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At 1,200 yards range the latter guns, owing to some defect in the ammunition, were withdrawn, to be tried on another occasion.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