Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, SEPTEMBER 27, 1884.

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 456,

For the Week ending September 27, 1884.

Price 10 cents. For sale by all newsdealers.

SOLDERING ON CAST IRON.

There are cases where brass requires to be united to cast iron, and drilling and riveting would either make a clumsy job or would weaken the parts. Soldering, if effective, is incomparably the better way. By many mechanics it is supposed to be either a trade secret or a skillful trick to make solder adhere to cast iron, but it is not so. The process differs but slightly from soldering on an already tinned surface, as sheet tin.

If the cast iron is white iron, or a thin casting that has become chilled in the casting—iron not amenable to the file—it should be cleaned from surface impurities by scraping, or scouring and washing in potash water. Then dip it for an instant in clear water, and wash it quickly with undiluted muriatic acid of the ordinary commercial strength. Go over it at once with powdered rosin, and solder, with the soldering iron, before the surface has had time to dry.

Another plan, and a better one especially for soft gray iron castings, is to file the surface clean, wash as before, wipe it over with a flux made of sheet zinc dissolved in muriatic acid until it is surcharged, or is a saturated solution, and has been diluted with its own quantity of water. Then sprinkle powdered sal ammoniac on it, and heat it over a charcoal or clear hard coal fire until the sal ammoniac smokes. Dip at once into melted tin, remove, and rap off the surplus tin.

RAW HIDE WHEELS.

In 1860, just before the war, the writer was employed to start a manufactory, one of the exactions being the construction of a machine for drawing and flattening fine brass wire. The connections of parts were first made by pulleys and belts—they did not hold; gears of necessarily very fine cogs broke their teeth; some were made of steel and hardened, but did not stand. The requisite appeared to be resistance and toughness of material. Raw hide was suggested, and some gears made of that material did their work well. Since then the use of this material has been noticed under similar conditions. Lately hydraulic compressed raw hide has been favorably mentioned as material for friction rolls and pulleys, for skate rolls, and as facings for friction wheels. There is no question of its advantage as a material for small pinion gears where much strain comes on each tooth; if not exposed to the continuous action of oil—animal oil especially—these wheels will bear a deal of rough usage. One of the useful qualities of raw hide is its yielding to a shock or sudden strain without breaking and without giving a permanent backlash. Steel and the best of Norway iron will break under strains to which compressed raw hide will only slightly and temporarily yield. The teeth of raw hide blanks can be cut in the gear cutting engine as well as those of iron or steel, and the material can be more readily turned in the lathe. If a lubricant is required in the working, clear water is the best.

CANCER.

Any disease which is acknowledged by all to be full of danger, is sure to be associated with quackery. Unprincipled men take advantage of the popular ignorance of medical remedies to make money. In respect to no disease is this more true than in the case of cancer. And the success of imposition is made easier from the fact that the name is constantly applied to tumors of various kinds, which have nothing of a serious character, which will disappear of themselves if they are only *let alone*. If, however, the name of *cancer* has been suggested, and then either a "cancer doctor" has been called, or without any such addition some one of the boasted remedies has been employed, when the tumor gradually diminishes and eventually disappears, the case is heralded as a "cancer cure," and the delusion is greatly strengthened thereby. For instance, the common red clover has a great reputation in some parts of the country for curing cancer, and to attempt to convince the believers in its efficacy that they are under a mistake is perfectly useless. The case of this one and of that is quoted in proof, whereas no one of them doubtless had ever the least reason for fear or the slightest sign of cancer.

The simple fact is that cancer is not at all a local disease. It affects the entire system; the change of tissues which constitutes what is recognized as the "cancer" is only the local manifestation. Hence the well known truth that removal of the ulcerated part, the tumor, is constantly only a temporary relief; the disease returns to its power, and commonly is soon fatal. Hence the universal dread of "the knife," and hence the readiness to flee to those who give the comforting promise that they will "draw out the cancer by the roots;" and beyond question such men will be encouraged in their imposture by continued applications for the use of their *skill*. If they treated only cases where true cancer exists there would be but comparatively small evil done, for there is too much reason to believe that the disease is of its very nature fatal, and that its progress to a painful death is sure and steady despite the utmost reach of human skill; but harmless tumors are constantly submitted to their care. Everything with them is invariably a "cancer," and it must be drawn out. The applications which are made destroy the tissues, for how can they draw the cancer out without it? That which was harmless becomes a source of suffering and even of danger, and if the patient recovers after the "doctor" has taken all the money available, it is paraded as a *cure*, whereas no cure was needed.

The domestic remedies, such as the clover above noted, are commonly harmless, and while they do no good they serve to pacify the patient. If cancer is there, it goes on its evil way unchecked; if a simple, non-malignant tumor is involved, it either disappears or remains stationary in progress, and presently clover or perhaps cancer root (*Conopholis Americana*) is in greater repute than ever.

The International Electrical Exposition, Philadelphia.

(THIRD PAPER.)

The number of visitors daily arriving in incoming trains shows a steady increase, and the great hall, which, during the very hot weather of two weeks ago, was but sparsely filled, is now, at certain hours of the day, almost crowded. At night there has been, ever since the opening, a large attendance; at times reaching the respectable figure of 7,000 visitors.

Crossing the wooden bridge which separates the main hall from the annex, and descending to the ground floor, the visitor has his attention attracted by a circular railway with miniature locomotive and cars. This is the exhibit of a switch and signal company, and is constructed in exact imitation of a section of railroad. The general plan of this system is not new, but novel features have recently been introduced which do much to make a perfect safeguard against ordinary accidents. Experience has shown that no one person, however trustworthy, should be intrusted with the signaling of swift moving trains; and this automatic signal system, never tired, requiring no sleep, and not subject to sudden attacks of disease, is designed to operate railway signals with unfailing certainty. It is operated by a current of electricity transmitted along the rails, showing the customary red targets when trains are in dangerous proximity, and white targets when all is clear.

The trouble with this class of signals heretofore has been that when, by one of those accidents to which electric currents are subject, the flow of electricity is stopped, the warnings cease. Not so, however, with this one. A stoppage of the current causes the dropping of the danger signal, and not until the circuit is again complete will the safety signal be shown.

An eminent authority, who has looked carefully into the matter of electric signaling, insists that the normal condition of the signals should be "danger," and that the agency through which they are worked should at all times be active when "safety" is shown. The apparatus should be free from atmospheric influences, simple, strong, and not easily disarranged.

These conditions seem to be present in the apparatus described. Move the miniature locomotive along the same track on which another car rests or is moving, and, when it reaches the same section, the engineer is confronted with a series of red danger signals. He can follow another train if he will, but he cannot get into its immediate vicinity without being warned, not once, but frequently.

The track is, in fact, only used for a part of the circuit. There is a secondary or telltale signal; the switches are all automatically locked and fitted with a circuit breaker. To illustrate the working of this system, let us take a section of the track, insulated at the ends of the section from the adjacent rails. At one end of the section there is a battery consisting of a single cell, one pole being attached to each rail, while at the other end of the same section there is placed an electro-magnet with one wire attached to each rail. Here we have established a complete metallic circuit from the battery, through the rails and magnet, back again to the initial point.

The electric current, seeking the point of least resistance, flies along the rails, for they have great conductivity. Thus, even during storms of rain and snow, the magnet is supplied with electricity. Now the magnet holds the signal at "safety;" but when there comes into the same section another train, the wheels, being better conductors than the small wires of the magnet, effect the short circuiting of the current, and, demagnetization taking place, the signal "safety" is permitted to drop, and in its place appears the warning "danger." The projectors say that in order to insure perfect reliability of working, reliable metallic continuity must be had throughout the whole length of the signal section. The fish-joints, they say, make ordinarily electrical connection between adjacent rails, but this connection cannot be relied upon; sometimes the splice will be loose, and often the rust and dust between the rails and splice bar will interfere with a continuous circuit. To make the circuit entirely reliable therefore at the rail joints, adjacent rails must be connected by wire. The ends of this wire are wrapped around the heads of stout rivets and soldered thereto; holes are then drilled in the flanges of the adjacent rails, and the rivets firmly driven into the holes, thus making an entirely reliable electrical connection from rail to rail. They thus explain the insulation of the track. Plates of fiber about one-eighth inch thick are placed between the bottom of the rail and the chair, and between the forelocks and the rail. There is also placed a piece of the same material, of the shape of the rail section, between the ends of the connecting rails, to prevent an electrical contact being made by the creeping or expansion of the rails. The latter are insulated by using a wooden splice bar on the outside of the rails, a divided fish-bar on the inside, and a piece of fiber between the ends of the rails. It should be added that a single cell battery will operate the signals of this system through a mile section of track.

It seems somewhat odd that in an otherwise automatic system, the weights which operate the "danger" and "safety" signals should be required to be wound up by hand. To the average student of human nature, it would seem as easy for a man to forget to wind up a pulley apparatus as it is for a switchman to forget to turn his switch or show his danger signal.

Now that the Edison exhibit is in good running order, it attracts, and naturally, much interest. The chief object is, of course, Edison himself, though one of his employes, who is usually seated in the pagoda-like structure at the southern end of the exhibit, was frequently surrounded last week by a curious audience under the misapprehension that they were in the presence of the wizard.

In dynamos are shown the various sizes manufactured by the Edison Company, ranging from that of a capacity of twenty-five lights to the largest one ever constructed, and said to possess the power of generating 1,200 incandescence lights, each of 16 candle power. The Edison dynamo of the ordinary type has often been described to the readers of the SCIENTIFIC AMERICAN. But there are two dynamos placed on exhibition here by the Edison Company which are in some not unimportant features essentially novel. One is a type of disk machine, and the other the great 1,200 light machine already referred to. The principle upon which these two machines are constructed is, of course, the same, but the application is dissimilar. In the disk dynamo there are two electro-magnets of the horseshoe pattern placed upon a horizontal plane surface, having their opposite poles in series. Radial segments forming a disk of copper revolve between the poles. These segments are insulated the one from the other. Upon the periphery of the disk there are a number of thin pieces of copper—each being likewise insulated—connecting certain pairs of segments.

The armature of this dynamo is the disk itself, and as in the case with the wire of the armatures of dynamos of the regular type, the current is excited by the passage of the segments through the lines of force of the magnet. The axis is the initial point of departure of the current in this machine, thence it traverses the segment *en route* to the circumferential strip. After completing half the circumference and reaching another segment, it is led off by the brushes from the commutator. The current has therefore three consecutive times been led by the poles of the magnets; an operation which has served to increase it. The great 1,200 incandescence light dynamo is again different from this. The magnet does not differ from that found in the Edison dynamo of the well-known type, save in its immensity. It is the armature of this machine which is particularly unique. There are circular iron plates forming the core placed similarly to like plates in the ordinary dynamos. On these, however, set up longitudinally, are copper bars ¾ of an inch wide and having a thickness of ½ inch. Each is served with a coating of parchment paper and mica for the purpose of rendering them well insulated, not only from the core, but from each other as well. There are spaces between these bars through which a current of dry air can be forced, so as to prevent, at all times, the armature from becoming heated. Then there are circular strips of copper at the end of the machine served with vulcanite in order to insulate them from each other. The bars are joined in pairs to these circular strips. The commutator is not reached by the current until the latter has been twice through the magnetic field. So perfect is this mechanism that, it is said, not even a portion of the current, not a spark, can leave the brushes of the commutator until it has done its work.

There are other apparatus in this Edison exhibit which, by reason of recent improvements, merit more than passing notice; new devices for systematizing small incandescence systems, new modes of controlling current, and the like. These will be noticed in a subsequent article.

As types of incandescence lamps may be multiplied as long as any new material can be found for an incandescent loop, the crop of new lamps may safely be relied upon not to fail for some time to come. In the Weston exhibit is a new incandescence lamp which is said to give promising results when tested as to resistance and life. The filament is formed of an altogether novel material called tamadine. It is prepared from cellulose by a new process, the details not having yet been made public. It is said to be unusually strong when compared with other filaments used in this species of lighting, and to be capable of sustaining high temperatures. It is cut in sharp curves in the ordinary loop-form.

With gas and electric lighting in juxtaposition as they are here, and their respective adherents ready to demonstrate their relative advantages, an excellent opportunity is offered for comparison. The description given on the fifth day of the National Conference of Electricians by Prof. Preece, of a recent installation of an isolated electric light plant in his house to the exclusion of gas, proved a rather severe blow to the representatives of the gas lighting interests at the Exposition, not because of the fact, which really proves very little, but because it comes from so distinguished a man as the Chief of the Postal Telegraph system of Great Britain. Prof. Preece said that he had experimented with, or rather established, the secondary battery in his own house as a means of supplying electricity for lighting. He explained that he lived far away from any source of electricity, and consequently his house had been lighted by gas. He preferred, he said, to burn his gas in the garden to avoid the poisonous products of combustion, and merely use it as a means of power for running a dynamo-electric machine. His gas-engine was, he said, of two horse-power, and ran a Gramme dynamo of 42 volts and supplying 52 amperes. This dynamo, running three hours each day, under the care of a servant, charged 17 Plante cells, each containing 12 plates about two feet square. This arrangement, he continued, had run for about four months without the sign of failure, and lights his house perfectly with incandescence lights, besides being used lavishly for other purposes.

Now, to those who have had the time and inclination to compare the relative cost of gas lighting and that to be had from electricity through the interposition of storage batteries, this lighting-plant of Prof. Preece's would not particularly commend itself. But to the casual observer it is otherwise, and when so good an authority as Prof. Preece talks about "the poisonous products of combustion" in illuminating gas, it sends a cold shiver through him.

As a professor of physics remarked here the other day, there is nothing like giving figures when comparisons are made, and it would have been just as well if Prof. Preece had told us how much it had previously cost him to do with illuminating gas what he was now accomplishing with electricity, and just what his secondary battery plant was costing him. Had he done this, there is excellent reason for the belief that those now contemplating the establishment of a similar plant would liever have a little poison in their atmosphere and save their purses so unwonted a strain.

Speaking of giving figures, the following table has been prepared by an authority, giving the comparative amounts of the products of combustion of electricity, illuminating gas, and oil:

Light of 100 candles.	Products per hour.		
	Water Vapor, Kilos.	Carbonic acid in cubic meters.	Heat in calories.
Electric lamp, arc	.....	.....	57—15
" " incandescent	.....	.....	290—536
Gas, Argand burner	0·086	0·046	4860
Lamp, petroleum, flat flame	0·080	0·095	7800

Next in importance, perhaps, to knowing what force electricity is the expression of—a problem for abstract contemplation—comes the ability to accurately measure it. It may do to-day for a company with thousands of lights aglow and a great plant to offer the incandescent light for the same price as that demanded by the gas companies for the same intensity or candle-power. But should the gas companies lower their rates thirty per cent., or even fifty per cent., and there is good reason to believe that they could reduce them still lower than this, how are the electric-light people to know exactly how much light each patron is using?

A voltameter will show the amount of electricity passing during a certain period, and hence it might seem to have the requisite ability; but it is well-known that, as the amount of electricity which has gone through any part of a circuit is not a true measure of the work done unless accompanied by indication of the resistance through which it is forced, or the potential through which it falls, any apparatus, to give true results, should indicate directly the number of units expended, or indirectly by expressing some function of what has been done.

There are several meters that will perform this work more or less accurately, for it has long been known that a certain amount of current would transfer electrolytically a certain amount of metal from one electrode to another, and many electricians have tried to get a meter founded on this action of the electric current, their labors being attended with more or less success. It seems, however, that up to quite recently no one has attempted to join the hydrometer with this well-known action of the electric motor. Such an instrument, with the hydrometer as a base, is now to be seen at the Exposition in Philadelphia.

It may be described as a hydrometer furnished beneath the bulb with an electrode, and still another connected with the cell, graduated to mark on the flotation-line as it goes up or down just what amount of electricity has gone through. For example, suppose that the metal has been charged on the bulb electrode for three months. As a result of this charging, the hydrometer will be found to have been lowered in a just proportion. If now the current be reversed, for the same period of time, the electrical equivalent of the total metal that has been thrown off from the bulb will be found to be shown on the rising scale.

If this little apparatus, which it should be said is of simple construction, is found to give an exact measurement under all conditions, it is bound to become an indispensable adjunct to all electric lighting plants.

Though the Exposition has now been open since the 2d instant, not a single accident has been recorded, notwithstanding the fact that powerful currents are at all times running from one end of the building to the other. This indicates how excellent has been the supervision of the committee, and does much to sustain the assertion made by the electric light companies last winter, when so much indignation was expressed against the maintenance of their street lines, that, when properly insulated and left undisturbed, currents of high and low potential can be carried through a crowded thoroughfare without injury to either life or property.

All the circuits are insulated, and are metallic throughout, no ground connections being used. The conductors of all the main circuits had sufficient weight per running foot to enable them to carry their currents without heating. In cases where circuits are taken from large to small conductors, and the large conductor carries a current likely to raise the temperature of the smaller wire, if accidentally diverted through it, an improved automatic safety device is introduced into the circuit of the smaller conductor, by which the circuit is automatically interrupted whenever the current, passing through the smaller conductor, is in excess of the point of safety. Similar automatic safety devices are used in all circuits run in the vicinity of electric light and power circuits. Circuit wires exposed to moisture are provided, in addition to their insulated covering, with a coating of waterproof material.

When the electric motive force exceeds 300 volts, the different parts of circuits outside the electro-generator, or the apparatus which they energize, are not permitted to approach one another nearer than eight inches. Where it is practicable to do so, positive or outgoing conductors are clearly marked so as to distinguish them from negative or return conductors. Where circuit wires pass through walls, floors, or ceilings, special insulating incombustible tubing is used to incase the wire. All the dynamo-electric machines are insulated from the ground, and are surrounded by railings, so as to prevent the too close approach of the public.

An Australian Drought.

In February last, in New South Wales, a correspondent of a provincial newspaper traveled for some 200 miles by railway, and throughout the whole journey he saw on either side nothing but a desert—"a wilderness destitute of any green thing, without any water worthy of the name, of cattle in the paddocks, dead or dying; the sun's scorching rays fell on fields as hard as iron. The leaves of the trees were as motionless as death itself, there being not a breath of air stirring. The state of affairs was quite as bad in other parts of the country. There were thousands of square miles of land, baked and cracked, with the dry, brown grass flying off in dust, without a vestige of green or a drop of water anywhere." The expedients resorted to in this terrible crisis were sometimes of a most desperate character. Some farmers endeavored to send their cattle down to the coasts or to the towns, but they died on the road, and their owners had to bear not only the loss of the animals, but the cost of their conveyance. This double loss largely prevented others from imitating their example. They sat down in mute despair to watch their ruin. One man lost 20,000, another 50,000, and the third 150,000 sheep, without the slightest power to save one of them. Millions of sheep have died, and hundreds, and probably thousands, of colonists who were prosperous last year are poor and, perhaps, ruined to-day. Even in Sydney the drought was so severe that the inhabitants had to be placed on an intermittent allowance of water. Rain has at last fallen, and, therefore, the severity of the crisis may be regarded as past.

Death of Robert Hoe, Printing Press Manufacturer.

The firm name of R. Hoe & Co. is known wherever American printing presses are to be found, and that is in nearly every quarter of the world. The senior member of the house, Robert Hoe, died at Tarrytown, N. Y., Sept. 13, in his 70th year. The elder Robert Hoe, the father of the deceased, came to this country from England in 1803, and was the first man in the United States who made saws of cast steel, beginning the manufacture of printing presses in 1805. The late Robert Hoe, when a young man, with his brother Richard M., succeeded to the business established by their father, which has become the largest of its kind in the world.

Their cylinder press, in 1827, marked the first great advance on hand printing presses, and it was followed in 1837 by the double cylinder, and in 1846 by the rotary, of which the largest sized, or ten cylinder, would print twenty thousand sheets on one side in an hour. Their latest, or perfecting, press will print twenty thousand large sheets on both sides in an hour, and deliver them folded. The deceased was a public spirited citizen, an active member of several charitable institutions, and one of the chief movers in the establishment of the Academy of Design.

The St. Louis Industrial Exhibition.

This exhibition, which opened Sept 2, presented a worthy comparison with other similar displays being held in several of our large cities. Over $600,000 had been been expended on the erection of a fine exhibition building, and the aggregate exhibits are valued at more than $3,000,000, including machinery, textile fabrics, and a good representation of the products of the West and Southwest. The railroads made low fares to intending visitors, and the city and State will undoubtedly reap the benefit of the enterprise and liberality which originated and carried through so creditable an exposition.

Copper for Roofing.

The newspapers published in the Lake Superior copper mines region recommend the use of copper as a roof covering in place of tin. In reply to an inquiry by one of our contemporaries as to the relative economy and benefits of copper over tin, an architect furnishes the following: We always specify the use of copper for covering roofs, when we can induce owners to allow us to do so, on account of its durability; although its cost is about $14 per 100 square feet over price of tin roofing. But when we reflect that a tin roof requires constant repairs, and painting at least every two years, at a cost of two to three cents per foot, varying as to the number of coats, the cost of repairs for six years, together with the cost of tin roof, equals the cost of copper.