some of these vehicles as an attraction for the rabbits, and, although expensive, might be added where they cannot otherwise be induced to take the poison, or it might be so to make them take it more readily. The reports under this head are very conflicting with regard to effect of poisoned grain. It is allowed that the poisoned grain is not nearly so successful when the grass is green and plentiful as it is when dry and scarce. It is also generally allowed that while oats and wheat poisoned with phosphorus have at first been successful in destroying the rabbits, it is at the same time the opinion that the rabbits after a time cease to take either the one or the other. I think, however, that these results are only what were to be expected. When the grass is plentiful and green not only will the rabbits be comparatively careless about food such as oats or wheat, but they will not be so likely to see the grain on the ground as they would when the grass is brown and bare. Then, again, all animals are endowed in a greater or less degree with the instinct which leads them to refuse to take what they see is destroying them. The rabbits would at first—and perhaps for a little time in the case of arsenic, and longer in that of phosphorus, which is a slow poison—take the grain; but as soon as those which took it began to die in any number the others would stop eating the grain. It is well known that the same thing happens where poison is laid for native dogs, rats, and other animals.

Although I think the failure of the attempts made in Victoria to destroy the rabbits with poison is largely due to not changing the vehicle in which the poison was laid, the main cause of the failure there has, in my opinion, been the want of simultaneous action on the part of the owners whose land was infested with rabbits. The law in Victoria is only applicable to a portion of the lands of the colony—that alienated by the crown; and even in the case of land to which the law does apply it has very seldom been enforced, for it has provided no penalty for neglecting to destroy. There the defaulting owner can only be compelled to do so by the shire councils—who have the carrying out of the act—putting men on the defaulter's holding to destroy the rabbits, and, like our own boards of directors, these councils dislike to exercise this power, and have seldom or never done so. The result has been, that while some owners did all they could to clear their land, others did nothing. The rabbits are, therefore, increasing in some districts; as numerous as ever in others; and, although a great many have been destroyed, their spread has not been really checked, for they are every other month making their appearance in fresh districts. Under these circumstances, it is not surprising that in Victoria owners speak hopelessly of being able, except at an expense which would be most oppressive, to do more than keep the rabbits down; but there is little doubt that the result there would have been altogether different had owners been compelled, as they can be in this colony—and as I trust they will be—to carry out the work of extermination promptly and simultaneously on all the holdings.

Chlorate of Potash Explosions.

Potassium chlorate, generally known as chlorate of potash ($2KClO_3$) is composed, as to its distinctive constituents (*i. e.*, apart from its oxygen), of the non-metallic gaseous element, chlorine, and the soft metal, potassium, which is lighter than water, and melts at about the temperature of 145° F. In other words, chlorate of potash is an association of chloric acid (ClO_3) with two atoms of potassium. We believe that the acid has never been obtained in its anhydrous state. As combined with water it is a thick liquid, which sets on fire dry organic substances with which it comes in contact. The chloride of potash, being free of oxygen, has not the ignitive characteristics of the chlorate. Chlorine is a feeble supporter of combustion, but its affinity for hydrogen gives to it certain striking combustive relations in specific proportional combination, largely affected, however, by conditions of temperature, light, and exciting mechanical force. The two elements will not combine spontaneously in the dark—light, according to its degree, causes somewhat gradual combination, producing the suffocative hydrochloric acid (so to speak, an imperfect combustion); but in the direct rays of the sun the instantaneous union makes an explosive combustion. Potassium combines with oxygen with great avidity—hence result the violent reactions shown in the common experiment of throwing some potassium upon water; hydrogen is set free, and burns with the potassium; ultimately a fused globule of caustic potash (hydrate of potassium) remains, which unites with the water below with a sharp explosion.

Hydrogen will burn in an atmosphere of chlorine, where carbon will not. With heat or friction chlorate of potash united with sulphur, charcoal, etc., undergoes dissociation of elements. In heating the chlorate of potash alone, first oxidation proceeds to the perchlorate stage, then complete deoxidation follows, and a chloride of potash remains.

We make these remarks as introductory to an account of an explosion which we take from the Australasian supplement to the *Chemist and Druggist* (London), and will add that in December last we made reference also to the subject of the danger arising from neglect of precaution in handling chlorate of potash.

"A shocking occurrence took place at Wellington, N. Z., on December 21 last, by which a lady was literally blown to pieces and a building partially wrecked. The facts are as follows: At the shop of Mr. Barraud, chemist, London Quay, some blue fire was in course of preparation for use at the theater. On testing a small portion of the mixture it was found dangerously explosive, too much chlorate of potash having been inadvertently used in the composition. Accordingly, Barraud's assistant, named Anthony, took it out in the back yard, and began to destroy it by slow combustion. He had occasion to leave for an instant, and before he could return his wife happened to go into the yard, and seeing chemicals on fire, at once threw a bucket of water on the burning mass. A terrific explosion immediately took place, which shook the whole city, and was heard at a distance of some miles. Mrs. Anthony received the full force of the shock, and was frightfully mutilated. Both arms were torn off, also one leg, the lower jaw, and the scalp. Wonderful to relate, she lingered for some time. All the windows in the vicinity were smashed, and other damage done. The stone mortar in which the composition had been mixed was hurled many feet into the air, and thrown clear over the tops of the houses into the next street. Fortunately nobody else was injured. This dreadful occurrence created a profound sensation in this city."

Some points are worthy of special attention in connection with this event. In the *blue* pyrotechnic compound there was possibly some sulphate; but the question to consider is, whether explosion was dominantly due to dissociation of the water or dissociation of the chlorate. We note:

1. Another instance is given that a compound dangerously explosive can burn by moderate combustion without explosion.

2. There is every probability that the explosion was occasioned by hydrogen liberated by the instantaneous dissociation of a portion of the water. It will be inferred that such effect was more likely to have been produced from a spray of water than from a large body of water.

3. It is possible that the sudden shock of a comparatively large body of water thrown upon the contents of a small mortar aided to increase the force of the explosion. In other words, the molecular constituents of a salt being, as it were, in a state of high tension, or vibration, and almost ready to explode, may be driven to explosion simply by the shock of a liquid thrown upon them. But the violent dissociation of the elements of water thrown upon an ignited mass would itself be a still greater shock.

In Philadelphia, April 13, a drug clerk compounding a gargle, pulverized separately in the same mortar one ounce of chlorate of potash and one ounce of tannic acid—the latter an organic acid. In the trituration of the two together, with sufficiency of friction, an explosion could be taken for granted, but an explosion followed by simply pouring the powdered tannin upon the powdered potassium compound. The heating of the mortar in rapid pulverization suggests itself as the cause of the accident, and possibly there may have been contact with some dampness.

Some time previous to this, some of the salt had fallen from a full drawer upon the guides supporting a drawer of ferrocyanide of potassium immediately below it, in an Arch street drug store; in pulling out the lower drawer, sufficient friction was caused to result in an explosion, blowing out the drawer violently, and causing considerable damage.

As belonging to the same category of phenomena, we note the "discovery" in San Francisco of a violent explosive, which is made by grinding together *one* part of trinitrophenol (one of the anilines), *one* part of tar, and afterward cautiously adding *five* parts of chlorate of potash.—*Amer. Ex. and Review.*

Improvement in Refining and Crystallizing Starch Sugar.

The sugar made from starch, to which it has been proposed to give the collective name of *amylose*, has hitherto been sold either in solid masses or granulated by scraping in finer grains ready for mixing with cane sugar. F. Soxhlet, of Munich, takes the ordinary starch sugar of commerce and mixes with it 70 or 80 per cent of alcohol of 80° Tralles, or pure wood naphtha (methyl alcohol). Pulverized starch sugar is then added to this sirupy mixture and the whole left to solidify at a temperature *above* 30° C. (86° Fah.), with frequent stirring. The sirup obtained in making starch sugar can also be treated in this way. The mass of crystals thus obtained is pressed and put in a centrifugal machine. The alcohol is recovered by distillation.

For making solid transparent starch sugar (dextrose hydrate, $C_6H_{12}O_6,H_2O$) the starch sugar solution is concentrated in a vacuum to 46° B. (taken at 90° C.), and put in moulds to crystallize at a temperature between 35° and 50° (95° to 122° Fah.). At lower temperatures the well-known warty crystals form.

This method depends, it will be observed, upon the removal of uncrystallizable and unfermentable substances from the sugar by means of ethylic or methylic alcohol, in which grape sugar is itself but slightly soluble.

Prize for Comets and Meteors.

So much extra research, resulting in valuable discoveries, was occasioned by reason of the prizes for astronomical discoveries of last year, that Mr. H. H. Warner, of Rochester, N. Y., has concluded to continue the comet prizes during 1882, together with an additional prize for the discovery of meteors.

Prize first is two hundred dollars in gold, for each discovery of a new comet, made in the United States, Canada, Great Britain, or Ireland.

Prize second, two hundred dollars, for any meteoric stone found in any of the above countries during 1882, that contains fossil remains of animal or vegetable life, thus proving the inhabitability of other planets.

Prize third, fifty dollars, for a specimen of not less than two ounces, of any meteoric stone (whether it contain organic remains or not), seen to fall in the United States during 1882

LIFE-SAVING APPARATUS AT THE RECENT NAVAL AND SUBMARINE EXHIBITION.

(Continued from first page.)

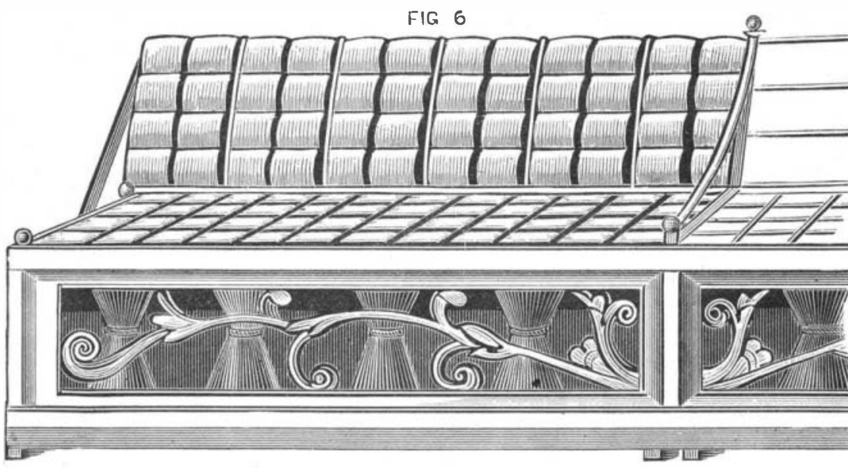
900 passengers. The decks proposed are fore and main and fore and aft saloon decks, and sponson house tops. The design took a first prize at the aquarium. Figs. 2 and 3 show the raft on deck and afloat. This raft took the 100 guinea prize at Islington.

Rose's life-buoy seat, shown in Fig. 3, consists of two thin iron buckets screwed together at the bottom, with tops closed. They may be used as buckets, or a buoy, or to render a hencoop seat buoyant—*vide* Figs. 4, 5, and 6. The cushions of the hencoop seats are life belts. A specimen made for Sir T. Brassey's yacht, the Sunbeam, was shown.

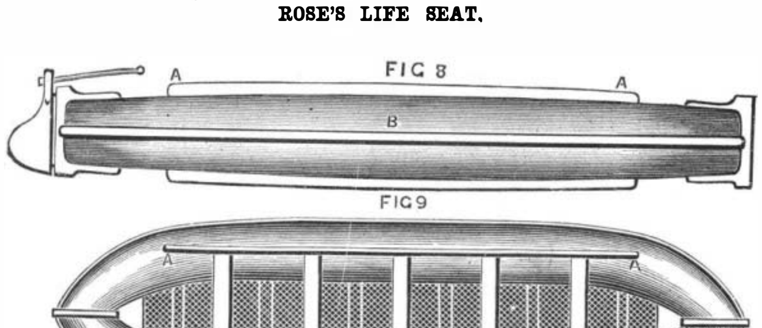
Copeman, of Downham Market, exhibited a raft constructed of seats by means of connecting rods, spars, and grating seats. This was put together by two men in less than two minutes repeatedly at the Exhibition (see Fig. 7). It is a very serviceable, strong, and simple arrangement. The inventor claims that the expense is small—about $25 extra on each seat; that the space occupied is no more than that of ordinary seats; that it is always ready for use, and when in the water cannot be upset. Masts and oars are carried. The strength and simplicity of this will probably commend it. It is to be tried shortly for the Prince of Wales.

The wreck escape, shown in Figs. 8, 9, and 10, is the work of Mr. Hodgson, another practical man eminently qualified to judge as to what may be done in a moment of danger, having earned eight or nine medals for saving life himself, and also so ready to point out anything good in designs of others, that one must respect the honesty of his opinions. Two wreck escapes, one of wood tubes and cells, the other steel, weight 7 to 17 cwt., supporting twenty to seventy-five men; rope bottom reversible; may be used as an ordinary boat, the resistance being brought down to much less than is usual in bottomless boats. It is stated that it has been actually tried and obtained good speed. The form appears to be a very good one for a bottomless boat. It was tried with success before Admiral Mends in 1869. It is, we believe, the first and also the best reversible boat. It is possible for a man under it to open the ropes asunder and creep through the bottom.

Figs. 4 and 5.—ROSE'S LIFE BUOYS.



ROSE'S LIFE SEAT.



HODGSON'S WRECK ESCAPE.

PREPARATION OF ALUMINUM.—Aluminum sulphide is obtained from powdered cryolite; and it is then decomposed by heating to redness with iron turnings. The cryolite is first dissolved in water, which dissolves out the sodium fluoride. The residue, aluminum fluoride, is calcined with calcium sulphide, the results being aluminum sulphide and calcium fluoride.

Inspection of Locomotive Boilers.

The following regulations for the inspection and test of locomotive boilers have been adopted and published by the Massachusetts Railroad Commissioners under the provisions of chapter 73 of the acts of 1882:

1. All boilers for locomotives, before going into service, must be subjected to a hydraulic pressure of 150 pounds per square inch. 2. The water must be heated to near the boiling point. 3. This test must be repeated at least once a year. 4. The superintendent of motive power, master mechanic, or other proper agent of the company will attend in person. He will remain outside, while an assistant will examine the fire box from the inside. 5. A record of all tests will be made, giving dates and anything worthy of mention, and communicated to the board. 6. Special examination of the stay bolts of locomotives in service should be made not less frequently than once in three months. 7. When these examinations are made, all the water must be drawn from the boiler, so that the vibration of the sheet may indicate any unsoundness of the stay bolt when it is struck with the hammer. The board urgently recommends, in addition to these regulations, that the four upper rows of stay bolts shall be drilled from the outside three-fourths of an inch in depth and three-sixteenths of an inch in diameter.

Coal by Wire.

The proposal of Sir Henry Bessemer to bring coal by wire, instead of by rail, is very simple. Although coal is still our great agent in the production of motive power, it must not be forgotten that Sir William Thomson has clearly shown that by the use of dynamo-electric machines, worked by the Falls of Niagara, motive power could be generated to an almost unlimited extent, and that no less than 26,250 horse-power so obtained could be conveyed to a distance of 300 miles by means of a single copper wire of half an inch in diameter, with a loss in transmission of not more than 20 per cent., and hence delivering at the other end of the wire 21,000 horse-power. Sir Henry exclaims, "What a magnificent vista of legitimate mercantile enterprise this simple fact opens up for our own country! Why should we not at once connect London with one of our nearest coal-fields by means of a copper road of one inch in diameter and capable of transmitting 84,000 horse power to London, and thus practically bring up the coal by wire instead of by rail?" He supplies the equivalent in coal of this amount of motive power. Assuming that each horse-power can be generated by the consumption of 3 lb. of coal per hour, and that the engines work six days and a half per week, we should require an annual consumption of coal equal to 1,012,600 tons to produce such a result. Now, all this coal would, in the case assumed, be burned at the pit's mouth at the cost of 6s. per ton for large and 2s. per ton for small coal—that is, at less than one-fourth the cost of coal in London. This would immensely reduce the cost of electric light, and of the motive power now used in London for such a vast variety of purposes, and at the same time save us from the enormous volumes of smoke and foul gases which this million of tons of coal would make if burned in our midst. A 1-inch diameter copper rod would cost about £533 per mile, and, if laid to a colliery 120 miles away, the interest at 5 per cent. on its first cost would be less than 1d. per ton on the coal practically conveyed by it direct into the house of the consumer.—*Iron.*

Furniture Polish.

A. Messer, of Berlin, dissolves 3 kilos of shellac in about 15 to 20 liters of pure spirits (alcohol), and then mixes this with another obtained by dissolving 100 grammes of gun cotton in 100 grammes of high-grade sulphuric ether to which is added 50 grammes camphor and enough 96 per cent. alcohol to completely dissolve the mass. This polish is finally rubbed up with pure linseed oil. To 100 parts of it, 5 parts of a saturated solution of camphor in oil of rosemary are then added. A very dilute solution of benzole in alcohol is used for polishing off.

The Lamson Case.

Among the affidavits bearing on the case of Dr. Lamson received by Mr. A. W. Mills, the prisoner's solicitor, was one by Dr. H. H. Kane, who has charge of a hospital in New York devoted to the treatment of persons habituated to the use of opium and other drugs. He is described as author of the following works on the subject: "The Hypodermic Injection of Morphia; its History, Advantages, and Dangers," New York, 1879; "Drugs that Enslave; a Study of the Opium, Morphine, Chloral, and Hashisch Habits," Philadelphia, 1881; and "Opium Smoking in America and China," New York, 1882. Aftermentioning that the majority of his patients are and have been physicians or druggists, and dwelling upon the tendency to carelessness in prescribing morphia and other drugs which he had noticed in the case of those who had become accustomed to use such large doses of such drugs themselves, Dr. Kane remarks that, as regards the question of insanity from the habitual use of opium or its alkaloids, more especially morphia, but little definite is known. Insane asylum reports every year record from one to eight or nine cases of insanity attributed to the prolonged use of opiates, and physicians in general practice recognize the use of narcotics as a rare, though well-established, cause of insanity. A person with a hereditary tendency to insanity, or with a mind weakened from any combination of circumstances, or from actual bodily disease, using this drug in large amount for a considerable time, could hardly escape some unsettling of his mental and moral powers. In the majority of instances the insanity thus produced is chiefly marked by weakening of the will power, entire change of the moral tone, loss of business ability, sundering of family ties, and carelessness about the ordinary duties of life. Actual mania, melancholia, and dementia are probably rare, but have undoubtedly occurred from this cause. Some persons inherit or acquire in after life an idiosyncrasy which renders them more susceptible to the physical, mental, and moral ill effects of opium than obtains in the ordinary individual, and a like idiosyncrasy has been known to lead to death from doses previously considered safe. This is especially true with reference to the hypodermic use of morphia. Certain persons can take large doses of opium for years with impunity, while others, of a peculiarly nervous temperament, are injured out of all proportion to the time the drug has been used or the amount taken. In the majority of cases, habitual users stop short of actual insanity as ordinarily classed, although they manifest marked deterioration or total abolition of will power and memory. A tendency to lie with reference to their habit, inattention to family and business, and the manifestation of a very decided change in moral tone may be marked. Dr. Kane would say, in conclusion, that of all forms of the opium habit, that of hypodermic injection as a rule works the most harm in the shortest time.—*London Times.*

The Loess of North America.

The distribution of the loess formation in the Central basin of the United States is summed up as follows by Mr. R. E. Call, in a recent issue of the *American Naturalist:*

It is found in the States of Ohio, Indiana, Michigan, Iowa, Kansas, Nebraska, Illinois, Tennessee, Alabama, Mississippi, Louisiana, Arkansas, Missouri, Kentucky, and in the Indian Territory; but *in every instance* is apparently confined to the higher lands along the larger streams. Its superficial extent is greatest in Nebraska, where, according to Aughey, its area is three-fourths that of the State, or 56,994 square miles. In Iowa its superficial area is estimated by White at about 5,000 square miles, but his calculations included only those sections along the Missouri, inasmuch as he was evidently unacquainted with its existence in Central Iowa, and in the eastern portion of the State. Its area appears to be next greater in Missouri, which is, indeed, but the southern extension of the Iowa and Nebraska deposit. In most of the other States where it occurs its area is comparatively small. It is not found outside of the central basin. Its material is exceedingly fine, very silicious as proven by numerous analyses, ashy color with slight yellowish tinge—normally; and often highly calcareous. In all these repects it agrees entirely with published descriptions of foreign loess. *In situ* it presents a remarkably homogeneous structure, usually appearing in massive walls without, or with but faint lamellation, the latter feature being purely local. So perfect is the homogeneity that very careful examinations of specimens of soil from the Missouri valley and the valleys of the Des Moines and Iowa rivers failed to reveal even slightly marked physical differences.

SOAPSTONE ground fine can be moulded into different shapes by mixing with water-glass, and when dried closely resembles the natural stone.

The Rabbit Pest in Australia.

The Chief Inspector of Stock of Victoria, Australia, gives in a recent official report the following account of the rabbit pest in that colony:

Rabbits are to be found, less or more, all over the western and northwestern portions of Victoria, and as far up the Murray as the Owens River, but in no great numbers as yet, and from Echuca upward they are principally confined to the banks of the river. In the western districts they are very numerous and destructive, and in the Wimmera, where the country is comparatively scrubby and poor, it may be said they have all but taken possession of the crown lands, and to a large extent also of the alienated land. On one property alone in the Colac district it is said that between $150,000 and $200,000 have been spent in destroying rabbits, while some owners are paying as much as $10,000 a year to keep them down, many $5,000 a year, and almost every holder of land is year by year put to a considerable expense in protecting his pasture and crops from these pests.

A great many modes of dealing with this evil have been tried in Victoria, viz., fencing the rabbits out, shooting, hunting with dogs, ferreting and netting, snaring and trapping, digging out and blocking up the burrows, and destroying the rabbits with noxious gas and poison. In all these modes, again, the work is at times done by the owner's own men, sometimes by contract, and at other times under the bonus system. When the rabbits are to be fenced out a wire netting, 4 feet broad, with 2½ inch mesh, is put on an ordinary wire fence, the netting to the extent of one foot being bent and put in the ground at an angle to prevent the rabbits from burrowing. They try to do so close at the foot of the fence, but stop when they come upon the netting. The cost of the netting for a fence rabbit-proof of this sort is about $250 a mile; and if it is found that rabbits cross the Murray after our land is cleared, and Victoria continues to be infested, it may be necessary to run a rabbit-proof fence along the river to keep them from again obtaining a footing in this colony. Dogs (terriers, cockers, and other dogs which hunt by scent) and guns are generally used together, though sometimes kangaroo dogs and greyhounds are taken out with the terriers to kill the rabbits they put up. Where the rabbits have made a settlement the most effective, but the most expensive, way is to dig them out, or, where it can be done (in rocky and stony ground) to block up the burrows and starve the rabbits in their holes. Ferreting and netting is also a very successful mode of destroying them; but ferrets are comparatively scarce, they are liable to be lost, and every one cannot manage them. A good many have also been taken in traps and snares, but these appliances are also expensive and comparatively slow.

The exterminator (the machine employed to charge the burrows with noxious gas) is also in some cases an effective mode, but it is expensive, and the machine is cumbersome and unwieldy to take about, while the holes at times in the warrens are of such a sort (as in the case of bilbee and wombat holes, of which the rabbits take possession) as to render the gas inoperative; and in other cases there are fissures in the ground which allow it to escape. A good many different sorts of poison have been laid, and in a great many different vehicles.

(1.) *The Poison.*—The poisons most frequently used have been arsenic and phosphorus, and in a few cases strychnine. Arsenic has been longest used, generally in conjunction with sugar and bran. Phosphorus, again, has been more recently tried, and is now far more generally laid than any other poison.

(2.) *The Vehicle.*—A mixture of crushed wheat and sugar, or bran and sugar, has been found an excellent vehicle, so far as destroying the rabbits is concerned, but the mixture is dangerous for stock, more especially sheep. Whole wheat has been used successfully, with arsenic, and latterly with phosphorus, but does not seem to retain the poison so long as the oats, and is more liable to be eaten by sheep. Oats have within the last few years been employed very successfully and extensively as a vehicle for phosphorus. Carrots have also been tried with good results as a vehicle for arsenic. This is what was to be expected, as all animals are fond of carrots, but the supply is comparatively limited, and in many cases they cannot be laid without endangering the stock; they are poisoned by bruising the outside and strewing it with arsenic. Potatoes have been used successfully as a vehicle for strychnine, and could of course also be used for other poisons, especially arsenic. Turnips, pumpkins, and melons could be used in the same way as carrots; and cabbage leaves, turnip tops, green corn, and sorghum could also be made vehicles by slitting or opening them, where there is room, and laying the poison in slits or openings. But all these, like carrots and potatoes, can only be used where the stock can be removed from the paddock, or where these vehicles can be laid where the stock cannot get them. In cases, however, where the rabbits have been reduced in number, and it is of course of great importance to complete their destruction, sufficient precautions could be taken by laying down hollow logs, digging holes in the ground, fencing off small patches, and in other ways to keep the stock from reaching the poisoned vehicle.

Oil of rhodium has been employed successfully in conjunction with some of these vehicles as an attraction for the rabbits, and, although expensive, might be added where they cannot otherwise be induced to take the poison, or it might be so to make them take it more readily. The reports under this head are very conflicting with regard to effect of poisoned grain. It is allowed that the poisoned grain is not nearly so successful when the grass is green and plentiful as it is when dry and scarce. It is also generally allowed that while oats and wheat poisoned with phosphorus have at first been successful in destroying the rabbits, it is at the same time the opinion that the rabbits after a time cease to take either the one or the other. I think, however, that these results are only what were to be expected. When the grass is plentiful and green not only will the rabbits be comparatively careless about food such as oats or wheat, but they will not be so likely to see the grain on the ground as they would when the grass is brown and bare. Then, again, all animals are endowed in a greater or less degree with the instinct which leads them to refuse to take what they see is destroying them. The rabbits would at first—and perhaps for a little time in the case of arsenic, and longer in that of phosphorus, which is a slow poison—take the grain; but as soon as those which took it began to die in any number the others would stop eating the grain. It is well known that the same thing happens where poison is laid for native dogs, rats, and other animals.

Although I think the failure of the attempts made in Victoria to destroy the rabbits with poison is largely due to not changing the vehicle in which the poison was laid, the main cause of the failure there has, in my opinion, been the want of simultaneous action on the part of the owners whose land was infested with rabbits. The law in Victoria is only applicable to a portion of the lands of the colony—that alienated by the crown; and even in the case of land to which the law does apply it has very seldom been enforced, for it has provided no penalty for neglecting to destroy. There the defaulting owner can only be compelled to do so by the shire councils—who have the carrying out of the act—putting men on the defaulter's holding to destroy the rabbits, and, like our own boards of directors, these councils dislike to exercise this power, and have seldom or never done so. The result has been, that while some owners did all they could to clear their land, others did nothing. The rabbits are, therefore, increasing in some districts; as numerous as ever in others; and, although a great many have been destroyed, their spread has not been really checked, for they are every other month making their appearance in fresh districts. Under these circumstances, it is not surprising that in Victoria owners speak hopelessly of being able, except at an expense which would be most oppressive, to do more than keep the rabbits down; but there is little doubt that the result there would have been altogether different had owners been compelled, as they can be in this colony—and as I trust they will be—to carry out the work of extermination promptly and simultaneously on all the holdings.

Chlorate of Potash Explosions.

Potassium chlorate, generally known as chlorate of potash ($2KClO_3$) is composed, as to its distinctive constituents (*i. e.*, apart from its oxygen), of the non-metallic gaseous element, chlorine, and the soft metal, potassium, which is lighter than water, and melts at about the temperature of 145° F. In other words, chlorate of potash is an association of chloric acid (ClO_3) with two atoms of potassium. We believe that the acid has never been obtained in its anhydrous state. As combined with water it is a thick liquid, which sets on fire dry organic substances with which it comes in contact. The chloride of potash, being free of oxygen, has not the ignitive characteristics of the chlorate. Chlorine is a feeble supporter of combustion, but its affinity for hydrogen gives to it certain striking combustive relations in specific proportional combination, largely affected, however, by conditions of temperature, light, and exciting mechanical force. The two elements will not combine spontaneously in the dark—light, according to its degree, causes somewhat gradual combination, producing the suffocative hydrochloric acid (so to speak, an imperfect combustion); but in the direct rays of the sun the instantaneous union makes an explosive combustion. Potassium combines with oxygen with great avidity—hence result the violent reactions shown in the common experiment of throwing some potassium upon water; hydrogen is set free, and burns with the potassium; ultimately a fused globule of caustic potash (hydrate of potassium) remains, which unites with the water below with a sharp explosion.

Hydrogen will burn in an atmosphere of chlorine, where carbon will not. With heat or friction chlorate of potash united with sulphur, charcoal, etc., undergoes dissociation of elements. In heating the chlorate of potash alone, first oxidation proceeds to the perchlorate stage, then complete deoxidation follows, and a chloride of potash remains.

We make these remarks as introductory to an account of an explosion which we take from the Australasian supplement to the *Chemist and Druggist* (London), and will add that in December last we made reference also to the subject of the danger arising from neglect of precaution in handling chlorate of potash.

"A shocking occurrence took place at Wellington, N. Z., on December 21 last, by which a lady was literally blown to pieces and a building partially wrecked. The facts are as follows: At the shop of Mr. Barraud, chemist, London Quay, some blue fire was in course of preparation for use at the theater. On testing a small portion of the mixture it was found dangerously explosive, too much chlorate of potash having been inadvertently used in the composition. Accordingly, Barraud's assistant, named Anthony, took it out in the back yard, and began to destroy it by slow combustion. He had occasion to leave for an instant, and before he could return his wife happened to go into the yard, and seeing chemicals on fire, at once threw a bucket of water on the burning mass. A terrific explosion immediately took place, which shook the whole city, and was heard at a distance of some miles. Mrs. Anthony received the full force of the shock, and was frightfully mutilated. Both arms were torn off, also one leg, the lower jaw, and the scalp. Wonderful to relate, she lingered for some time. All the windows in the vicinity were smashed, and other damage done. The stone mortar in which the composition had been mixed was hurled many feet into the air, and thrown clear over the tops of the houses into the next street. Fortunately nobody else was injured. This dreadful occurrence created a profound sensation in this city."

Some points are worthy of special attention in connection with this event. In the *blue* pyrotechnic compound there was possibly some sulphate; but the question to consider is, whether explosion was dominantly due to dissociation of the water or dissociation of the chlorate. We note:

1. Another instance is given that a compound dangerously explosive can burn by moderate combustion without explosion.

2. There is every probability that the explosion was occasioned by hydrogen liberated by the instantaneous dissociation of a portion of the water. It will be inferred that such effect was more likely to have been produced from a spray of water than from a large body of water.

3. It is possible that the sudden shock of a comparatively large body of water thrown upon the contents of a small mortar aided to increase the force of the explosion. In other words, the molecular constituents of a salt being, as it were, in a state of high tension, or vibration, and almost ready to explode, may be driven to explosion simply by the shock of a liquid thrown upon them. But the violent dissociation of the elements of water thrown upon an ignited mass would itself be a still greater shock.

In Philadelphia, April 13, a drug clerk compounding a gargle, pulverized separately in the same mortar one ounce of chlorate of potash and one ounce of tannic acid—the latter an organic acid. In the trituration of the two together, with sufficiency of friction, an explosion could be taken for granted, but an explosion followed by simply pouring the powdered tannin upon the powdered potassium compound. The heating of the mortar in rapid pulverization suggests itself as the cause of the accident, and possibly there may have been contact with some dampness.

Some time previous to this, some of the salt had fallen from a full drawer upon the guides supporting a drawer of ferrocyanide of potassium immediately below it, in an Arch street drug store; in pulling out the lower drawer, sufficient friction was caused to result in an explosion, blowing out the drawer violently, and causing considerable damage.

As belonging to the same category of phenomena, we note the "discovery" in San Francisco of a violent explosive, which is made by grinding together *one* part of trinitrophenol (one of the anilines), *one* part of tar, and afterward cautiously adding *five* parts of chlorate of potash.—*Amer. Ex. and Review.*

Improvement in Refining and Crystallizing Starch Sugar.

The sugar made from starch, to which it has been proposed to give the collective name of *amylose*, has hitherto been sold either in solid masses or granulated by scraping in finer grains ready for mixing with cane sugar. F. Soxhlet, of Munich, takes the ordinary starch sugar of commerce and mixes with it 70 or 80 per cent of alcohol of 80° Tralles, or pure wood naphtha (methyl alcohol). Pulverized starch sugar is then added to this sirupy mixture and the whole left to solidify at a temperature *above* 30° C. (86° Fah.), with frequent stirring. The sirup obtained in making starch sugar can also be treated in this way. The mass of crystals thus obtained is pressed and put in a centrifugal machine. The alcohol is recovered by distillation.

For making solid transparent starch sugar (dextrose hydrate, $C_6H_{12}O_6,H_2O$) the starch sugar solution is concentrated in a vacuum to 46° B. (taken at 90° C.), and put in moulds to crystallize at a temperature between 35° and 50° (95° to 122° Fah.). At lower temperatures the well-known warty crystals form.

This method depends, it will be observed, upon the removal of uncrystallizable and unfermentable substances from the sugar by means of ethylic or methylic alcohol, in which grape sugar is itself but slightly soluble.

Prize for Comets and Meteors.

So much extra research, resulting in valuable discoveries, was occasioned by reason of the prizes for astronomical discoveries of last year, that Mr. H. H. Warner, of Rochester, N. Y., has concluded to continue the comet prizes during 1882, together with an additional prize for the discovery of meteors.

Prize first is two hundred dollars in gold, for each discovery of a new comet, made in the United States, Canada, Great Britain, or Ireland.

Prize second, two hundred dollars, for any meteoric stone found in any of the above countries during 1882, that contains fossil remains of animal or vegetable life, thus proving the inhabitability of other planets.

Prize third, fifty dollars, for a specimen of not less than two ounces, of any meteoric stone (whether it contain organic remains or not), seen to fall in the United States during 1882