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SCIENTIFIC AMERICAN SUPPLEMENT

No. 667.

For the Week Ending October 13, 1888.

Price 10 cents. For sale by all newsdealers.

A LETTER ENVELOPE GUM GREATLY NEEDED.

In consequence of the decline in the supply of gum arabic, the Post Office department has been obliged to abandon its use of this excellent material as a sealer for letter envelopes. In lieu of gum arabic a filthy and foul-tasting compound has been substituted, which is a disgrace to the department and a nuisance to all who have occasion to seal a government envelope. Any one who closes a letter in the ordinary manner finds the lips soiled and a villainous taste left in the mouth.

It is to be hoped the ingenuity of chemists will be able to purify the substances now used, or produce a new gum that shall be free from the objections mentioned. Such an invention or discovery ought to prove highly profitable to its author, for it is greatly needed by the public.

A PROPOSED ELECTRO-MOTOR TRIAL.

The project of a large sleeping car company to have built for them a four-mile electrical railroad, for illustrating the advantages of each type of motor, will be the first really practical attempt to compare the various systems on the same line and under similar conditions. If the avowed purpose of the company may be accepted in good faith, and the projectors of the various systems will really assent to such comparative trials, we are likely to get at more cold facts concerning electro-motors than we have had for many a day. The advantages and defects of the overhead trolley system and the underground conduit plan will be exposed before critics eager to make them known. There is the curve on the plane and on grade, the straight line on grade, starting and stopping, unexpected weights and hauls, and the like. Which system can most quickly accede to the requirements, most readily overcome the various difficulties, and bear the handicapping? What are the relative advantages of taking the current from a wire overhead, and from a third rail, and from a sunken main?

The projectors of the third-rail system say that the trolley system is uncertain; the trolleys snap from their propelling wires or fly off at slight impediments, relying on the climbing capacity of the passengers in the car below to keep them in their places. On the other hand, the overhead people—we do not refer to celestial folk, who would not, of course, prevaricate about such small things as electro-motors—we say these overhead people declare the trolley system to be the only reliable one; the transmission of the electrical energy being wholly removed from contact with the ground, which, as is well known, is the worst of insulation, and carried through the air, which is the best. In the use of high tension currents, they aver, and it would seem with reason, that it is difficult to protect the public, and with low tension currents slight leakages often suffice to reduce the available energy below the amount required to operate the road. Those who may have watched unprejudiced the progress of the various systems of electrical locomotion will doubtless agree that each seems to have some special virtue in the way of economy or certainty of operation. And so it is to be hoped this wealthy manufacturing company is sincere in its promise to give each a fair trial. A four-mile line would seem to be adequate for the purpose, and the neighborhood of large stationary engines a most convenient starting point.

THE NEW PHILADELPHIA SUBWAYS.

The plan adopted for burying all the telegraph and telephone wires of Philadelphia has about it that air of cool consideration and substantiality that mark the Quaker mind. After long investigation of the hundred and one good, bad, indifferent, but always cheap plans for burying the wires, the managers of these companies have thrust all aside and hit upon an expensive system of their own in the belief—a reasonable one, be it said—that it will prove cheapest and most satisfactory in the long run. They will build a brick conduit eight feet high and four feet wide through the main streets and avenues. There will be fifty 3 inch iron pipes, each containing 100 wires, and so 5,000 wires in all. One connection only will be made with each block, a main running from the conduit and underneath the house line to the middle of the block, where, from the top of a tall pole, the wires will be run in mid air to the rear of each house. The estimated cost of construction, it is said, will be $250,000. Powerful pumps will keep the conduit filled with dry air, and every foot of main may be subjected to daily inspection because of its generous dimensions.

As will be seen, it is not necessary, in such a system to tunnel every main street and avenue, but, at most, only every second or alternate one, for from one line the wires may be run to the blocks on either side. Indeed, the number of main lines could, it is obvious, be still further reduced by branching, and, doubtless, it was only the fear of possible trouble from complication that induced the Philadelphia managers to forego the temptation to so lessen their construction account. The work is now fairly started, indeed, a part on the south side of Market Street, from the Delaware River to Fourth Street, is nearly complete.

Curiously enough, the tunnel system has been looked upon, from the very first, as impracticable, because of its cost. Nor is this surprising when we remember that most of the estimates for construction were for lengths of lines greatly in excess of what is now found to be required, while some seemed to be based upon such elaborate construction as that of the Paris sewage system. This Philadelphia system, even though it should fail of success as first projected, may, through experiment and modification, yet prove the most worthy of all, and furnish criteria for a practical system of subway construction.

THE DIRECT PRODUCTION OF LIGHT.

In his paper entitled The History of a Doctrine, read before the American Association at their last meeting, in Cleveland, Prof. Langley gave a graphic account of the development of the undulatory theory of light. He held that much yet remained to be done in that field of research, and he formulated a definite object for investigation—the relations between radiation and heat. For at the present time it is far from clear how much heat the purely light-giving radiations from a luminiferous body can produce. The mechanical equivalent of light is as yet unknown.

We have every reason to believe that it is very low. There is little doubt that could we estimate the equivalent in energy of the light-giving radiations of a source of light, it would be surprisingly small. Acting on this idea, and assuming and probably believing that the hypothetical luminiferous ether is an actual entity, Prof. Lodge, in England, and Prof. Hertz, in Germany, have been making very interesting experiments in the direction of the production of light. Accepting the identity of luminiferous and electrostatic disturbance ethers in accordance with Clerk Maxwell's hypothesis, they have endeavored by rapidly alternating pulsations or electrostatic discharges to produce light waves without the intermediation of ignited or incandescent matter. Hertz produced such rapid alternations that, treating them as waves, their length would have been two meters. Lodge's oscillations were slightly longer.

Nothing is truer than that the contrast between the small amount of energy absolutely needed to produce light and the large amount that practically has to be expended gives a disparaging view of man's progress. In the flame of a candle, a lamp, or a gas burner the light is probably derived from ignited carbon. Yet in the case of gas, for raising this carbon to the light-giving temperature, not over one or two per cent of the heat of the flame is theoretically required. Of the total radiations of a gas flame, according to Sir. C. W. Siemens, but five per cent are luminous, and for an incandescent electric lamp he gives about the same ratio. These estimates can be accepted as provisional only, but they are at least indications of the amount of waste. In the maintenance of the incandescent electric lamp a full horse power is required to keep a few feet of minute carbon filament at the incandescent temperature. Taking the useful radiations at five per cent of the total, it follows that we should be able to run twenty times as many lamps could we produce radiations restricted to the range of light.

Prof. Lodge's way of putting the case is so very striking that we refer our readers to it, as given in the last issue of the SCIENTIFIC AMERICAN. He states his case as a whole with great clearness. Where he refers to "atom" he probably employs the word in the physicist's sense, and as a concession to accuracy might have done better in using the word "molecule." It is evident that to his mind the ether is a real entity. In this he corresponds with the general tendency of English physicists. In comparison with some of the positive views concerning the ether which were enunciated at the last British Association meeting, Prof. Langley's address on the subject of radiation reads almost like a proclamation of uncertainty. From such an authority as Prof Langley, one who by his classic experiments on radiant energy has won the highest reknown, the *quasi* disclaimer comes with added grace.

The ether is still hypothetical; an *a priori* attempt to produce light by throwing it into oscillation by direct electric action seems based on an insecure foundation. A few years ago the world was startled by the announcement that the astronomer Lockyer had discovered the identity of all the elements and the unity of matter. When this came to be sifted down, it proved only a hypothesis, although a highly probable one, based on spectroscopic observations. It was so well founded that it holds ground to the present day as a probable proof. Yet in the practical sense it was nothing. When first reported many doubtless saw the transmutation of metals near at hand.

So it will be with the experiments we speak of. Should they lead to the production of light unaccompanied by obscure heat radiations, the world will be incalculably benefited. The energy corresponding to the maintenance of a single horse power will give the light of five thousand candles. Oil will be burned no longer, save in isolated places. An ordinary house will be lighted by a motor of $\frac{1}{50}$ horse power. "Wasting the midnight oil" will have a mechanical as well as an intellectual significance. All the world, therefore, must wish well to the patient investigations of Prof. Lodge and his co-laborer. Should they shorten their waves to the proper length, and find that they are light waves indeed, they will do more for civilization than Argand, Murdoch, and Lebon.

Gas Fuel for Locomotives.

An ordinary 3,000 gallon tender weighs about 73,400 lb., when in working order, with full tank and 12,000 lb. of coal. The tender, when empty, weighs about 36,400 lb., of which the tank alone accounts for about 8,000 lb. The trucks, sills, etc., therefore, weigh about 28,400 lb. and, when the tender is loaded, serve to carry a weight of 45,000 lb. in the shape of coal, water, and the tank itself. The carrying part of the tender, therefore, weighs about 63 per cent of the parts carried. If we assume that this proportion holds good in the far larger tender needed for natural gas, the weights come out as follows:

	Lb.
Gas tank	50,000
Gas	3,000
Water tank, say	7,000
Water	25,000
Total	85,860
Add 63 per cent for trucks, sills, etc.	54,092
	139,952

Nor is this the worst of the story. Taking the average weight of the tender when fuel and water are half consumed, the ordinary and the natural gas tenders compare as follows:

	Natural gas tender.	Ordinary tender.
One-half supply fuel	1,930	6,000
Fuel tank	50,000	} 8,000
Water tank	7,000	
One-half supply water	12,500	12,500
Trucks, etc.	54,002	28,400
Total	125,522	54,900

In other words, when both tenders are fully loaded, the natural gas tender is nearly double the weight of the ordinary tender *of the same capacity*, the excess of weight being 66,600 lb. When both tenders are half empty, approximately the average running condition, the difference in weight is over 70,000 lb., and the ordinary tender weighs less than 44 per cent of the natural gas tender.

Even if these immense differences in weight did not enhance the first cost and diminish the hauling power of a locomotive with a natural gas tender, the great increase in the length of the tender, necessitating an entire reconstruction of all round houses and turn-tables, would condemn the project.

The many useful and valuable properties of natural gas are self-evident, but a little consideration will show that it is very unsuitable for use on locomotives running any considerable distance. It is possible that under special conditions compressed fuel gas could be stored to run a locomotive a short distance. The necessity of making the tank and connections absolutely tight would probably be a serious objection. The gas that escapes from the present natural gas pipes is a source of danger, but the loss is made up from the ever flowing wells, whereas a leakage from a reservoir containing only a limited supply would soon mean a stoppage on the road for lack of fuel.—*Railroad Gazette.*

Collapsible Lifeboats.

The new Inman and International liner City of New York, which has just made her first round trip across the Atlantic, has as great, probably more, lifeboat accommodation than any other vessel afloat. In all says *Engineering*, she carries thirty boats of large size, capable of carrying every soul on board in ordinary sailings. It has only been possible to carry such a large number of boats without unduly encroaching on the promenading space by adopting semi-collapsible lifeboats. There are sixteen of the ordinary boats, ten of "Chambers' patent unsinkable semi-collapsible lifeboats," and four of "Berthon's patent unsubmergible lifeboats." The latter boats are now so well known that it is not necessary to describe them here. They collapse into one-fifth their width for stowage, and it is claimed for them that when wanted they can be extended almost automatically, inhaling at the same time from 100 to 200 cubic feet of air into eight separate air cells between the inner and outer skin. Chambers' boat is of much newer origin. A craft of 26 ft. length, 7 ft. beam, and 3 ft. 4 in. depth, has a displacement of 11 tons, and affords accommodation to forty people. The depth of the boat proper is 14 in., but above that is a canvas washboard fitted with galvanized iron stanchions and rails, and hinged to the gunwale of the boat. When raised to the perpendicular the washboard locks itself into position by means of stays. In the ship the boat only occupies a space 18 in. in depth, so that three may easily be placed the one above the other, and yet not occupy a greater height than the ordinary boat. There are formed around the inside of the hull something like forty air-tight compartments, of over 3 tons space, which gives the boat greater buoyancy. The bottom of the boat is so arranged that it may be used as a raft in the event of its being overturned, and rods and ropes are fitted to enable any one in the water to get on to such a raft or to right the boat when overturned. The seats in the inside of the boat are formed into tanks for stores, provisions, and distress signals. The advantages of these semi-collapsible boats may be appreciated when it is mentioned that had the same number of ordinary boats been placed on board the City of New York, nearly three times the space occupied would have been needed.

California Ship Building.

The building of the steel steamers Arago and Pomona and the launching of the cruiser Charleston have demonstrated the fact that as fine steel steamers can be built on this coast as at any place in the world. With this fact established, it is well for us to compare the advantages possessed by our ship builders over those of the East, and no better showing can be made than by comparing the new steel steamer Pomona, lately built by the Union Iron Works, and the steamer Corona, just launched from the yard of Neafy & Levy, Philadelphia. The Corona was contracted for October 29, 1887. She was to be 230 ft. long, 34½ ft. beam, and 16 feet deep. She was launched August 4, 1888. Now we propose to allow two months from that time to finish her and prepare her for sea. It will then take her two months to come round the Horn, two weeks to clean up and overhaul her, and two weeks to furnish her for her first trip, which will bring the time to about the 4th of January next before she will be ready for service.

The Union Iron Works contracted to build the Pomona September 14, 1887. She is 230 feet long, 33½ feet beam, and 16 feet deep. She was launched May 26, 1888. Was completed, furnished, loaded, and started on her first trip July 29, and returned to this port after a successful and perfectly satisfactory trip, August 4, on the morning of the same day the Corona was launched. Shipmasters inform us that a ship of this kind is worth $130 per day, and the difference in time between the day the Pomona entered service and the day next year when the Corona will be here ready for work shows a large amount in favor of the Pomona. As to cost, the contract price for the Corona was $188,000 in Philadelphia, or $198,000 delivered here. The contract price of the Pomona was $200,000, or only two thousand dollars more, and while the Pomona is at work earning money for her owners, the Corona has yet to be completed and make a long ocean voyage.

By this comparison we show that the Pacific Coast can build just as good, serviceable ships, and far more expeditiously than can the old yards of the Eastern coast.—*Wood and Iron, San Francisco.*

Opening of the American Institute Fair.

The fifty-seventh annual exhibition of the American Institute was opened Oct. 3, Mayor Hewitt delivering an address in which he felicitously compared the extensive and varied displays now made at these fairs with those which its managers were able to present to the public fifty years ago. There are said to be more articles on exhibition this year than ever before, every inch of available room having been taken. The building is tastefully decorated, the large fountain in the center of the hall, banked with flowers, ferns, and grasses, being unusually attractive in the bright illumination furnished by a profusion of electric lights, the moving machinery and the interested crowds of visitors making up a busy and animated scene in which some new attraction can always be found. The admission price has this year been reduced to twenty-five cents, that more people may avail themselves of an opportunity to see this display.

Artificial Coloring Substances.

The possibility that some of the numerous pigments now produced synthetically may be used for the purpose of coloring articles of food lends importance to any experiments that may be made as to their physiological action. Studies of the action of a few such compounds upon the animal organism have been made incidentally in the course of an investigation undertaken by Herr Weyl as to the relation between chemical constitution and physiological action (*Berichte*, xxi., 2191). Of the "nitroso" coloring compounds, only the "naphthol green B" was examined, and this proved innocuous when administered to dogs in doses of one or two grammes daily for a fortnight. Of the "nitro" compounds the dinitrocresol, or "saffron substitute," has already been reported as non-injurious. "Martius yellow," or dinitro-*a*-naphthol, which is well tolerated by rabbits, killed medium sized dogs when small doses were given by the stomach. A dog weighing 6,850 grammes, to which a half gramme dose was given on two successive days, and a gramme of the more soluble sodium salt on the third, died on the fourth day. Less than a gramme sufficed to cause the death of a similar dog when administered subcutaneously. It is noteworthy, however, that a sulpho acid of "Martius yellow," known as "naphthol yellow S," proved innocuous to dogs even when administered in four times those quantities.

Picric acid, a "nitro" compound, has been long known to be poisonous. Concerning "aurantias" (hexanitrodiphenylamine) there seems to be some conflict of statement, which possibly finds an explanation in the occurrence of two isomeric compounds in commerce, an "aurantia" from the Berlinanilinemanufactory having been found non-poisonous to rabbits, while one from Basle is said to have proved very injurious to men. Among the "azo" coloring compounds none that is poisonous has yet been met with by Herr Weyl. On the other hand, three "saffranin" preparations were all of them found to exercise a toxic action. —*Pharm. Journal.*

Beating the Weighing Machine.

The drop-in-a-nickel-and-get-your-exact-weight machine which stands on the platform of the Consolidated road's depot at Meriden was surprised and fooled a short time ago by a bright young lady from East Hartford. At the close of the State fair, among the crowd at the depot awaiting the arrival of the trains, three young ladies, whose ruddy and healthy complexion clearly indicated that they were from the country, were prominent. Tired of promenading in the waiting rooms, they sought the outside platform. They had gone but a few steps when the weighing machine caught their sight. After a careful inspection it was declared "very 'cute," but the leader of the trio was suspicious, and as she stepped upon the platform she put a button in the hungry aperture. It did not work. So the young lady joined her companions, and at a respectful distance gazed at the contrivance while a Silver City dude enriched the machine by a part of his winnings at the races and ascertained his avoirdupois. As the gleeful indicators returned from 125 to the zero point, the owner of the unsuccessful button was inspired with a thought, and after a long delay in finding her pocket, she fished out a five cent piece, a pencil, and a card.

Armed with these, she again stepped upon the platform—to the intense amusement of the bystanders—and dropped in the nickel. The indicator quickly whirled around to 135. She did not move, but put number 135 on the card, then said, "Step up here, Ethel." Ethel stepped, and the hand now pointed to 254. The number was put on the card, and Sarah was invited to join the progressive weighing party. The dial now showed that the scales had a burden of 354 pounds. As they stepped to the platform, to indulge in a lesson in subtraction, the indicator slowly sneaked to zero, apparently crestfallen by the cheap way in which it had been treated. The girls were from East Hartford, and the novel way that they beat the machine was heartily enjoyed by a number of spectators. —*Hartford, Conn., Post.*

Whooping Cough.

The value of Mobin's treatment of whooping cough by sulphurous acid is receiving strong confirmation from many sources. Dr. Manly, in the *Practitioner*, expresses the opinion that, if it was carried out in every case, at the end of six months the disease would be unknown. The method used by him is as follows: The patient is in the morning put into clean clothes and removed elsewhere. All his clothes and toys, etc., are brought into the bedroom, and sulphur is burnt upon a few live coals in the middle of the room. The fire is allowed to remain in the room for five hours, and then the windows and doors are thrown open. The child sleeps in the room the same evening. About twenty-five grammes (a little under an ounce) of sulphur to every cubic meter may be burnt. This is equivalent to rather more than ten grains per cubic foot. The room is fumigated in a like manner during the night; the patient practically living in an atmosphere of diluted sulphurous acid gas for some days, while in several cases the process is repeated at the end of a week.

Electrical Glass Breaker.

The Pittsburg *Dispatch* states that: "Several glass factories are now using electricity for a novel purpose. Heretofore, when they wanted to cut one of the large cylinders of window glass, a simple but primitive method was used. This consisted of the pulling out from the furnace of a thin shred of glass heated white. This was quickly wrapped around the bottle-shaped end of the cylinder, and it burned through or fractured the glass. A pair of tongs had to be used in the process. By the new method, the glass cylinder is encircled with a fine wire, the extremities of which are put in connection with a small electric battery. It is necessary that the wire adhere closely to the glass. When a current of electricity is passed through the wire, the latter becomes red hot and heats the glass beneath it. Then a single drop of water deposited on the heated place will cause a clean breakage of the glass clear around the path of the wire. Contrary to what takes place with the usual process in the treatment of this fragile material, it is found that the thicker the sides of the cylinder are, the better the cut."