facility and the valves retain their charge. The pump, therefore, seldom requires priming, even when used to raise the material a great distance. Two props in front serve to support the pump firmly while being operated. They are closed in when not in use. The balancing of the pump on two wheels at the center also renders the discharging of its contents and cleaning very convenient, by reversing the inclination, in which position it may also be readily charged, when necessary, through the induction port, the discharge being closed.

The couplings, F, used for connecting the sections of hose together and to the pump and tank, are of novel construction and designed especially for this purpose. Those attached to the pump and tank are furnished with fixed wrenches, by which the connection is quickly and perfectly effected. When the hose is detached, both portions of the coupling are sealed with suitable caps, and the entire apparatus rendered airtight. The receiving tank used is of ordinary construction and provided with inlet and discharge openings, and also with an indicator for showing correctly the quantity of material contained. The action is said to be sensitive and accurate.

A flanged collar, attached to the top of tank, supports the charcoal furnace in which the noisome gases, displaced from the tank while being filled, are deodorized and rendered inoffensive. This form of deodorizer is employed as being the most efficient and economical. The purifying action of the fire is intense, and the displaced gases, after passing through it, are entirely without odor.

In addition to its use for removing night soil, the apparatus is claimed to be equally efficient in removing the contents of sewers and traps in a like inoffensive manner.

The original patent for the use of the deodorizer, in combination with an airtight tank, for cleaning sinks and cesspools without offense, was granted to Louis Straus, January 28, 1868, but the apparatus has been in very limited use, owing to the inefficiency of the pumps heretofore designed for use in connection with it.

The patent on the pump valve was granted to William Painter, of Baltimore, August 5, 1873. Patents on other portions of the apparatus are now pending, and the company is about to apply for patents abroad.

The apparatus, we are informed, has already been adopted in the National Capital to the entire exclusion of the old bucket system. The plan there employed is represented in Fig. 5, the soil being pumped into barrels fitted with the deodorizing furnace. It is also in successful operation in Baltimore, and negotiations are now pending for its introduction in other cities. Our large engraving will give an excellent idea of the complete apparatus as it appears in use.

For further particulars, address The Odorless Excavating Apparatus Co., 44 North Holliday street, Baltimore, Md.

Scientific American.

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Contents.

(Illustrated articles are marked with an asterisk.)

Advertisers, rare chance to	264	Lightning freak, strange	260
Answers to correspondents	266	Locomotive, a compound	261
Apparatus for emptying vaults, etc*	255	New books and publications	265
Balloon to Europe, failure No. 2 of the	256	Notes and queries	266
Bisulphide auxiliary engine, the	260	Oyster, habits of the	262
British Association, meeting of the	264	Paris—Letter from Prof. Thurston	261
Business and personal	266	Patent litigation, important	262
Butter and churning, curiosities of	257	Patents, official list of	267
Caoutchouc from common plants	256	Patents, recent American and foreign	265
Caustic soda, new method for	262	Pavements, street	257
Combustion of explosives, heat of	262	Petroleum for fuel, crude	257
Cow, a $40,000*	263	Press for fruit, lard, etc	259
Crank pins, the proper length of	260	Propeller, helicoidal concavo-convex*	263
Decimal measures, new basis for	259	Sash fastener, improved*	259
Devil fish, the	263	Scientific and practical information	257
Ditching by steam power	258	Sewing machine, that ancient*	260
Drafting instrument, a valuable	264	Siemens steel furnace, the	263
Fire for life buoys, inextinguishable*	258	Switch, railroad*	262
Gas from crude petroleum	260	Technical research and education	256
Gunnery trials, recent	257	Telegraphing maps and plans	263
Guns, recently constructed	264	Vienna prizes, the	256
Hammer, power spring*	262	Wear of journal boxes, taking up*	260
Hot air engine, the	260	Whiteblackbird, a	260
Induction, peripolar*	259		
Launch Firefly, the steam*	258		

TECHNICAL RESEARCH AND EDUCATION.

One of the most eminent English chemists is reported to have recently said, in response to a question relative to the progress of original investigation in England, that in that country such research seemed to be declining, while in the United States far more was being accomplished toward its pursuit. Were we disposed to doubt the latter part of this assertion, and even were we unaware of the constantly advancing labors of the scientists of Yale, of Harvard, of Cornell and of other seats of learning throughout the country, we should be strongly inclined to admit its truth from the evidence afforded by a recent visit to that model technical school, the Stevens Institute. In three laboratories we found original labor in virtually actual progress, and from three workers—professors, yet only students in that highest of colleges. Nature—we gleaned a few general words in explanation of the object to which the researches of each were directed. President Morton's investigations into the beautiful phenomena of "fluorescence," and also his brilliant discoveries of thallene and petrolucene, we have already described in detail. We have also alluded to his spectroscopic researches in relation to the uranic salts, and we found him still engaged upon the same subject. We were shown his laboratory for the purification of the uranium, a process of some length, carried on by himself in order that he may obtain the metal free from impurities, with which he states it is always combined when obtained direct from commercial sources. From the result of this operation he obtains various compounds of the body, among which are several new salts; amongothers, thallio-uranic sulphate and rubidio-uranic sulphate. President Morton is also investigating the properties of chrysene and pyrene, both substances obtained from coal tar subsequent to the production of anthracene, and which differ from each other in many respects. We were also shown a specimen of pure anthracene, which appeared in delicate sheets of a pearly luster, almost perfectly white. Other specimens of the same substance, not so pure, had a decided greenish yellow tinge, while another preparation, by distillation; of the material resembled moist sugar, with, of course, the above noted difference in tinge. A very beautiful product also obtained was pure alizarine, from anthracene, the last process of the operation being sublimation, when the alizarine appears of its natural brilliant orange red hue. Dr. Morton tells us that he has been unable, thus far, to obtain thallene in sufficiently large quantities to meet his requirements—he wanted a barrel of it—and that he is therefore turning his attention to anthracene as being the nearest similar substance. He hopes, eventually, to be able to produce, from thallene, artificial alizarine.

Professor Mayer is engaged upon a series of very interesting investigations in acoustics, mainly relative to the relation between sound and heat. He promises some strikingly original experiments and important lectures in the course of the next month or two, which we shall take occasion to lay before our readers.

Professor Thurston, our late correspondent from the Vienna Exposition, has returned to this country and is engaged in the continuation of his experiments on the torsional strength of materials; obtaining his results by the aid of the testing machine of his own device, an invention which we have already described. His most recent work has been upon specimens of iron and steel, from which he has obtained the following data: The pieces were made in nearly uniform thickness and of about $3\frac{3}{4}$ inches in length. In the center, a neck was formed $\frac{5}{8}$ inch in diameter, to which point the strain was applied. Sample No. 1 was of Ulster iron, 1 inch bar, twisted to 220°; it broke under a torsional force of 225 pounds. No. 2, ordinary spike iron, nail rod, $\frac{3}{4}$ inch bar, angle 150°; it broke at 240 pounds. No. 3, French tool steel annealed, $1\frac{1}{2}$ inches round, angle 160°; it broke at 400 pounds. No. 4, Bessemer steel $1\frac{1}{2}$ inches round, angle 75°; it broke at 300 pounds. No. 5, Lowmoor iron, 1 inch square forged down from $1\frac{1}{2}$ inches, angle 220°; it broke at 200 pounds. No. 6, common American iron, make unknown, $\frac{5}{8}$ inch bar, angle 220°: it broke at 200 pounds. No. 7, Naylor's tool steel, $\frac{7}{8}$ inches octagon, angle 140°; it broke at 400 pounds.

It would be hardly fair to close this brief reference to the labors now in progress at the Stevens Institute without duly crediting the work of the students as well as that of the professors. Among the practical results of the instruction afforded, we were shown two admirably constructed magic lanterns, destined for use in the lecture room, made entirely by a pupil, and in a manner which would compare favorably with that of skilled instrument manufacturers. Besides these there were a large number of metal articles used in blowpipe operations, and also many other excellently made tools and instruments for the chemical and physical laboratories, all entirely the handiwork of the students. We also noticed several original designs for machinery, and an admirably executed graphic representation by curves of the results obtained by Professor Thurston in his late experiments upon the torsional resistance of wood.

There is an excellent system carried out in the mechanical department of the Stevens Institute which we do not remember to have seen practiced elsewhere, and which it appears might be advantageously followed in every technical school. We allude to instructing the student how to invent. It must be generally conceded that the young man who leaves his college, perhaps an able draftsman but withal a mere copyist of the original ideas of others, labors under disadvantages and will find greater obstacles in his path of progress than another student who graduates able to suggest, modify or even invent plans to suit the varying circumstances. Than this, no fact seems to be more thoroughly recognized in the course of study above referred to; and instead of requiring the pupil to duplicate completed plans or produce merely handsome drawings, he is called upon at once to use his own brains in direct origination, and thus to apply in practice the instruction he gains in theory in the class room. To each student the Professor assigns some special work; to one, for instance, he hands a rough general idea of a steam governor, and tells him to improve it and construct a finished machine, bringing in every requisite calculation; to another, he assigns a peculiar form of steam boiler; to a third, an anchor hoisting gear for the Stevens battery; and so on through the class, each individual being left free to design precisely as he chooses, working only from the mere crude hint given him in the beginning. If the articles are of such a nature as are capable of ready construction, they are actually made within the Institute in the machine or instrument shop, and afterwards utilized for their purposes; so that the pupil not only designs but in some cases sees embodied the result of his thought. It is needless to add that if the student has any inventive genius, this means developes it; and he leaves the school with a mind trained to think independently, or, in other words, to grapple at once with the problems which are constantly presenting themselves in the everyday practice of his profession.

THE VIENNA PRIZES.

Seventy thousand articles have been exhibited at the Vienna show, and 26,002 awards have been distributed. Of this aggregate number of premiums, 421 were diplomas of honor, 3,024 medals for progress, 8,800 medals for merit, 8,326 medals for good taste, 978 medals for art, 1,998 medals for coöperation, and 10,465 diplomas of merit or honorable mention. These were awarded as follows: Austria (without Hungary) 5,991, Germany 5,066, France 3,142, Italy 1,908, Hungary 1,604, Spain 1,157, England and colonies 1,156, Russia 1,018, Switzerland 722, Belgium 612, Norway and Sweden 534, Turkey 470, Portugal 441, United States 411, Denmark 309, Holland 284, Roumania 238, Japan 217, Brazil 202, Greece 183, China 118, Egypt 75, Republics of Central and South America 44, Persia 29, Morocco, Tunis, and Tripoli 20, Madagascar, etc., 10, Monaco 9, Mexico, Siam, and Turkestan, each 1.

It will be noticed that the United States ranks No. 14 on the list, and it will at first sight seem rather curious that we should be distanced in numbers of prizes gained by countries so far behind the age as Spain or Turkey. It is hardly fair, however, to draw any comparison except through the relative proportion of distinctions gained as compared with the number of exhibitors from each nationality, while the nature of the articles for which the honors were given must also be taken into consideration, regarding which facts accurate information has not yet appeared. The position of the United States is, of course, attributable to the paucity of our representation, a circumstance, however, which cannot be urged in the case of England; so that, so far as that country is concerned, and even considering everything, we are somewhat at a loss to understand how, not merely with its own fine display, but also with that of its dependencies, Great Britain managed to reach so low a place on the list.

We expected, as a matter of course, to see local industries fostered, and consequently the leading of the nations by Austria, followed closely by Hungary, does not surprise us. The proximity of Germany, France, and Italy also accounts for their large figures; but on what possible ground Spain, a country for the past three years in a constant state of turmoil, with what little industries it had all but paralyzed, and producing nothing of major importance either in manufactures or arts, is granted a higher number of prizes than England, is totally beyond our comprehension. We shall await the full reports of the exhibition with increased impatience, if only for a solution of this paradox.

FAILURE NO. 2 OF THE BALLOON TO EUROPE.

Soon after the collapse of the *Daily Graphic* advertising balloon, on the occasion of its original inflation preparatory to the start for Europe, the proprietors determined to make use of such portions of the cloth as might be serviceable in the manufacture of a smaller gas bag for another trial. They accordingly reduced the bag from a capacity of 500,000 cubic feet to 250,000; and on October 6th, at 9:30 A. M., Mr. Donaldson, the aeronaut accompanied by two newspaper men, Ford and Lunt, started from Brooklyn, N. Y., "direct for Europe." During the preceding week Donaldson had made a couple of short ascensions in a small balloon, and had no difficulty, he said, in reaching that "easterly current."

On this last excursion, the balloon was provided with a life boat, as a car, to be used in case the voyagers should, by any unforeseen circumstance, be compelled to descend upon the raging deep. The boat was stocked with water and provisions for 40 days, together with a considerable quantity of sand ballast. The morning of the ascent was fine, and the balloon rose majestically, passing northerly over the cities of Brooklyn and New York at an elevation of about a mile, and for some time formed a conspicuous object in the heavens, for the gaze of our citizens. But it finally faded away into a mere speck and then wholly disappeared, going northeasterly. At 3 P. M. intelligence was received that the balloon had come down in a furious rainstorm at New Canaan, Conn., 60 miles from New York; and from the accounts of the poor aeronauts, they narrowly escaped with their lives. They represent that they sailed along beautifully until about 1 P.M., when they suddenly entered the precincts of a violent rain storm, which, spite of all they could do in the way of throwing out ballast, drove the balloon down to the earth, upon which they were tumbled in great disorder and violence, while the big bag and boat brought up against the trees and rocks. The balloonists further admit that, almost from the beginning of the voyage, they had to continue throwing out ballast in order to keep themselves afloat, which would seem to indicate that the balloon was in a leaky condition at the start. The *Graphic* people, however, insist that the machine was sound and strong, and allege that the fall was due to the great weight of water which accumulated on the surface of the balloon. If this is the fact, it might be desirable to provide the balloon with an umbrella, on the next trip to Europe, to keep off both rain and sun.

CAOUTCHOUC FROM COMMON PLANTS.

The extensive demands for india rubber, and the comparative scarcity of the supply, has augmented the price until it now stands at nearly one dollar per pound in this market. The crude matter comes from tropical regions, and is derived mostly from certain trees, the nomenclature and localities whereof were presented in a recent article in the SCIENTIFIC AMERICAN.

A variety of attempts to find substitutes for rubber, or new sources of supply, have been made. In the matter of substitutes, several valuable compositions have been invented, which are used in place of rubber for specific purposes.

Among the new sources of supply are the fruits, seeds, and juices of various plants, which have been successfully treated by Mr. D. M. Lamb, of Strathroy, Canada. By fermenting the asclepia or common milkweed plant, followed by pressure and evaporation, he separates a gummy liquid having the characteristics of rubber, and, like it, capable of vulcanization.

From the bamboo berry grown in the South, from flax seed and other seeds, he also obtains in this manner a similar gum, from which, it is said, a good article of vulcanized rubber may be made, and also an excellent waterproof varnish. It is alleged that these substances may be produced at a cost not exceeding 20 cents per pound, and that a company with a large capital subscribed is about to introduce the manufacture here.

RECENT GUNNERY TRIALS.

The special Board appointed to make comparative trials of howitzers, field guns, and mitrailleuses, assembled at Fortress Monroe on the 1st of October and closed their labors on the 6th. The trials were made under direction of General Gilmore, President of the Board, assisted by Colonel Treadwell of the Ordnance Department, and Captain Lorraine of the Artillery. The trials were made on the seashore near the Fort, the target being 9 feet high and 40 feet long.

The guns tried consisted of the ordinary Napoleon 9 pounder field gun, carrying 12 lbs. canisters; weight of gun about 900 lbs.; worked by 8 men; range of firing 800 yards; the ordinary 8 inch field howitzer, weight of gun about 2,500 lbs., worked by 8 men, range of firing 800 yards; the small Gatling gun, caliber ·42, weight of gun 200 lbs., worked by 2 men, range of firing 800 and 1,200 yards; the one inch Gatling gun, 900 lbs., worked by 4 men using canister cartridges each containing 21 half inch balls, range of firing 800 and 1,200 yards.

The remarkable advantages of the Gatling gun were never more thoroughly established than on this trial. At 800 yards the small gun threw 600 shots in 90 seconds, of which 515 hit the target, being from 8 to 10 times more than the hits made by the howitzer and field guns.

At 1,200 yards range the latter guns, owing to some defect in the ammunition, were withdrawn, to be tried on another occasion.

At 1,200 yards range the Gatling guns, both sizes, exhibited great success in striking the target with deep penetration. The heavy Gatling threw 5,355 missiles in 90 seconds, of which 1,595 struck the target. These are remarkable results and have probably never been surpassed in this species of gunnery.

CRUDE PETROLEUM FOR FUEL.

We are indebted to our correspondent at Norristown, Pa., Mr. H. L. Acker, for a further communication in reply to our comments on his letter upon the above subject, recently published.

He states that further trials, from which more exact data may be expected, will shortly be made; and it is therefore unnecessary to give his present letter in full. He informs us that the price of coal at Lamokin, Pa., is $6.30 per tun, and the price of crude oil 6¼ cents per gallon in bulk; and, on an allowance of 4 lbs. of coal per horse power per hour as a basis, he figures the relative costs of the two fuels at $5.40 for coal for ten hours, and $4.37½ for the petroleum.

In respect to an allowance of 4 lbs. of coal per hour, he says: "That is, of course, when the boiler and engine are most favorably constructed. But you are aware that, as a general thing, this will not hold good," etc. We will here remind our correspondent, and others who are studying on steam power, that a favorably constructed boiler and engine, properly run, should consume not over two pounds of coal per hour per horse power, and it is this quantity of fuel that they must beat, if they expect to drive coal out of use. We allowed 4 lbs. for the particular engine referred to, because more than half the fuel actually required to do the work is ordinarily wasted. But it is an unnecessary waste.

By reference to back numbers of the SCIENTIFIC AMERICAN, our correspondent will find plenty of examples of marine, portable, and stationary steam engines which run on 2 lbs. of coal per hour per horse power. Nearly all of the ocean steamers now plying between New York and Liverpool run on 2¼ lbs. per horse power per hour, some of them on 2 lbs., while the Cowper compound marine engine runs on 1½ lbs. This latter is the best practice yet reached, we believe; but theoretically, we ought to use only ½ of a pound of coal per horse power per hour.

STREET PAVEMENTS.

About three years ago, the subject of street pavements attracted considerable attention, and we had specimens of nearly every description that had ever been patented laid in various parts of the city. The general interest in this matter seems of late to have died out; but to those who own horses or have any regard for the sufferings of the noble animals, this will always be a subject worthy of consideration. The patent pavements, almost without exception, were found to be worthless, and the city authorities at last found this out and came to the conclusion that stone in some shape, and stone only, was fit for the pavement of our streets, particularly the thoroughfares. Of the other kinds of pavements, the Nicholson is the only one which has still any advocates. It is a good pavement as long as it lasts; but its lack of durability, the insecure foothold it affords in frosty weather, and its high price, are drawbacks which will always tell against it; besides, it cannot but be considered prejudicial to the public health, for it absorbs a portion of the effete matter constantly deposited upon it, and retains this in a moist state, favorable to decomposition, much longer than any other pavement we have. Of the stone pavements, the Belgian and the Guidet are generally acknowledged to be the best; and their superiority over the cobble stones, as usually laid in our streets, cannot be denied. The principal complaint against these pavements, particularly the former, is that the stones wear smooth and the horses slip; not only in winter, when there is frost, but at all times when dragging heavy loads and on starting. The fault found with the cobble stones, as they are put down in the streets of New York, is that the smaller stones sink after they have been subjected to a certain amount of travel, the larger ones, against which the hoof is apt to strike when thrown forward, remaining prominent, tearing off the shoe and causing the horse to stumble. Moreover, owing to the numerous inequalities of the surface, the horse must expend an increased amount of force to pull his load, and starting is rendered very difficult. But if cobble stones are properly selected, that is, if they are small and of a uniform size, they are superior to any stone pavement ever put down in giving a good foothold and doing little injury to the hoof.

Now, notwithstanding stone pavements are the only ones to be recommended at present, it is possible we may be able to secure something better for the future; and it being a matter of so much importance, there is every reason why the city government should seek to encourage experiment. Not such experiment as was tried under the old *régime* and which cost the tax payers so much; but let each patentee have a chance to exhibit his pavement, and demonstrate to the public whatever merits it may possess, by laying down a hundred feet or more in some of our public thoroughfares at his own expense. In this age of progress and enlightenment, it would seem as though we might ride with more comfort and have some feeling for our horses.

To the city railroad companies this is a matter of special interest, and it seems strange that they have not made greater exertions to protect their horses' feet and thereby diminish one great item of expense. No one has ever rode on the front platform of any of our horse cars without noticing with pain the difficulty the poor brutes experience in starting for want of a good foothold. The average length of time that a horse is serviceable on any of the city lines of cars is about three years and a half, and at least fifty per cent are rendered unfit for service on account of injury done to their feet or limbs, or from strains, the result of frequent slipping and consequent over exertion.

A model pavement would be one affording a good foothold, impenetrable by water or moisture and comparatively level, that is, presenting an even surface. It should possess a certain amount of elasticity, which would not only render it less injurious to the horses' feet but would tend to deaden the sound of vehicles passing over it. If such a pavement could be produced at a reasonable price, and if it were durable, it would certainly meet with public favor, for it would prove a blessing to the horse and a great saving to the owners of horses.

CURIOSITIES OF BUTTER AND CHURNING.

The art of making butter is by no means of modern date; this, the derivation of the word from the Greek *buturon*, and this again from *bous*, a cow, and *turos*, cheese (literally cow's cheese) sufficiently indicates. But although the word is of Greek derivation, it was late before this people had any notion of it. Their great poets, Homer, Theocritus, and Euripides, who, like Shakspeare, drew the stores for their immortal creations from all sources of knowledge, do not speak of it, although they mention milk and cheese. Aristotle, the famous philosopher of olden time, first speaks of a fat substance contained in milk which, under certain circumstances, becomes like oil. Herodotus the Greek historian is the most ancient writer who, in his account of the Scythians, describes a process for making butter. The word *buturon* first occurs in Hippocrates, who was nearly contemporary with Herodotus, in the fifth century B. C. "The Scythians," says Hippocrates, "pour the milk of mares into wooden vessels and shake it up violently, making it foam, when the fat part which is light rises to the top and becomes *buturon*." Dioscorides, 33 B. C., says that good butter is prepared from the fattest milk of sheep or goats, by shaking it in a vessel till the fat separates. He says, also, that it can be melted and poured over pulse and vegetables, instead of oil, and might be used in pastry instead of oil. It is evident from this that drawn butter is not a modern invention, and that our pastry cooks have certainly learned something from their grandmothers.

But the principal use of butter among the Greeks and Romans was as an ointment and a medicine. The Romans were accustomed to anoint the bodies of their children with it to render them pliable, and the Burgundians extended its applications by using it as a hair oil. Plutarch, the prince of ancient story tellers, informs us that a Spartan lady once paid a visit to Berenice, the wife of Deiotarus, and that one smelt so strongly of ointment and the other of butter, that neither could endure the other. We are not told what kind of ointment it was, but we can safely assert that the butter must have been very rancid.

The ancient Christians of Egypt burnt butter in their lamps instead of oil; and in more recent times, it was used for the same purpose in Roman Catholic churches, during the Christmas festival, to avoid the great consumption of olive oil. The Cathedral of Rouen has a tower called the butter tower, from the fact that the Archbishop of Rouen, in A. D. 1500, finding the supply of oil to fail during Lent, permitted the use of butter in lamps, on condition that each inhabitant should pay six derniers, with which money the tower was built. There are other "butter towers" at Notre Dame, Bourges, etc.

It is evident from the early history of butter that the Greeks and Romans did not use it to any extent in cooking or in the preparation of food, but Anaxandrides, a poet who lived shortly after Hippocrates, mentions a banquet where the Thracians ate butter, to the astonishment of the Greeks. But the article formerly called butter was oily and impure, wanting the firmness and consistency of that of modern times. It was consequently prone to decomposition, and its use limited. The ancients had usually accustomed themselves to good oil, and butter, in later times even, has been very little used in Italy, Spain, and the south of France, but was sold chiefly by the apothecaries for medicinal purposes. Most modern Biblical critics agree that the word translated butter in our version of the Scriptures means milk or cream, or, more properly, sour thick milk. In the 30th chapter of Proverbs, we find a verse beginning "the churning of milk bringeth forth butter, etc." This would certainly seem to describe the preparation of butter, but the original Hebrew words *chaleb metz* signify squeezing or pressing, as for example, the udder of a cow; so that milking, and not making butter, is supposed to be meant. It is very probable that the formation of butter was discovered by accident in the transportation of milk in skins, which are still used in Barbary. In this country the Arabs churn their cream by suspending it contained in skins of goats in their tents and pressing it to and fro. Dr. Chandler, in a journey from Athens to Corinth, noted the mode of churning in the Levant. It consisted in securing the cream in skins, and then treading them with the feet. In Bengal, probably owing to indisposition to exertion in consequence of the excessive heat, they manage to make butter come by simply turning a stick around in the milk, but the product cannot be large. The inhabitants of the interior of Africa seem to be favored with respect to butter. The famous traveller Mungo Park, whose adventures delighted our boyish days, says that a tree grows there, resembling American oak, which bears a nut like an olive. When the kernel of this nut is boiled in water, it yields a butter, which the traveller asserts is whiter, firmer and of a richer flavor than any he ever tasted from cow's milk; and which will keep without salt for a whole year. The natives call it *shea toulou* or tree butter, and large quantities are made.

SCIENTIFIC AND PRACTICAL INFORMATION.

TEST FOR ARSENICAL COLORS ON WALL PAPERS AND IN PAPER GENERALLY.

Professor Hager recommends the following method for detecting this dangerous class of arsenical colors, which, we may remark, are not confined to green alone, for even red sometimes contains arsenic: A piece of the paper is soaked in a concentrated solution of sodium nitrate (Chili saltpeter) in equal parts of alcohol and water, and allowed to dry. The dried paper is burned in a shallow porcelain dish. Usually it only smolders, producing no flame. Water is poured over the ashes, and caustic potash added to a strongly alkaline reaction, then boiled and filtered. The filtrate is acidified with dilute sulphuric acid, and permanganate of potash is added slowly as long as the red color disappears or changes to a yellow brown upon warming, and finally a slight excess of chamelion solution is present. If the liquid becomes turbid, it is to be filtered. After cooling, more dilute sulphuric acid is added and also a piece of pure clean zinc, and the flask closed with a cork split in two places. In one split of the cork a piece of paper moistened in silver nitrate is fastened, in the other a strip of parchment paper dipped in sugar of lead. If arsenic is present, the silver soon blackens. The lead paper is merely a check on the presence of sulph hydric acid. According to Hager, the use of permanganate of potash is essential, otherwise the silver paper may be blackened when no arsenic is present.

CURIOUS SUBSTANCES IN GUANO.

In former communications, says *La Nature*, M. Chevreul has called attention to the unexpected effervescence manifested by guano when combined with water. The author now considers that this property is due to the presence of bicarbonate of ammonia.

It is quite credible that this effervescence might take place if the guano were placed in a moist field, the material losing instantly all its excess of carbonic acid and consequently its activity. Once saturated, it becomes inert. M. Chevreul finds that the material dissolved by the water is crystalline and, as above noted, constituted by an ammoniacal salt but as yet the acid is not determined, though it is probable that it belongs to the long series of uric derivatives. The residue obtained after the action of water is partially soluble in alcohol, the solution containing various immediate principles of the guano, and among them the odorous principle or avic acid. The portion not dissolved consists especially of phosphate of lime.

It is an interesting fact in relation to avic acid that guano, despoiled of this substance and hence rendered inodorous, regains in a short time its characteristic aroma. The same has been found true of musk, which although once deodorized becomes again a perfume after several years. It is believed that, by a peculiarity analogous to the above, game leaves upon the ground a permanent scent, traceable by the delicate organs of the dog.