ROAD TARRING IN FRANCE.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

On the Continent the oiling or tarring of roads is making considerable progress. The methods which seem to be the most successful can be divided into two general classes. In the first case we find products such as Westrumite, Pulvanto, and the like in which the liquid tar obtained from mineral or vegetable oils is formed into an emulsion or a solution in water and thus sprinkled upon the road. The solution in water can be obtained by adding alkali such as ammonia, or by the use of casein or other products. The liquid which is thus obtained can be applied to the road from an ordinary sprinkling cart. Another way of applying it is to pipe the water from the mains through a hose and use a special form of nozzle into which the oil or tar is fed from a reservoir. For use in cities this is quite practical. M. Forestier has designed a good form of mixing nozzle which consists of two conical pieces fitting into each other in such a way that the water stream acts by aspiration to draw in the oil and mix it with the water in the nozzle. The distance between the two cones can be adjusted to suit the conditions of the case. From the side of the nozzle a rubber hose leads to the oil tank, which can be well carried on the back of the man who is doing the sprinkling. For a larger supply the hose is placed directly into the oil barrel, and the latter is run along on a cart by a second man. To avoid the use of a valve in the supply pipe to regulate the flow, the nozzle carries a small air-valve which can be permanently adjusted for a given supply.

Much more efficient than the method of sprinkling is the application of a layer of hot tar compound upon the road, which has just been thoroughly swept so as to leave the surface quite clean. In this way the road absorbs the hot tar and this forms a very solid coating, as the tar sinks for a considerable depth below the surface. According to the report which was made recently by Chief Engineer Heude, the hot tarring method is to be considered one of the best to be used upon roads on a large scale. In 1905 he treated some 150,000 square yards of roadway in France and finds that the results are excellent and quite justify the expense which is occasioned. The dust which usually results from the wear of the road had disappeared, and at the same time the annual expense of keeping up the road diminished so as to more than compensate for the cost of the process. This comes from the great reduction of expenses for watering the road, sweeping and mud-scraping as well as from the greater durability of the road-bed, so that not only does the tarring process cost nothing, but it gives an annual economy of $0.01 per square yard yearly. One coating of tar lasts about a year.

To carry out this method practically, the treatment should be made during warm and dry weather and at certain hours of the day. To avoid an unexpected rainfall it is necessary that the operation should be done quickly. With the primitive apparatus which was used at first, requiring a great deal of hand labor, it was hardly possible with gangs of a dozen men to tar more than 1,000 square yards of road per day, applying the tar by means of hand brushes. This led to the use of an automatic system which could be used for applying on a large scale and in a continuous manner, so that it is now possible to treat more than 2,000 square yards per hour. We also avoid heating the tar over a fire, which is always dangerous, and the steam-heating system is employed here. The apparatus of the Lassaily system is illustrated here. It consists of a tar-heating car and a spreading car. The tar which is used here is the semi-liquid product which comes from the gas works.

The tar-heating car is composed of three main parts. In front is placed the boiler, which furnishes the steam for the heating. The cylindrical tank carried in the rear communicates with the boiler and is designed to heat the tar by means of a worm piping in which the steam passes. Below the main tank is the receiving tank of square section, placed between the side beams of the truck. It is designed to receive the cold tar from the barrels. A small hand pump is also carried on the car. The apparatus works as follows: The tar is delivered either in tank-wagons, which are emptied directly by piping into the receiving tank, or in oil-barrels, which are easily drawn upon the car by a pulley and are emptied into the tank. After the tar is fed into the tank the remaining operations are carried out entirely by the steam. First the cylindrical tank is filled with steam and then it is cooled off on the outside by means of a small quantity of water, some 20 gallons, which is fed upon the top cover of the tank by the above-mentioned hand-pump. As the steam condenses it forms a partial vacuum and causes the tar to be sucked up from the lower tank through a pipe provided with a valve. It takes up about 250 gallons in this way. The second operation is to make the steam pass in the worm piping of the tank so as to heat the tar until it reaches some 200 to 212 deg. F. When this point is reached the tar commences to boil over, and this can easily be observed. Third, the steam is again sent into the tank from the boiler, and it acts by pressure to force the hot tar through a suitable piping which leads to the outside and serves to discharge it into the top of the tank-wagon so that it can be applied by the latter upon the road. When the heating reservoir has been thus emptied the steam which it contains is again condensed by a cold water feed as above and by closing the outer valve a partial vacuum is created which sucks up a fresh supply of tar from below.

The Tarring Wagon at Work.

There is no loss of water by this system, and all the hot water coming from the tar heating and the cooling spray is recovered. It passes through a worm piping placed in the cold tar tank, thus heating up the latter somewhat, and is cooled down so that it can be taken up by an injector and used for the boiler feed. While the tar-spreading wagon is automatically applying the 250 gallons of hot tar on the road, the fresh supply of tar is being heated in the first apparatus, so that the work goes on without stopping and at a very rapid rate, inasmuch as it only takes half an hour to charge, heat, and discharge 250 gallons of tar, or 2,650 pounds weight. The wagon which is used for spreading the tar on the road is observed in the first view in actual operation. It is automatic in its action and is made up of four principal parts, namely, the tank for carrying the heated tar, a smaller tank which is used for regulating the supply, a spraying tube provided with a set of holes, and in the rear a set of spreading brushes. The tar which is contained in the main tank passes by a pipe into the regulating tank where a float indicating device enables it to be kept at a constant level, thus giving a uniform speed of flow and consequently a regular spread on the road. For the spreading the car has a spray tube about two yards long pierced with holes which are calculated so that with a horse going at the average speed the feed of tar is one-half what is needed for a new road. In this case, which is the most general, two coats of tar are used on the road. For a road which has already been tarred, a single coat serves to keep it in good condition.

The set of four spreading brushes takes the hot tar as it is fed on the ground and spreads it automatically in a thin and very regular layer. The brushes are movable and are attached to the wagon by chains, being weighted with ballast to give the right pressure on the road. In this way we suppress the gang of hand spreaders which causes the greater part of the expense in a tarring system, and the result is quite as satisfactory. Thus equipped, the spreading car is able to apply 5,300 pounds of tar, which is furnished from the heating wagon in one hour. This amount serves to cover 2,400 square yards, from which it will be seen that the process is a rapid one.

Notes on a Dissected Porpoise.

BY W. K. GREGORY.

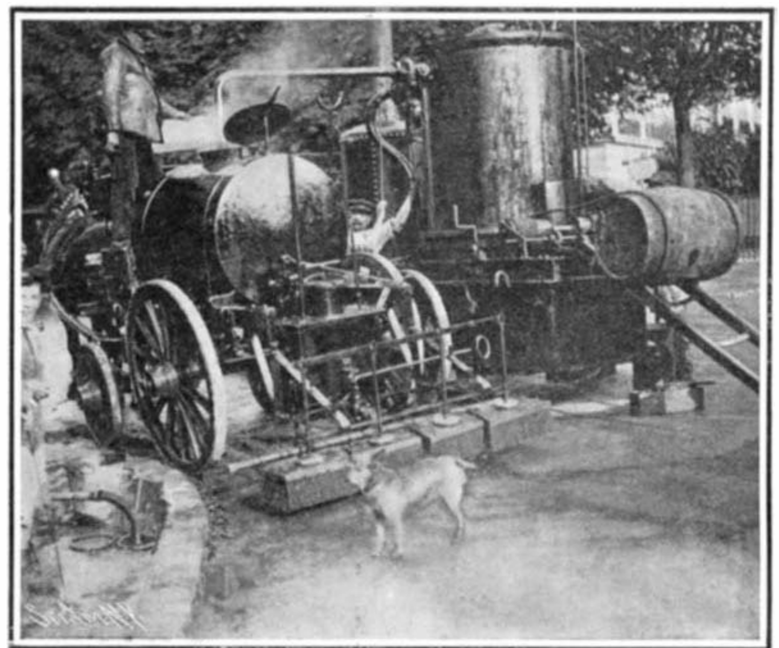
For the first time in several years a dead puffing pig or harbor porpoise (*Phocæna communis*) floated near the shore here at Wood's Hole, Mass., last summer. A young man swam out and dragged it in, and I joyfully carried it off in a wheelbarrow to the Fish Commission laboratory for dissection. I say joyfully; for although everyone knows that a porpoise is a whale, and whales are mammals, it does not fall to the lot of every one to verify this remarkable fact by dissection. My porpoise was about as fish-like as any of its kind, and several people on the road to the

Sprinkling with Oil by Means of a Portable Mixer.

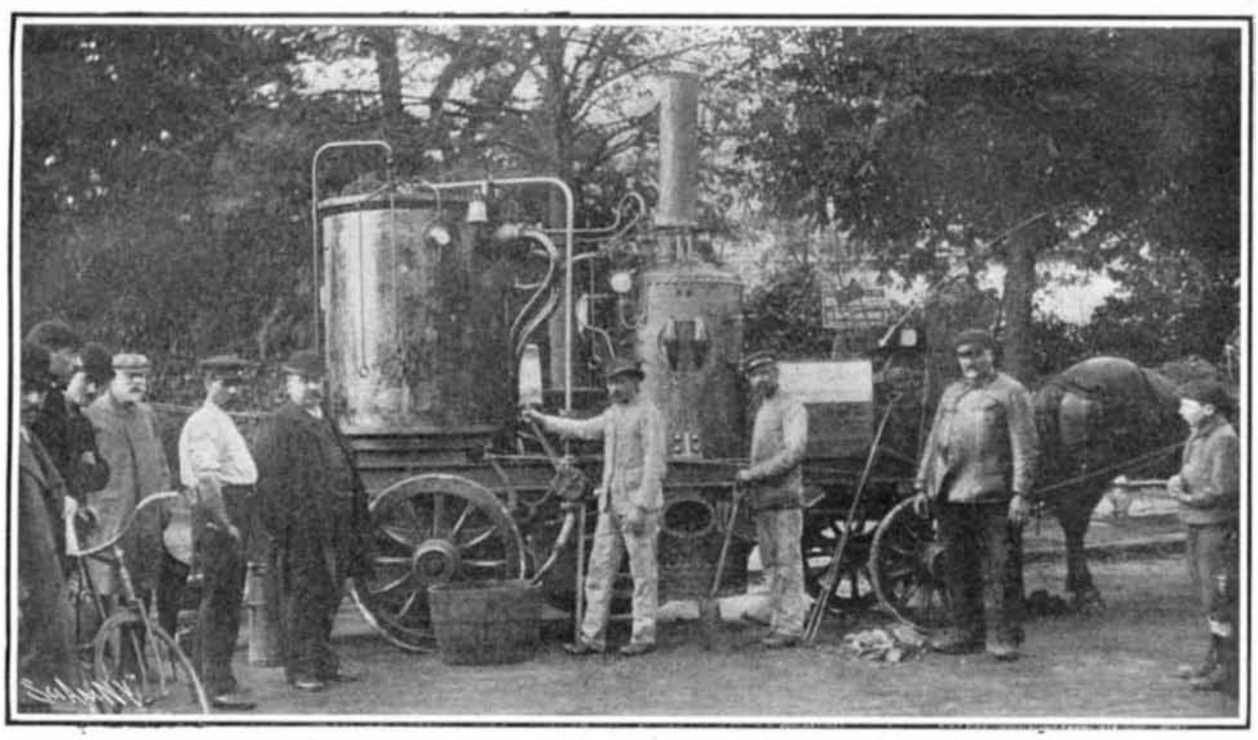
One Way of Applying Tar or Oil Consists in Piping the Water from the Mains Through a Hose. Oil or Tar is Fed to a Special Nozzle and Mixed with the Water.

ROAD TARRING IN FRANCE.

A Road-Tarring Wagon.



The Tar-Heating Apparatus.



Machine for Preparing Tar to be Spread on Roads.

Portable Apparatus.

ROAD TARRING IN FRANCE.

laboratory thought it was a shark, a mistake that seemed justified by its high back fin, shark-like flippers, overhanging upper jaw, and white belly.

The skin, however, was quite unshark-like, since it lacked the minute enamel denticles that so thickly bestud the skin of the shark; and except for its lack of hair, the skin, which was very tender, rather resembled that of a young pig.

Below the skin a layer of fatty tissue, or blubber, completely enveloped the animal. This blubber was variously modeled all over the body, so as to produce a fish-like external form, especially in the back fin, tail-flukes, and the superficial portions of the flippers or fore-limbs. The fins of fishes are elaborate structures with a complex bony framework and musclature, but in the porpoise the corresponding organs were seen to be mere superficial imitations, trumped up, as it were, after the amphibious ancestors of the porpoise had entered into competition for a living with the denizens of the sea. These parts were here quite simple, lacked a bony framework, and were formed wholly of skin-covered blubber, which, however, contained so much tough connective tissue that it rapidly dulled my knife. The thick coat of blubber also served to keep the animal warm, for being a mammal and breathing with lungs, it requires a constant body temperature, far higher than that of fishes, which have a temperature much nearer to that of the cold medium surrounding them.

After the fish-like disguise of skin and blubber was stripped off, I came upon great masses of very red muscle. The most superficial layer was of great power and thickness, and evidently corresponded to the panniculus carnosus muscles, that cause the skin to twitch in land mammals. In man these muscles are almost vestigial, but are represented in the feeble muscles that move the scalp and wrinkle the forehead. In the porpoise, as in other whales, these superficial muscles attain all over the body an extraordinary development, and being everywhere attached to the underlying flesh and bones, impart mobility and great strength to the motions of the body in swimming.

Below the superficial muscles the other muscles, bones, and soft parts corresponding to those of quadrupedal land mammals were uncovered, but here they were seen to be variously modified to suit the peculiar mode of life. The animal was a young female, and I removed the reproductive organs for preservation in formalin. These, part for part, were remarkably similar to those of ordinary mammals. A peculiar modification was seen in the stomach, which was divided into three connecting pouches, or sacks, and in its complexity suggested the stomach of a cow. However, the suggestion that a porpoise might ruminate was long ago refuted by a close comparison of the stomach of the porpoise and of the cow, which exhibit essential differences. The first division of the stomach was lined with comparatively smooth whitish tissue, which exhibited irregular rugose folds. The interior of the second stomach-pouch presented a very coarse network of blood-filled and glandular tissue. After the third division, which was again of different nature, the small intestine followed in seemingly endless coils, the whole intestinal tract measuring not less than fifty-four feet in length.

The lungs appeared to be much like those of ordinary mammals, but the windpipe, or trachea, showed a remarkable adaptation to aquatic conditions. The trachea, in order to prevent the accidental entrance of food or water, was continuous, with a tube leading right across the throat, its end tipped with cartilaginous lips, and fitting neatly into those openings (called choanæ) in the back of the palate which lead up through the skull to the nostrils. This "intra-narial epiglottis," as it is called, is also developed in the young of the common opossum. The mouth of the young opossum is fastened to the teat of the mother, and the milk is squirted by the mother down the throat of the young, but the "intra-narial epiglottis" prevents the milk from entering the trachea and choking the young animal. The occurrence of this organ in two such widely-separated mammals as the opossum and porpoise is doubtless a response to a similarity of needs. However, the embryos and young of many other animals retain this organ in a more or less vestigial condition; and since the operation of sucking milk is far more complex than that of swallowing the milk squirted into the mouth, it is quite probable that the latter method is the more ancient one, and that both porpoise and opossum have inherited the intra-narial epiglottis from those very ancient mammals of the Cretaceous period which undoubtedly gave rise to all the later or viviparous mammals.

The nostril or blowhole, on the top of the head, was guarded by a valve to prevent the inrush of water. In front of the nostril, and beneath the blubber, I exposed a pair of long coiled tubes, provided internally with irregular folds. These organs are thought to regulate the pressure of the already inhaled air before it is delivered to the lungs, since the pressure of this air of course becomes greater as the animal dives into deeper water. The necessity for the animal to remain long under water and to breathe at long and irregular intervals seemed to explain the excessive quantity of blood, which flooded everything while I was dissecting the animal. For obviously, long-delayed breathing would require an unusual amount of oxygenated blood, which in turn would require an increase in the total carrying capacity of the arteries. This was effected by the frequent breaking up of the arteries into a network of fine vessels, before they passed into the ordinary capillary vessels of the organs. The brain of the porpoise was seen to be large and richly convoluted, but to lack the olfactory or smelling lobes, which project so conspicuously in the lower foreward portion of the brain of ordinary mammals.

A feature highly suggestive of the long evolutionary history of the porpoise was observed in the dorsal or back fin. This showed on its front edge, on the surface of the black, rubber-like skin, a series of small, horny, almost prickly projections. Now, in the dolphin, *Neomæris*, these peculiar hardenings of the skin are much more prominent and better formed, not only along the front edge of the back-fin, but also in several rows along the back, where they take the form of small horny tubercles. In the armadillo, to cite a familiar case, the horny surface plaques are supported by bony scutes imbedded in the skin. Hence certain naturalists have suggested that the horny tubercles in the dolphin *Neomœris* and the porpoise represent the last stages of degeneration of a former body armor, that in the ancestral dolphins the skin may have been largely overlaid by horny plaques, supported by bony scutes; and this hypothesis is strengthened by the finding of bony scutes in association with the fossilized bones of certain dolphins, so that armorclad whales may have been as characteristic of certain former geological epochs, as unarmored whales are of the present. Furthermore, it has been suggested that since whales are undoubtedly descended from land mammals, the earliest whales must have lived along the seashore, and that an armored skin would be useful in protecting the animal from the pounding of the surf. But this is, of course, mere hypothesis.

HOT-WATER SUPPLIES TO TOWNS.

BY THOMAS PARKER.

Fortunately for some of the inland towns of Queensland, good supplies of potable water from artesian wells have been obtained within the municipal areas, and the towns have been reticulated with pipes to convey the water throughout. When the temperature of the water is not too high, the water mains are connected direct to the bore pipe at the surface, and the water is used, at its original pressure, for domestic and fire-extinguishing purposes. These waterworks have been a great boon to up-country towns, where hitherto the only water supply was derived from stagnant surface tanks, and obtained, in most cases, very irregularly, and at the expense of a long haulage. As wooden buildings are the rule in these towns, the value of the water supply for fire purposes is very great indeed.

When, however, the heat of the artesian water is abnormal, or, say, over 120 deg. Fah., it has been customary to cool the water by spraying it into a cool water tank of iron elevated 60 feet, thus losing part of the pressure of the water, or by conducting a portion of the supply into an earthen water tank containing coils of pipes, through which the hot water from the well is passed before entering the town mains. Otherwise, the expansion of the mains, due to the heat of the water coming into them direct from the artesian well, would cause breaks at the lead joints of the pipes in the streets.

Recently, however, a scheme has been designed by the writer, and carried out successfully in two towns, for conveying the water hot, and direct from the bore well to the town. As this method has been found to be much less expensive than the usual cooling schemes, and as it retains the full pressure of the bore supply, so valuable for fire purposes, it has been considered a great improvement on the old method of cooling the water before conveying it to the consumers. The heat of the water is also found to be valuable for baths and laundry purposes.

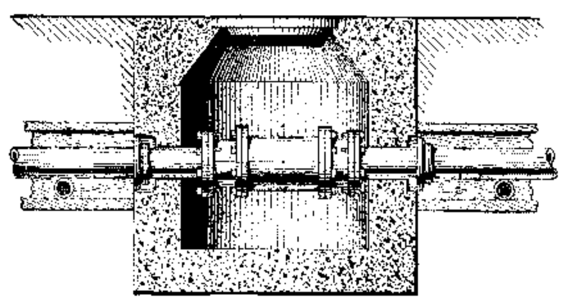
A description of the reticulation of the town of Muttaburra, in Central Queensland, on this new method will give a good idea of the system. The site of the bore which supplies the water is about half a mile from the center of the town. The depth of the artesian well is 2,707 feet, and the flow is about 750,000 gallons per day. The temperature of the water is 138 deg. Fah.

Before entering the town mains, the water passes through a stone trap, the gratings in this trap serving to keep back from the mains the gravel or stones which are sometimes thrown up by these underground water springs. The trap has a large base, and is set upon a concrete foundation, about 4 feet below the street level, and the whole is surrounded by a concrete-walled chamber, and a cover at the ground surface.

From this stone trap the mains are carried about 3 feet below the surface of the streets, and incased in wooden boxing. A reference to the drawing will show the mode of inclosing the pipes. The pipes rest upon rollers, formed of short lengths of one-inch galvanized iron piping, laid crosswise on the bottom of the wooden boxing. At intervals of about 200 feet, expansion joints are inserted in the mains, which are so set as to allow the lengthening and shortening of the sections of the mains between the fixed points, which will be afterward described. When the hot water is turned into the mains, the system works in the following way: The heat of the water causes the pipes to expand and increase in length, and each end of the section of main, which enters the expansion joint at opposite ends, moves toward the center of the expansion joint, like the piston in a steam cylinder. Here, between the ends, a space of three inches is left to allow for the lengthening of the section of main, without allowing them to touch each other. The expansion and lengthening of a section of main, about 200 feet in length, does not amount to over half an inch, so that the 3-inch expansion space at the ends of the lengths of pipes allows ample margin of expansion space. The reverse process and movement, of course, takes place when the water is—on rare occasions—shut out from the mains, and the pipes cool. The section of main affected by cooling shortens, and the ends draw back within the expansion joints, like the back stroke of the piston in a steam cylinder. The wooden boxing in which the street mains are inclosed is formed of 1½-inch planks of cypress pine of the locality, a timber which has been found, by repeated tests, to be proof against the ravages of white ants, which are very prevalent, and destructive of timber constructions, in the district, and, indeed, in the State of Queensland generally. At each intersection of the streets, a fixed point is constructed. This consists of a cast-iron cross piece, with four ways, bedded firmly in a large block of concrete. The cross streets are about 700 feet apart; this being the interval between the fixed points, the expansion and contraction of each section of main takes place within these limits. The four ways of the cross piece are made with socket ends to receive the main pipes.

In each section of the mains a sluice valve of the usual type is placed to control the section. Fire plugs are also provided at intervals of about 250 feet apart, to which a hose can be attached for fire extinction. At the lowest point of the town a pressure valve is placed, which can be set to open at any pressure, and is intended to act as a safety or escape valve, to relieve the mains from any accidental shock, or occasional undue pressure, from the too quick opening or shutting of valves, or undulation of the original pressure of the water at the bore pipe. This latter pressure is about 60 pounds per square inch, and the pipes and other castings of the system were all tested with a hydraulic pressure up to 100 pounds per square inch. The cost of the bore was about £2,707, and of the reticulation of the town about £2,013, making a total expenditure of about £4,720.

One of the hitherto undeveloped resources of artesian wells in Queensland is the available power due to the pressure and flow of the water. At one Queensland town it is estimated the flow from the bore will



EXPANSION JOINT FOR HOT-WATER MAINS.

develop nearly 30 horse-power, and it is intended by the municipal authorities to utilize this power for electric lighting purposes.

Official Meteorological Summary, New York, N. Y., August, 1906.

Atmospheric pressure: Highest, 30.31; date, 2; lowest, 29.75; date, 27; mean, 30.01. Temperature: Highest, 93; date, 6; lowest, 63; date, 25; mean of warmest day, 84; date, 6; coldest day, 68; date, 25; mean of maximum for the month, 81.2; mean of minimum, 69.4; absolute mean, 75.3; normal is 72.7; average daily excess compared with mean of 36 years, +2.6. Warmest mean temperature for August, 77 in 1900; coldest mean, 69 in 1903. Absolute maximum and minimum for this month for 36 years, 96 and 51. Precipitation: 3.68; greatest in 24 hours, 1.37; date, 7 and 8; average for this month for 36 years, 4.59; deficiency, —0.91; greatest precipitation, 10.42, in 1875; least, 1.18, in 1886. Wind: Prevailing direction, south; total movement, 6,443 miles; average hourly velocity, 8.7 miles; maximum velocity, 36 miles per hour. Weather: Clear days, 6; partly cloudy, 11; cloudy, 14. Thunderstorms: Date, 4, 7, 11, 21 and 23. The temperature of June was 2.5, July 0.9 and August 2.6 in excess, making the summer of 1906 2 degrees above the normal. These months were each below normal in rainfall, the total summer deficiency being 3.72.

New Island in Bering Sea.

A well authenticated story comes from the far North to the effect that an island has very recently been created in the Bering Sea. This new island has evidently been thrown up by a submarine eruption. Advices have been received from Seward, Alaska, which state that the new land is located not far from the island of Boroslow, which was upheaved in the same manner about a century ago.

News of the formation of this new land reached Seward from Unalaska, being carried to the latter port by Bering Sea fishermen. Vast quantities of rock were thrown up with the earth, thus forming acres of bluff, rugged headlands, according to the accounts given by these fishermen. That this upheaval was due to volcanic displacement seems very evident from what the fishermen say. They assert positively that the waters of the sea were very warm for a wide radius around the newly created island, and the atmospheric heat was so fierce that they were unable to approach near the land. This reported new island will be the subject of scientific investigation in the near future.

Science Notes.

Sponge fishing in Florida waters until about a year ago was all done by the use of poles with three-pronged hooks attached at an end, and the sponging operations were necessarily confined to shallowish water, the depth varying from fifteen to thirty feet. About a year ago, a Greek workman, who had been employed in one of the sponge-packing houses, tried the experiment of diving for sponges, and this method of securing them was attended with such good results that diving for them has now become a common method of sponge-fishing. Most of the sponge-divers are Greeks, and they are looked upon as trespassers upon the premises of the native spongers, and as likely to seriously damage future sponge-crop prospects. A bill prohibiting aliens from sponge-fishing in Florida waters, and another making it unlawful to deliver at any point in the United States any sponges taken from the Gulf of Mexico or Straits of Florida by diving, have passed both houses of Congress and will soon become laws; and a State law prohibits the taking of sponges by diving, and affixes a heavy penalty for a violation of the law. It is claimed that gathering sponges by diving, accompanied as it is by considerable tramping among them, will injure the beds seriously, and eventually deplete them.

It seems likely that we are to have some improvement over the present methods of obtaining hydrogen for balloons. Not content with the process of compressing hydrogen into steel bottles for use on the field and especially for military ballooning, inventors are looking for a chemical product resembling carbide of calcium or the new product "oxylithe," which will give off hydrogen when placed in contact with water. M. Güntz, of Nancy, has brought out a process for manufacturing the hydride of barium and which may no doubt be applied to the hydride of calcium as well. This latter body has the property of giving off hydrogen when treated with water. In the above process, electrolysis is carried out, using a mercury bath and a solution of barium chloride. A barium amalgam is formed here, and the mercury is driven off from it by distillation *in vacuo*, then the barium which remains is treated in a current of hydrogen so as to form the hydride. An industrial hydride of calcium has lately been brought out by M. George F. Jaubert, a prominent chemist of Paris and the inventor of "oxylithe," which latter product gives off oxygen when placed in water. The new product, known as "hydrolythe," produces hydrogen in the same way, and one pound of it in a pure state, when treated with water, will give about 10 cubic feet of hydrogen. To fill out a military balloon of 600 cubic yards it suffices to transport about 1,200 pounds of the product, while at present we need some 5 tons of steel cylinders and suitable vehicles must be provided for these, besides, the empty tubes must be taken back for refilling. For military work we thus have a great advantage which more than balances the higher price. The latter will bring the cubic yard of hydrogen to $1.00 or $1.50. At present, the cost of the product will no doubt prevent its use for ordinary ballooning, but by improvements in the method we may see the price lowered.

According to the latest official returns of the British government, great activity is being shown in ascertaining the extent of the thorium-bearing minerals in Ceylon which were first discovered during the mineralogical survey of 1904. Of these the most important is thorianite, a mineral new to science, and containing 70 to 80 per cent of the rare earth thoria, which is used in the manufacture of incandescent gas mantles. In England thorianite containing from 70 to 72 per cent of thoria realizes $150 per 112 pounds. With a view to encouraging further search for this valuable mineral a notice was published by the Ceylon government giving the above particulars and also stating the places where thorianite and thorite had been found. Intending prospectors were informed that the government would for three years undertake to levy no royalty on this mineral, except in those cases where extraction was made on crown lands, where the permission to wash is by agreement on liberal terms. There is a large area including all the province of Sabaragamuwa, and part of the central, western, and southern provinces, where the mineral may be looked for. Search is now being made in many localities. It is not possible to say at present how far a regular supply can be anticipated. About 140 pounds of thorianite, which were received from Mr. W. D. Holland, who first discovered this mineral, were sent to the crown agents in November, and sold by Prof. Dunstan of the Imperial Institute in London for $475. Prof. Dunstan is taking further steps to obtain reports on the commercial value of the sample sent to him and for supplying such further information as may lead to more discoveries. The mineralogical survey is further engaged in examining the gemming districts in Sabaragamuwa, and the southern province, in investigating discoveries of corundum and of heavy minerals containing rare elements, as for example allanite and several minerals belonging to the samarskite group.