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SCIENTIFIC AMERICAN SUPPLEMENT

No. 938.

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THE LABORATORY AND THE WORKSHOP.

The germs of civilization are engendered in the laboratory and closet of the chemist, but are in great part cultivated and brought to fruitage in the workshop of the artisan. Every step in civilization has been at first but an idea. These ideas, conceptions, or generalizations, arise in the brain of the experimenter and thinker, but he is usually powerless, through lack of tools and manual skill, to realize his conceptions. It is not often the case that a scientist possesses both the genius to conceive original ideas and the means and skill to execute them himself, or to compensate the skill of the mechanic and artisan in working out his ideas into realities. The possession of such means is usually found to dull the enthusiasm of the inventor, and it must be admitted that the most efficient stimulus to such brain work is the *res angusta domi*.

Many scientists have their brains and their portfolios crowded with outlines and sketches of inventions which they hope to give to the world at some future day, when *good luck* shall have come their way. But in numerous cases, good luck never comes, but instead thereof, the rider on the pale horse. Such inventions are then lost to the world. The question arises whether it is not the solemn duty of such men, in most cases, to publish their ideas, and place them on record, at least in such forms as to be available, in the shape of raw material for the practical man to elaborate, thus contributing their share to the weal of their race. A man who does this will not then have lived in vain, and cannot then be reproached, or reproach himself, as a "wicked and slothful servant," who "hid his talent in the earth."

A man of wide and varied scientific and technological experience—of a class of which we have many—often finds his brain teeming with new ideas. He can scarcely consider an industrial subject, when the mood is on him, without finding his mind crowded with novel combinations. These it is no irksome task for him to think out and elaborate, but a positive pleasure. Such pleasure is akin to that which actuates the poet and the artist in working out their inventions and conceptions. But the poet and the artist have the advantage that a penful of ink or a brushful of pigment is all they need to realize their inventions for public behoof. Here is where the scientist is weak, and often at the mercy of circumstances. In order to progress, he must go to the workshop and open his mind to the artisan and obtain the vicarious aid of his tools and his skill. We have then a very important and essential correlation between the scientific technologist and the wage earner, which deserves and should have discussion and consideration, as a factor, both heretofore and hereafter, in the progress of the arts of civilization. It is true that we have, in large cities, professional model makers, but this is a business specialty, which has but small bearing on the subject from our present point of view.

But there is another important side to this subject. We now have great numbers of technological journals, as exponents of almost every branch of the industrial arts. The main burden of their song, however, consists, in all cases, of continual expositions of accomplished facts, that is, of inventions already made—strides already taken in advance. This is all well; but in vain does the man of the workshop look for suggestions which will enable him to take part in the contest, in this glorious intellectual strife to benefit man, the only warfare that should be tolerated on the "dark and bloody ground" of our planet, the only kind of war that does not "make the angels weep."

The wage earner may be, and often is, a man of great native brain power, and even of extensive reading and high intelligence. But his energies are absorbed by his daily toil. He seldom has time, or means, or skill for experimental work, or even for thinking out new generalizations. He needs to have these more or less prepared for him, and then he can often get opportunities to realize them in the form of a working model, or piece of apparatus; say, a new oil lamp or gas burner or glow lamp, a new metallic alloy, or a new use or application of some one of the great multitude of materials and agents that have been continually coming before the world and growing cheaper during this century.

Occasionally complaints come from one of these men, that the field of invention seems to have narrowed or become exhausted, and asking what there is left to which they can bend their minds. This is due merely to the lack of spare time and energy to think and study. The conceiving of new inventions *may* be partly a matter of genius or intuition, but it *is* a faculty which requires knowledge and application to master, and practice to acquire skill therein. The field, instead of narrowing, is now rapidly broadening, and in an increasing ratio. The new metals and chemical materials continually coming forward and cheapening must necessarily insure this result. Future articles of this series will set this forth further. As one example, fine electrolytic copper is now but half what it cost a few years ago, and the sources and methods of production have been so greatly multiplied, improved and cheapened that there appears no chance of any important future rise in price. Hence copper and its numerous valuable alloys can now be applied to new uses, for which it has hitherto been too costly. Numerous other examples will be cited hereafter.

It is now proposed that this journal shall do more than hitherto to remedy the deficiency we have pointed out, and to indicate paths of promise to inventors, so far as human science is allowed to determine these.

A Prize of Fifty Thousand Dollars Offered for Improved Method of Propelling Street Cars.

The Metropolitan Traction Company sent a letter to the Board of Railroad Commissioners in November last, offering a prize of $50,000 for the invention of a system of street railroad propulsion superior to the cable and the trolley. In this letter the officers of the company say:

On streets where the lines are straight and the business is heavy the cable system is the most economical yet invented. For general use in a city, winding about through the streets following the routes of travel which the public wish to pursue, it is impracticable. You require straight routes for cable roads. We have in addition to the lines upon which the cable will be laid over eighty miles of street railroads now operated with horses, all below the Central Park. It is to these lines in particular that we now desire to direct your attention.

Up to the present time the only system whose practicability has been demonstrated is the overhead trolley. We are well aware, however, that its application in the streets of New York would not meet with the approval of the community. What we most desire now is to hasten the development and perfection of a better system. We therefore submit the following proposition:

First—We will set aside the sum of $50,000 to be awarded as a prize to any person who shall, before March 1, 1894, submit to your honorable Board an actual working system of motive power for street railway cars demonstrated to be superior or equal to the overhead trolley.

Second—The qualities necessary to meet this requirement shall be left to your decision; but with the present state of the art, a system to win the award must necessarily approximate the trolley as a standard of economy in operation, but should be without the features objectionable to the public that are in it.

Third—We shall exact no rights in the invention in return for the $50,000, and shall have nothing whatever to do with the making of the award further than to pay any expenses which your honorable Board may deem it necessary or wise to incur, either in the employment of experts, the giving of hearings, or the conduct of experiments—this in order that no effort may be spared to achieve the desired result.

In answer to this proposition, Mr. S. H. Beardsley, in behalf of the Railroad Commissioners, sent a letter to President John D. Crimmins, undertaking to cooperate with the company with certain limitations.

Mr. John D. Crimmins states that the offer of the company was made for the best interests both of the company and of the city. He was sure the overhead trolley would never be introduced into New York. The general idea was to encourage the invention of some sort of underground trolley system which would be free from the disadvantage of liability to kill horses and men in the streets above it.

We presume that any system of streetcar propulsion that presents the merits of economy and superiority over present methods would be carefully considered and adopted if found suitable to the requirements of the company.

The Torpedo Net Testing.

At the government torpedo station, Newport R. I., the torpedo net testing has progressed as far as the condition of the season will permit. There are four nets now at the station, three of the American known as the Midgley defense nets, and one Bullivant of the English make, such as are now used by foreign nations. Projectiles are used to test the relative strength of the nets and show their condition when pierced. The projectiles are 27 ft. 4 in. in length, and 16 in. in diameter, weighing about 1,600 lb. It is not expected that any net will stand a projectile which will pierce the strongest ironclad afloat. Your correspondent was shown the different nets that have been pierced, which are the Midgley nets only, and in each one the upright or woven wire strands only have been severed. The horizontal strands remained unbroken. It is absolutely necessary that they be non-corrosive in salt water, and as thin and light as possible. Wire heavily galvanized with zinc will resist salt water, but the ends of the wires where cut are not galvanized and will corrode in the water, so that they are coated over with a varnish, but sometimes this varnish is rubbed off by rough handling. The commander in charge is desirous of obtaining a metallic mixture of the greatest possible strength and absolutely non corrosive in salt water. The result will be looked for with interest.

The Electric Light Column.

On the evening of the 13th inst., says the Philadelphia *Ledger*, the huge wooden casing in front of Wanamaker's was taken down, and there stood revealed a handsome column of incandescent bulbs, with broad spiral stripes, each of a different color, white, blue, purple, orange, green, yellow, and crimson predominating. The column is about 25 feet high, and from it extend four long arms lined with rows of glass bulbs of different colors, two of the arms in the side aisles terminating in 25 bulbs each, and two in revolving balls of 266 bulbs each, at either end of the Chestnut Street facade, all handsomely colored. At intervals of a few seconds each stripe flashes with light, one brilliant color swiftly following another until the top of the column is reached, when the varying light is diffused along each of the arms until the two large bulbs are reached, where the flashing continues until all the colors are shown. Meanwhile the two large balls are kept revolving, and flash continuously with varying lights and colors. The whole affair, whose effect is very pretty, is ingeniously managed by a switchboard in the basement under the column, where a large cylinder, somewhat like that of a music box, is kept revolving by the dynamos of the establishment, the teeth in the cylinder closing and cutting off the circuit as contact is made with or withdrawn from the rows of separate conductors on the sides of the switchboard. As the lights change from one color to another they go out completely, leaving no lingering glow in the carbons to spoil the effect, as would be the case were it not that this has been guarded against by a current of air being ingeniously injected automatically by the machine.

The arrangement was a part of the famous electrical display at the World's Fair, where it elicited the admiration of thousands of visitors.

Opening of the Manchester Ship Canal.

The necessities of modern commerce have produced great ocean-going steamships, "the shuttles of commerce," and also the huge ship canals, which facilitate the movements of these large vessels and lessen the cost of transportation. We have from time to time described the progress of one of the great engineering feats of the day—the Manchester ship canal; and now we are glad to state that the canal is completed, and that the official opening took place December 7. The public opening will not take place until New Year's day, when a procession of vessels up the canal will take place, headed by the bark Wilhemine from Parrsboro, Nova Scotia. This vessel reached Garston November 27, and is now waiting for the opening of the canal to public traffic. It is laden with lumber. The company will pay £100 for the delay it incurs in waiting for the public opening of the canal. The captain of the Wilhemine will receive a handsome gold watch as a memento of the occasion.

The Midland counties of England are large consumers of raw material, and much time and expense will be saved by using the new canal. The Manchester canal will probably prove as valuable to Manchester as the North Sea canal has been to Amsterdam or the Cronstadt canal is to St. Petersburg. It is a curious fact that Peter the Great's original plan when he founded St. Petersburg was to make the new capital a port for sea-going vessels by means of a ship canal. The new Manchester canal compares favorably with other ship canals, except as regards length. This great undertaking cost about $75,000,000. The work has been illustrated and described in the SCIENTIFIC AMERICAN.

The Sea Trial of the New York.

The cruiser New York has just completed a series of general tests. According to law, the New York could not be legally accepted by the government, or the contractors receive the $50,000 reserved from the previous payments for building her, until a final test was made. The object of the test was to determine, by a forty-eight hours' run, her sea-going qualities and her structural strength. The rough December sea was admirably adapted to test the endurance of the new boat and the results considered as a whole are satisfactory, although some defects were made apparent.

The men were sent to their allotted stations on Monday, December 11, and every part of the vessel was subjected to a rigid inspection, every engine was minutely examined and run at varying rates of speed; the guns were fired, but not a rivet started and every bolt was in place when the three hours' firing test ceased. The turret-turning machinery was defective, and will be altered. The amidships magazine was found to be too near the fire room, as when the vessel is under steam the temperature reaches 120° in this compartment. Some of the ammunition hoists were inadequate to supply the guns rapidly enough. The arrangement of the sick bay in the bow is a serious defect, as the vibration is felt most here and the roar of the waves when at sea is deafening. The sick bay was flooded during the trip, water coming in through the torpedo tube. This fault of location is not to be laid at the door of the contractors.

Digestibility of Farinaceous Foods.

These enter so largely into the dietary of all invalids, that nurses and others should know that they are not all equally able to be digested. Experiments have lately been made on the different starchy foods, as to the rapidity with which they digest when treated by malt and pancreatic preparations. One gramme of each of the following starches and meals was boiled and made up to 100 c. c. with water. In each case the effect of 1 c. c. of pancreatic essence on the mucilage at 100 deg. F. was noted, a dilute solution of iodine, placed in drops on a white slab, being used as an indicator:

Indian Corn.—After digesting three hours with the pancreatic essence still gave a distinct blue with the indicator. Twenty hours' digestion appeared to have no further effect.

Wheat.—Distinct blue after two hours' digestion.

Rice.—Distinct blue after two hours' digestion.

Tapioca.—After half an hour's digestion gave only a faint green with the indicator.

Arrowroot.—Ceased to give a blue in ten minutes.

Potato.—Ceased to give a blue in ten minutes.

Oatmeal.—Gave a scarcely visible blue after digesting eighty minutes.

Wheat Flour.—After two hours' digestion gave a very faint blue.

Potato Flour (2 grammes).—Ceased to give blue in ten minutes.

Thinking that prolonged boiling might have some effect on the convertibility of starch, some experiments were instituted to test the point. Solutions of arrowroot and corn starches were brought to the boiling point in one case and in the other boiled for ten minutes. The time required for digestion was, in each case, the same, *i. e.*, the arrowroot ceased to give a blue in ten minutes and the corn still gave a blue after three hours' digestion. These experiments were repeated with malt extract and point to the following conclusions: Arrowroot and potato starches are the most readily converted into sugar by the amylolytic ferments. They are, therefore, the most suitable for testing malt and pancreatic preparations. Arrowroot and potato starches are the best for weak digestions. Chemically there seems to be no difference in digestibility between low-priced arrowroots, nor between the latter and potato starch. Root starches are more digestible than seed starches. So long as starch granules are burst, further (limited) boiling does not render them more digestible. In further experiments it was found that the addition of either acid or alkali to the pancreatic juice retarded the conversion of starch, but with saliva in the absence of either the conversion took place in four minutes.—*Pop. Med. News.*

Effect of Light on Oysters.

At a recent meeting of the Academy of Natural Sciences, Philadelphia, Professor John A. Ryder spoke of the effect on oysters of exposure to light. He referred to recent observations of Dr. Scheidt on the pigmentation of these mollusks under abnormal conditions. The right valve of the shell having been removed, the oysters were kept in a trough of running salt water. In fourteen days they showed a pronounced blackening of the entire right mantle, where normally there is no pigment, and this was again bleached when excluded from the light. Other specimens which were guarded from the direct action of the light remained uncolored, thus demonstrating that light is the active agent in producing the deposit of pigment granules. Blue glass was found to stimulate coloring, while red glass had the opposite effect.

Professor Benjamin Sharp remarked that a common species of flounder, Aclinus lineatus, commonly called the hog choker, has the underside almost if not quite as strongly colored as the upper side, thus differing materially from the other species of this group of fishes. Correspondingly it was found that its habits were so modified that the lower part of the fish was frequently so exposed as to be acted on by the light and not kept in contact with the rocks as in allied forms.

Dyeing Leather, Feathers and Other Animal Fibers.

F. Obermeyer, of Vienna, has a new process of dyeing animal fibers, which is said to be peculiarly applicable to feathers, leather, and horn. It depends on the fact, first, we believe, pointed out by Knecht, that the animal fibers resemble amido compounds in their constitution, and are therefore capable of becoming diazotized. This is done by subjecting them to the action of weak solutions of sodium nitrite acidified with hydrochloric acid for twelve to twenty-four hours, under conditions which exclude light. The diazotized fibers are then treated with either—first, neutral aqueous solutions of phenols at 80° C.; second, cold ammoniacal solutions of alkaline phenolates without excess of free alkali; third, neutral solutions of amines; fourth, acetic acid solutions of amines. In this method of dyeing and with such solutions the fibers remain quite uninjured. Red, yellow, and brown shades can thus be dyed. Those produced from amido bodies can be further diazotized and redeveloped into new shades, while by treatment with various metallic salts, copper chloride, ferric chloride, zinc acetate, potassium, etc., the shades are modified, being made darker and faster. All the shades are full and brilliant, and on the whole fast to soap.

Soap Bubble Solution.

According to a communication recently made to the Academy of Sciences, the following solution affords very thin and permanent bubbles:

Yellow resin	10 grammes.
Carbonate of potash	10 "
Water	100 c. c.

Boil until completely dissolved, and before use dilute the solution with four times its volume of water. It is somewhat difficult to float soap bubbles upon carbon dioxide, because if you managed, after a score of trials, to free your bubble from the pipe on which you blew it, the bubble usually bursts the moment it touches your heavy gas. You must remove every trace of hydrochloric acid, which is carried over with the gas, by washing, the presence of this acid being fatal to the life of a soap bubble.

Canal Cutting and Dredging on the Sacramento.

The progress of work by the new canal digging machine on Grand Island and of the dredger for strengthening the levees are thus described by the *Record-Union:* The machine built to cut the drainage canal inside the island is a one-yard Marion Steam Shovel Company's ditch dredger. The machinery was placed upon a hull 22 feet by 70 and cuts a canal 23 feet wide. This machine was started to work September 18, and excavated during the remainder of that month 16,100 yards, requiring of course some few days for the thorough adjustment of the parts. During the month of November it excavated 62,770 yards, or 2,414 yards for each working day in the month, or 115 yards for each working hour.

The material was deposited on both sides of the cut, and the month's work was a uniform canal 12,413 feet long for 2⅓ miles, 23 feet wide and a little over an average of 6 feet deep. The only delays were occasioned by fog on the morning watch, which on six or seven mornings occasioned a delay of three or four hours.

This machine is in charge of Allen Adams and is giving the landowners first-rate satisfaction.

The dredger Grand Island, built for the river levees, is a clam shell, with a hull 40 by 80 feet and with a boom 105 feet long. This machine is handling a bucket weighing 8,000 pounds, with wire ropes in place of chains. It was started to work on the 30th of October and for 22 hours per day is delivering, as nearly as may be, one bucket per minute, averaging in the material it is working in (fine river sand) two cubic yards to the bucket. This material, from the point of excavation to the point of delivery, is being moved 150 feet.

This dredger is building a roadway outside of the present levee 16 feet wide, and at the same time furnishing material to put a two-foot crown on the levee. It has already made one mile of this work, and it is expected to progress at the rate of about a mile in 11 days. It is in charge of J. Hyde, and with a few more days' breaking-in of the machine and crew will be a very efficient machine.

The machinery is all completed by Byron Jackson for the additional pumping plant to be installed at Ryde, and this plant will have a capacity of 30,000 gallons per minute, with compound engines of the newest type, and will, it is believed, with the large plant already in, give complete control of the rain and sipage waters.

The Plumber's Hat.

Has a plumber a right to wear his cap in one's house? This was the point submitted to the Highgate justices by an ex-fellow of Balliol. The plumber and his son came to the ex-fellow's house to clear away a stoppage in the bath. Arrived at the scene of operations they kept on their caps, as is the use of British workmen. The householder lectured the parent plumber on the bad example he was setting his son in not teaching him to take his cap off in a gentleman's house. The parent replied by setting up the custom of the trade to work covered. The plea was overruled, and the father plumber's cap thrown out of the window by the indignant ex-fellow. Then the parties aggrieved adjourned to the open air (it was drizzling), and went—the plumber capless and the ex-fellow carrying the plumber's cap—to seek counsel and advice of the nearest policeman, who referred them to the justices. The ex-fellow says that he was on the way called by the plumber "a thick-headed old fogy." Yet the justices fined him 10*s.* for his manner of giving a lesson in manners, and gave him no redress for this very unacademical language.

FRANCE will soon adopt an interesting innovation in the postal card system. The cards will be issued in the form of checkbooks, with stubs. The sender of the postal card can make memoranda of its contents on the stub, and can have this stamped at the post-office before the card is detached, so that a verified record of the correspondence can be kept.