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Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 184,
For the Week ending July 27, 1878.

VULCANIZING RUBBER.

In reply to numerous queries from our correspondents, we give the following general information respecting the processes in common use for vulcanizing caoutchouc. The purified and masticated gum is kneaded on warm rolls with the proper proportion of flowers of sulphur. Other substances, as whiting, white lead, litharge, zinc oxide, disintegrated refuse rubber (vulcanized), etc., are often added to increase the volume of the product and economize the more costly caoutchouc. Lead compounds blacken the goods through the formation of lead sulphide.

For soft goods the proportion of sulphur added is usually about six per cent. For the cheaper grades of fabrics a mixture in common use is, rubber 32, sulphur 2, whiting 25, white lead and litharge 4. The product is black, resembling that of which rubber overshoes are made. For lighter fabrics oxide of zinc is sometimes substituted for the lead. After thoroughly kneading the mixture into a homogeneous mass, it is rolled into sheets or boards, and from these the forms are moulded—the substance readily receiving and retaining the impression of a warm mould into which it is forced.

The heating or vulcanizing is conducted in strong cast iron cylinders, one end of which is movable and serves as a door. The goods to be vulcanized are loaded upon a car and run in upon a railway extending along the bottom of the chamber. Powdered steatite (soapstone) is freely used to prevent adhesion of the different articles, the goods often being packed in boxes filled with this substance. When the heater is charged and the door made fast, high pressure steam is admitted until the desired temperature is attained. This varies somewhat with the character of the articles—according to Dr. Chandler, five hours at 240° Fah. is said to be the temperature for fire hose. In factories where smaller articles are made, the goods are generally exposed in the heaters for four to four and one half hours, the temperature, at first about 250°, gradually being augmented to 275° Fah., at the termination of the operation. A temperature exceeding 280° Fah. injures the goods. Hard rubber, vulcanite, or ebonite differs from ordinary vulcanized rubber only in that a much larger proportion of sulphur enters into its composition and the vulcanizing process is conducted at a more elevated temperature. Usually the caoutchouc has incorporated with it half its weight of sulphur; but, as in the preparation of soft rubber, various foreign substances—metallic sulphides and oxides, shellac, asphaltum, etc.—are often added. Mixed with a little litharge it becomes very black; with sulphide of mercury (vermilion), bright red; and composition similar to the red vulcanite used for dental purposes is prepared with six parts of sulphur, sixteen of caoutchouc and eleven or twelve of vermilion. The vulcanizing operation is usually conducted at temperatures increasing from 275° Fah. to 305° Fah., the time required being about six hours. The articles are packed in steatite or supported in water trays in the vulcanizer, and, if to present a glossy exterior, are sometimes enveloped in thick thin foil.

Thin sheets of rubber or small articles are sometimes vulcanized by what is called the cold process (Parks's). In this the caoutchouc is simply immersed in a mixture of forty parts of carbon disulphide or benzolene and one part of sulphur chloride. It is next placed in a room heated to 70° Fah., and when all the carbon sulphide has been volatilized the process is in so far complete that it is only requisite to boil the material in one pound of caustic potash in about 2 gallons of water, the vulcanized caoutchouc being next washed to remove excess of alkali. The results of this treatment are not always satisfactory owing to the superficial action of the vulcanizing substances.

STRAWBERRIES AND CONSTIPATION.

Professor F. H. Storer, of Harvard University, in a communication to the *Journal of Pharmacy*, calls attention to the fact, not generally known (and which certainly would scarcely be expected), that ripe strawberries are very apt to induce constipation. He remarks that in this country particularly, "where an immense and well nigh universal consumption of this fruit is coincident with the setting in of hot weather, the constipating action of the berry is complicated and, as it were, increased by the excessive waste of water from the body, by perspiration, which occurs at this period; and there can be little doubt that, taking the two causes together, the strawberry season—though perhaps beneficial to some constitutions—is the occasion of much ill health among the American people."

This binding action of so popular a fruit as the strawberry is just the reverse of what might be expected, when we take into consideration the numerous small seeds of the berry, which, it would be supposed, would tend to promote discharges from the bowels by mere mechanical action.

It occurred to Professor Storer several years ago that Liebig's theory that the cathartic action of many saline medicines should be referred to their osmotic relations to the membranes of the intestinal canal and the blood vessels might be extended and made the basis of a rational treatment of constipation. He reasoned that it might perhaps be easy to annul the tendency to constipation so common in the hot, dry weather of early summer, by "checking or diverting the course of some part of the water which would naturally be exuded by the skin at this season, and causing it to pass into the rectum." This result he thought might be brought about by eating or drinking, frequently, small quantities of harmless indigestible colloid substances, which, while holding water forcibly, could not readily pass through the walls of the stomach by osmose, and would therefore reach the rectum as a liquid, and prevent its contents from becoming hard. He states that it is not improbable that the pulp-like flesh of prunes and tamarinds contains just such an inert indigestible colloid substance, and that to its presence is due the medicinal efficacy of these fruits. However true this may be, he has had no time as yet to study the matter; but having lately noticed that the action of one of the many mineral waters now in common use is closely analogous to that of his proposed colloid medicament, he deems the conception worthy of being kept in view and subjected to further tests. He finds that Friedrichshall bitter water, taken in doses of a small wineglassful three or four times a day, is an effectual cure for the constipations of early summer, and for those produced by strawberries; not that the water in these small doses acts as a cathartic, but that it carries enough water to the rectum to keep its contents soft. He has, however, prepared a solution of far less disagreeable taste than that of the Friedrichshall water, and equally effective against the kinds of constipation under consideration, by simply dissolving 15 grammes of Epsom salt and 8 grammes of common salt in a quart champagne bottle full of water. A small wineglassful of this solution may be taken on going to bed at night, on arising in the morning, in the middle of the afternoon, and of the forenoon also, if need be. Sometimes a couple of doses will be all-sufficient, taken at night and morning. These salts can be obtained almost everywhere, and may readily be carried about in traveling, in the form of dry powders, to be dissolved in water whenever they may be needed.

The mode of action of these small doses of saline matters is possibly to be explained on the old theory that the salts have a tendency to detain the water in which they are held in solution, and to prevent its passage through the walls of the intestines by osmose, thus allowing to be carried into the rectum a certain amount, which but for the presence of the salts would have been discharged through the skin.

PROFESSOR LANGLEY'S PAPERS ON THE SUN.

Those who are familiar with Professor Langley's high rank as a skillful observer of solar phenomena will not need to have their attention specially called to the series of articles on the sun which he has prepared for this paper. For freshness of information, clearness and aptness in illustration, they will be found superior to anything that has appeared on this subject for a long time. The article on eclipses, in this week's issue, is particularly timely, and we trust that not a few of the readers of the SCIENTIFIC AMERICAN will follow his advice in observing the coming eclipse and in reporting their observations. As Professor Langley shows, it is often in the power of non-professional observers to add materially to the scientific results obtained during the progress of such rare and imposing phenomena. The circumstance that the line of totality passes for the most part over a sparsely settled region makes it all the more important that every one who has an opportunity to witness the eclipse should become, if possible, for the moments of darkness at least, a scientific observer.

DESTRUCTION VS. CONSTRUCTION OF IRONCLADS.

While other nations are expending immense sums in the construction of heavy ironclads, and without apparently coming any nearer to a decision as to which is the more irresistible, shot or armor, we are wisely giving especial attention to studying how they may best be destroyed and now that our naval officers have become so familiar with the management and the capabilities of the submarine torpedoes, we expect soon to hear of an aerial torpedo, which, propelled by steam or compressed air or after the manner of a rocket, may as successfully attack the deck as the other can the bottom of these ships.

While political conditions demand of others that they should perfect and multiply all means of attack, we, fortunately, may confine ourselves to those of defense, making ourselves impregnable against scores of ironclads at less than the cost of two or three of them.

How Raisins are Prepared.

A strip of land bordering the Mediterranean, somewhat less than 100 miles in length and in width not exceeding 5 or 6, is the raisin producing territory of Spain. Beyond these boundaries the Muscatel grape, from which the raisin is principally produced, may grow and thrive abundantly, but the fruit must go to the market or the wine press. When the grapes begin to ripen in August the farmer carefully inspects the fruit as it lies on the warm dry soil, and one by one clips the clusters as they reach perfection. In almost all vineyards slants of masonry are prepared, looking like unglazed hot beds, and covered with fine pebbles, on which the fruit is exposed to dry. But the small proprietor prefers not to carry his grapes so far. It is better, he thinks, to deposit them nearer at hand, where there is less danger of bruising, and where bees and wasps are less likely to find them. Day by day the cut branches are examined and turned, till they are sufficiently cured to be borne to the house, usually on the hill top, and there deposited in the empty wine press, till enough have been collected for the trimmers and packers to begin their work. At this stage great piles of rough dried raisins are brought forth from the wine press and heaped upon boards. One by one the bunches are carefully inspected, those of the first quality being trimmed of all irregularities and imperfect berries and deposited in piles by themselves; so in turn are

treated those of the second quality, while the clippings and inferior fruit are received into baskets at the feet of the trimmers and reserved for home consumption. A quantity of small wooden trays are now brought forward, just the size of a common raisin box and about an inch deep. In these papers are neatly laid so as to lap over and cover the raisins evenly deposited in the trays, which are then subjected to heavy pressure in a rude press. After pressing the raisins are dropped into the boxes for market.

THE SUN.

BY S. P. LANGLEY, ALLEGHENY OBSERVATORY, PA.*

A "TOTAL" ECLIPSE.

Every one has seen an eclipse of the sun of some sort, but a "partial" eclipse as seen through a piece of smoked glass, though no doubt a curious and interesting, can hardly be called an imposing phenomenon. From some such experience, perhaps, many form an idea of what a "total" eclipse may be like, but in reality there is hardly any resemblance. Not only is a solar total eclipse, by general agreement, the grandest and most imposing spectacle nature offers, but it is to most the rarest of all; the chances being against any average human life's bringing the opportunity to see one from any given place on the earth's surface.

Besides this it is a most important opportunity for seeing certain things about the sun which are never visible even to the most powerful telescope at any other time. We say "about," and not "on," advisedly, for the things in question belong to a region extending out from the sun into space, where every feature is usually obliterated by the greater brilliancy of sunlight. It is only when this is withdrawn, and we are in the shadow of the moon, that the "corona" appears, though it is always existing there; as the stars are by day in the heavens unseen till the shadow of the earth makes night. When such an event as a total eclipse occurs, observers therefore travel if necessary across the globe to see it, though the spectacle lasts usually less than five minutes; and one such is to appear in the Territories of the United States on the 29th day of the present month.

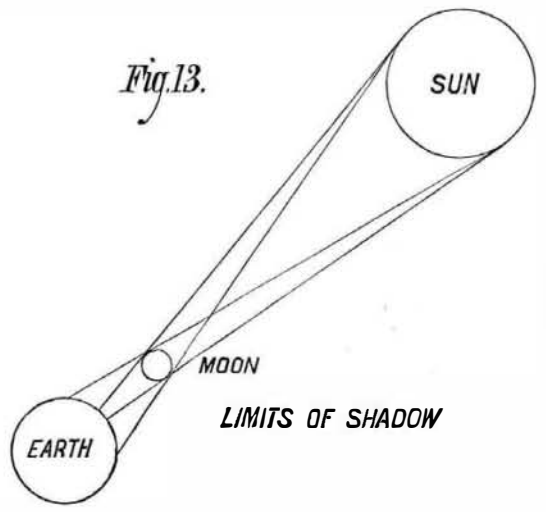
It will be seen from the annexed figure (Fig. 13) that when the moon comes between the sun and earth, two shadow cones are formed; one (the larger) within which the observer will have his view of part of the sun cut off by the intervening body (and see a "partial" eclipse), the other cone marking the limits within which the whole sun is rendered invisible, and the eclipse is total.

The first cone grows larger and larger as we go away from the moon in the direction opposite the sun, the second smaller and smaller. If the moon were a little further off than it is, the apex of this second cone might be reached without its touching the earth at all, and as her distance is variable this in fact sometimes happens. The moon is always so far away (and so small compared with the sun) that the section of the inner cone where it strikes the earth is at all times small, or, in other words, the part of the earth whence a total eclipse can be seen is never more than a very small portion of the whole. The section of the inner cone where it strikes the earth is (where the sun is vertical), generally speaking, a circle of less than 200 miles in diameter, and as this section is carried along by the moon's motion and the earth's together, it sweeps over the surface of our globe in such a narrow belt as is shown in Fig. 14, which is taken from the *American Nautical Almanac*, with a very slight modification that the heavy black line across the continent marks both the track along which totality lies and the width of the very narrow region through which alone it is visible.

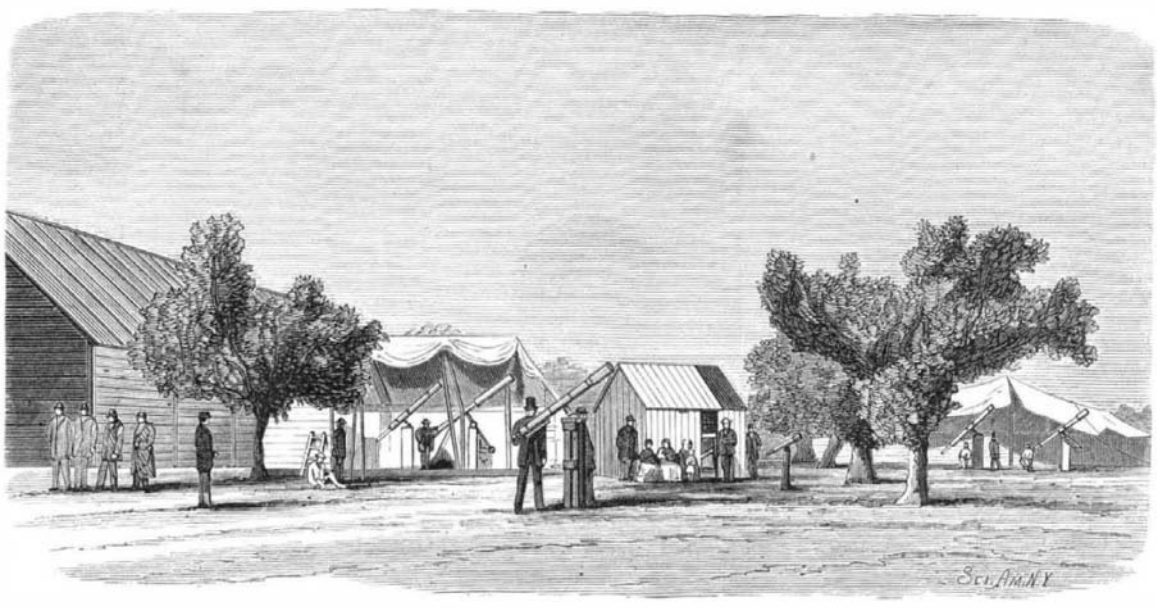
When from an elevated station we watch the progress of a total eclipse, the sun's disk is seen to be slowly invaded by the advancing moon, and as the solar brightness is gradually reduced to a thin crescent, daylight fades with increasing rapidity, and a quite peculiar and unnatural light, hard to describe but which no one forgets who has once seen it, spreads over the landscape. Then, and suddenly, we come to a new sense of the reality (if I may so speak) of the heavenly bodies, for the moon, which we have been accustomed to see as a disk of distant light on the far background of the starry skies, takes on the appearance of the enormous solid sphere which it is, and a faint glow within its circumference (due, perhaps, to reflection from the corona) makes its rotundity so perceptible that we feel, perhaps for the first time, the perpetual miracle which holds this great cannon-ball-like thing from falling. But almost at the same moment we become aware that its immense shadow is rushing toward us, blotting out the landscape, and advancing like a material darkness with an effect actually terrifying.

Lest I seem to exaggerate, let me quote the words of another, a trustworthy and careful witness. Principal Forbes, watching the eclipse of July, 1842, in Europe, says of this: "I perceived in the southwest a black shadow like that of a storm about to break, which obscured the Alps; it was the lunar shadow coming toward us. Those who have seen a locomotive approach at the rate of 40 miles an hour can judge of the stupefaction caused by the approach of this black column with all but lightning speed. I confess it was the most terrifying sight I ever saw. As always happens in the case of sudden, silent, unexpected movements, the spectator confounds real and relative motions—I felt almost giddy for a moment, as though the massive building under me bowed on the side of the coming eclipse."

Fig. 13.



Another witness, Captain Biddulph, says:- "The light cloud I saw distinctly put out like a candle. The rapidity of the motion of the shadow, and its intenseness, produced a feeling that something material was sweeping over the earth at a speed perfectly frightful. I involuntarily listened for the rushing noise of a mighty wind."



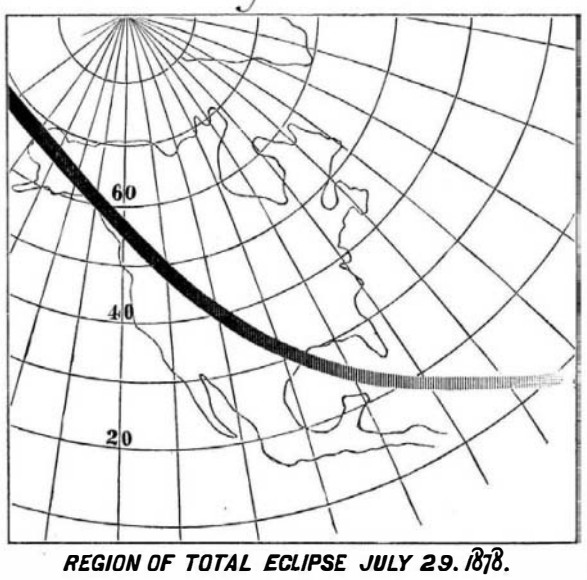
"ECLIPSE ENCAMPMENT."

The shadow having involved us, we look up to the place the sun occupied a moment ago, and find in its stead a black circle, around the edge of which are irregular flames, or what seem like flames, chiefly of a rose red, rising in fantastic shapes to heights which in some cases have exceeded 80,000miles (Fig. 15, p. 50). These are not always present in equal quantity. In the eclipse of this month they will probably be few, but they are always a beautiful spectacle. The illustration annexed (Fig. 15) is taken in part from a paper in the notices of the Royal Astronomical Society, describing the English observations of an eclipse in India, and gives a fair idea of the sizes of these "flames" compared with that of the sun. The variety and in some cases beauty of the "flames" themselves, when studied separately by the spectroscope, are very great, and even as small as the scale of the drawing is, they exhibit great diversity of outline. None are here seen entirely detached from the sun, and floating cloudlike above its surface, but such are sometimes visible. At the time of the eclipse at which this drawing was taken, the "flames" were the objects of principal curiosity, and it was even uncertain till then whether they were attached to the sun or moon. But the dark body of the moon was distinctly seen to advance over them, and their fluctuating character was exhibited by drawings taken a short distance of time apart. Thus the great prominence at A is shown on an enlarged scale at A′ with its curious twisted structure as it appeared to the English observers at Guntoor, while at B is another enlarged view of the same prominence as it appeared at Mantawalock which the eclipse reached later. It is very plain that its form has altered in the interval. The curious spiral, striated structure of A has also been observed by Professor Abbe of the United States Signal Service in portions of the corona itself, or in what appears to be such. The whole structure of these red "flames" allies them with the delicate cloud forms described here as seen in spots, and it will likewise be noticed that they are shown on the figure as not being seen about the solar poles, a region from which the spots are also absent. Beyond them, stretching out into space for distances sometimes equal to the sun's entire diameter, are brushes of pale light, whose extremities some describe as perceptibly curved and scintillating, or at least fluctuating. (These were to me the most striking thing in the eclipse of 1869.) It is not entirely certain how far these brushes are a real solar appendage, for something like them can undoubtedly be produced by the rays of the sun broken by the ragged mountainous edge of the moon, and seen reflected from the distant parts of our own atmosphere, in such a way that by an effect of perspective they seem to be entirely without it (Fig. 16). Nearer to the body of the invisible sun the light grows brighter and more continuous, till close to the black moon it becomes much brighter than full moonlight would be, and gives so much light that in the complete absence of the sun only the brighter stars are visible. The darkness is then by no means absolute, and it is further lessened by light reflected from regions in the extreme horizon, which are without the limits of totality.

The red flames are a part of what is called the chromosphere of the sun. The rest of the appearances described belong to the corona, the crown or glory about the eclipsed orb, as they seem, looking, in fact, much like the aureole represented by painters about the heads of saints. Fig. 16, p. 50 represents the inner corona and red flames as drawn by Professor J. H. Eastman, U.S.N. Fig. 17 is from a sketch by Tacchini, and shows the more extended corona rays as seen at the eclipse of December, 1870. The total phase lasts at the longest six or seven minutes, but rarely as much as that. In the case of the eclipse of 1870, observed at the station of Xeres de la Frontera, by the U. S. Coast Survey eclipse expedition, the whole duration was two minutes and ten seconds, and for the opportunity afforded by this brief interval the ocean had been crossed by a whole body of observers. Two principal parties were dispatched for the purpose by our Government, and the operations of that at Xeres, under the direction of Professor Winlock, may be taken as an example of the care and preparation used on such an occasion.

The party in this case consisted of fourteen, eleven of whom were from this country, and the station (in a vineyard near the town of Xeres) presented, from the number of the tents, the appearance of a military encampment (Fig. B). Every variety of instrument that science uses at such a time was in requisition: huge telescopes, solidly mounted and driven by clockwork, carried photographic apparatus; others spectroscopes; close by was a heliostat and horizontal telescope 40 feet in length, also for photography. Other telescopes were directed so as to form cameras, for sketching the corona; still others bore polariscopic apparatus for determining the character of its light. Elaborate provision for measuring its brightness was made, and in charge of a little division of the party in a neighboring orange grove, while a coast survey transit station had been improvised, with mounted transit, chronograph, chronometers for determining the time, and telegraphic connections established for the purpose with the Spanish Observatory of St. Fernando, near the city of Cadiz. Each of the observers had drilled himself for weeks beforehand in every part of every observation to be made by him, and there was such subdivision of labor that each had one thing only to do. As the critical moment approaches, lamps are lighted. Clouds are sweeping over the sky, and it has been raining a few minutes before, but now a break in the clouds appears about the sun, showing the light dwindled to

Fig. 14.



REGION OF TOTAL ECLIPSE JULY 29. 1878.

* For Part I. see SCIENTIFIC AMERICAN of July 20.