SCIENTIFIC AMERICAN

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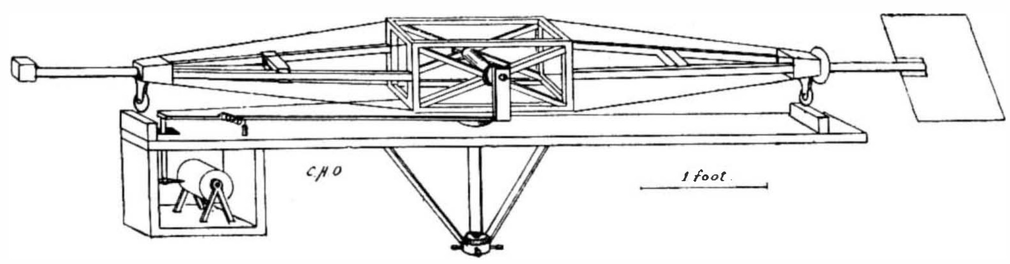

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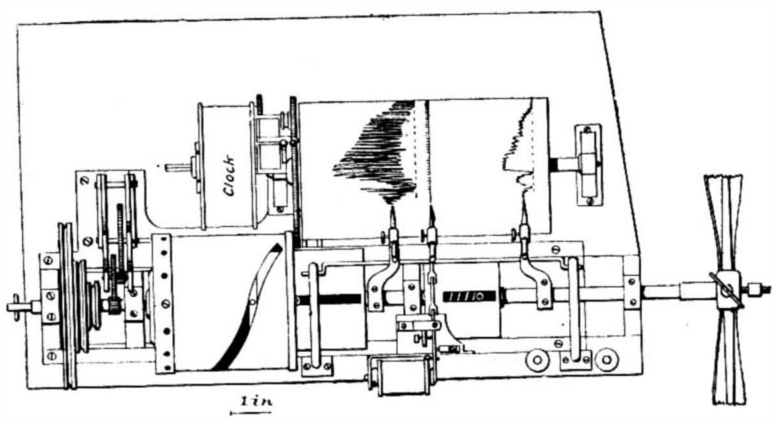

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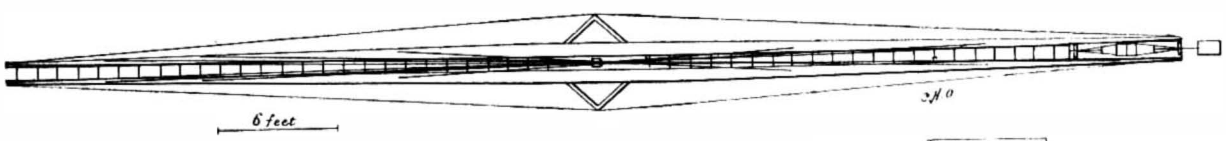

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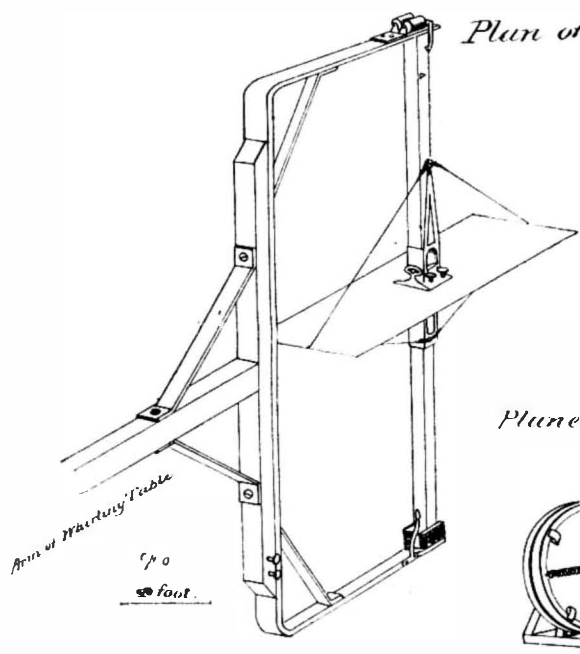
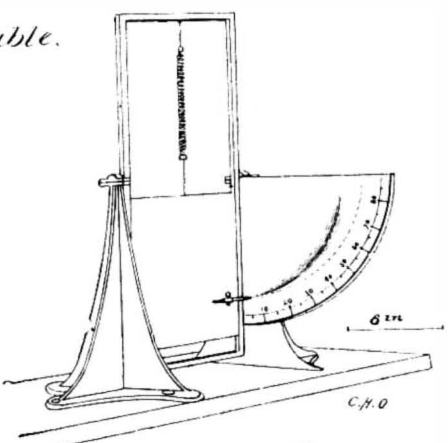


Plane Dropper



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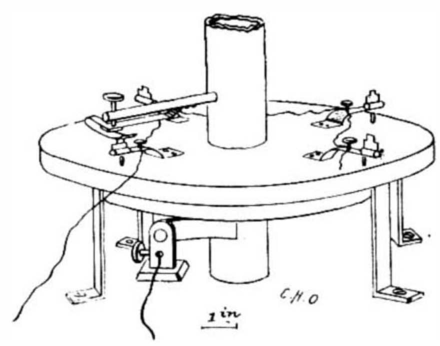
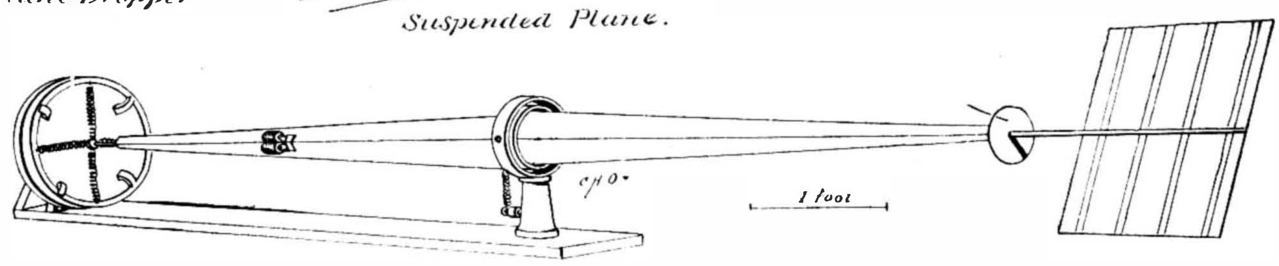


Quadrant Contacts of Whirling Table.



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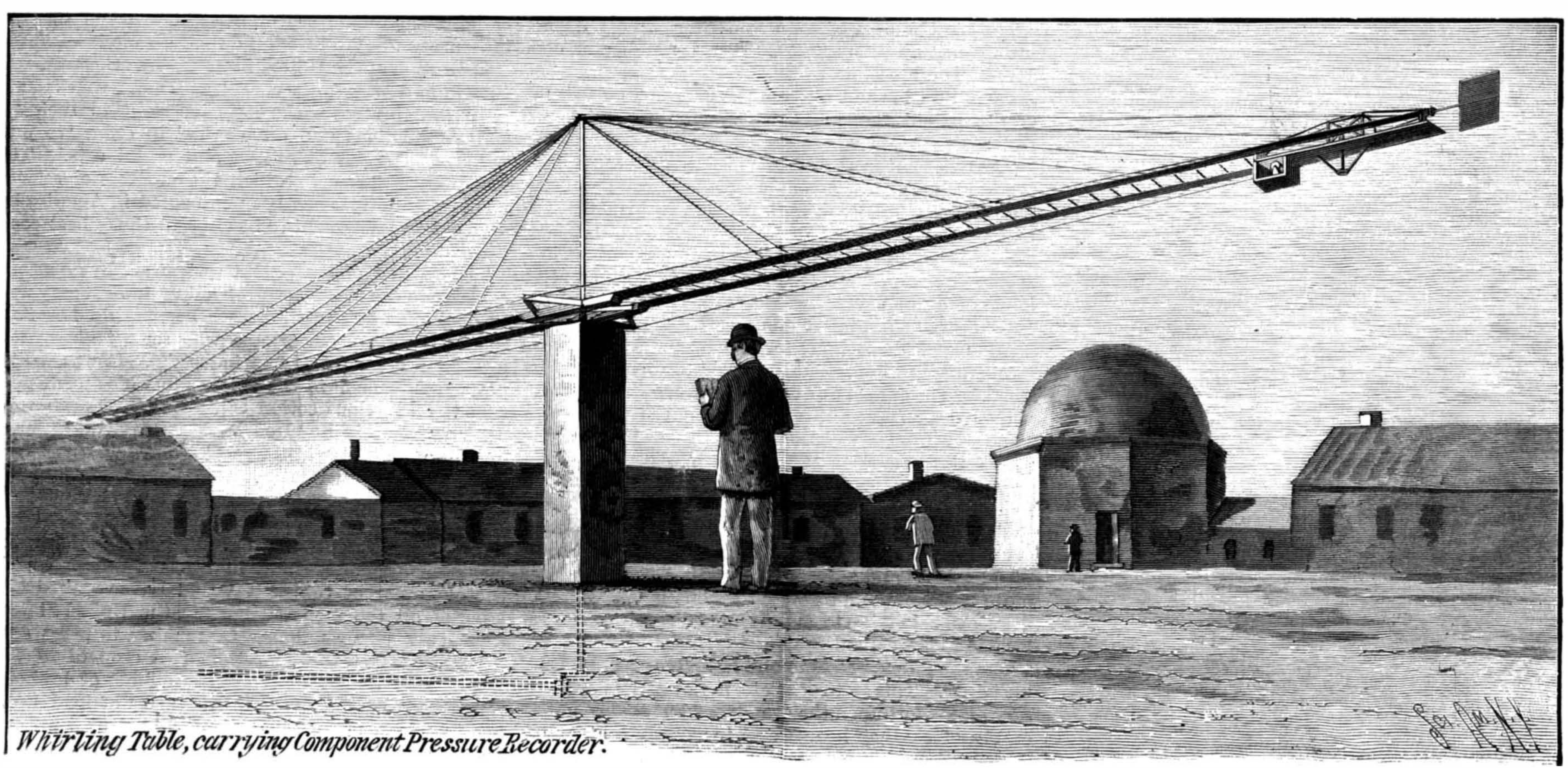

Whirling Table, carrying Component Pressure Recorder.

DR. S. P. LANGLEY'S EXPERIMENTS IN AERODYNAMICS.—[See page 101.]

Scientific American.

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NEW YORK, SATURDAY, FEBRUARY 13, 1892.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 841.

For the Week Ending February 13, 1892.

Price 10 cents. For sale by all newsdealers.

A VIOLENT ERUPTION OF THE SUN.

A very remarkable eruption of a solar prominence was observed on June 17 of the past year, at the Haynald Observatory, Kalocsa, Hungary, by the eminent astronomer, Julius Fenyi. At about a quarter to six in the evening the first signs of the eruption were seen, and eighteen minutes later the great mass of intensely heated matter was found by spectroscopic observation to be in rapid motion. The enormous displacement of the spectrum toward the blue indicated an apparent shortening of the ether waves due to rapid motion of the glowing matter toward the earth. The prominence was essentially hydrogen. Several observations for velocity were taken, a direct maximum of 890 kilometers per second, equal to 553 statute miles, being obtained. The mass represented a suspended column, subtending 111 seconds, and rose while observed to a height subtending 256·9 seconds of arc. But the velocity was not only in the direction toward the observer, it also moved laterally and also in the meridian. Combining two of the different velocities, a probable resultant velocity of 1,014 kilometers, or 630 miles, per second is obtained, leaving out of account any movement in the meridian. This is sixteen hundred times faster than a cannon ball moves, and is enough to indicate the projection of the hydrogen into space out of the sphere controlled by the sun's attraction.

The cause of the outbreak and its final result are mysteries. M. Fenyi even appeals to electricity as the possible cause. The next query would be, Where did the great mass of hydrogen go? Did it fly through space like a drifting cloud, to be torn to pieces and distributed to different orbs as a constituent of their atmosphere? If it possessed quality enough of gravitation to keep its mass together, it might, when appropriated by some distant orb, gravely modify its atmosphere. It might find oxygen enough in such atmosphere to combine with and produce a conflagration to be revealed to our astronomers years hence, when the ether waves announcing the disturbance would have traveled to the earth.

From the magnetic records at Greenwich Observatory, in England, it appears that there was a marked magnetic disturbance, very short lived but clearly registered, at the time of a similar disturbance observed from Paris on the same day. But this was slight in extent compared to other perturbations.

THE CONGRESSIONAL REPORT OF THE COMMISSIONER OF PATENTS.

Two annual reports are made by the Commissioner of Patents, one in the middle of the year, July, to the Secretary of the Interior, the other in January, to the Senate and House of Representatives. The latter has just been presented by Commissioner of Patents W. E. Simonds, late Member of Congress from Connecticut. It is his first report, and is a most able and interesting document. The value and importance of the services rendered by inventors are eloquently set forth, and the measures necessary to enable the public to reap benefits from these services are described. Among the means to these ends the improvement of the Patent Office is shown to be essential. Its present crowded condition is disastrous to all concerned. The health and efficiency of employes are sacrificed for want of room for air and action. The report concludes with several valuable suggestions for modifications of the existing patent laws in the interest of inventors and the people. We make the following abstracts from the report:

The total number of applications for patents during the year 1891 was 40,452. Total number issued, 23,244. Total receipts, $1,271,285. Expenses, $1,139,713. Balance now in the United States Treasury on account of the patent fund, $4,004,317. The Commissioner says:

"As regards the rooms occupied by the examiners, the need is urgent. The cubic feet of space per occupant is 916 feet. Dr. John S. Billings, in his work entitled 'The Principles of Ventilation and Heating,' gives 4,200 cubic feet as necessary for each person in a room with 'ordinary ventilation' for two consecutive hours of occupancy. These examiners' rooms are occupied seven consecutive hours each day, with the exception of half an hour for luncheon. These rooms hardly attain what might be called 'ordinary ventilation,' for all of them are dependent upon the doors and windows for fresh air, except that one of them has a small ventilating register, which cannot be used, and five of them have grate fires, which to a degree assist the ventilation. The heating is attained in some rooms by the steam pipes, in others by hot air registers, and in still others by stoves. It is the rule rather than the exception in these rooms that the floor space is so occupied by desks and cases for papers that the occupants move about in them through tortuous lanes. Cases of drawings belonging to the patented files are necessarily located in large number along the sides of the corridors, where the public passes to and fro. This is unsafe and unsightly. This state of affairs not only puts unnecessary discomfort upon the examiners, but it also unfavorably affects their health, and, to a degree that is more than noticeable, prevents them from d ing work to their full capacity."

The public benefits resulting from the policy of granting patents are sketched by the commissioner as follows: "The vast majority of our great manufacturing industries were originally based upon inventions recorded in the United States Patent Office. The following are a few and only a few of the American inventors whose reputation has become national and whose improvements have formed the foundation of manufacturing industries of great magnitude: John Fitch, Robert Fulton, and James Rumsey as to steamboats; Eli Whitney, as to the cotton gin; Oliver Evans, as to milling machinery; Amos Whittemore, Erastus B. Bigelow, and Barton H. Jenks, as to looms; Eli Terry, Ira Ives, Noble Jerome, and Chauncey Jerome, as to clocks; Peter Lorillard, as to tobacco making; E. I. Dupont de Nemours, as to gun powder; Jesse Reed, as to nail making; William Edwards, as to leather making; Jethro Wood, as to iron plows; Thomas Blanchard, as to lathes for turning irregular forms; Asa Spencer, as to geometrical lathes; Richard M. Hoe, Isaac Adams, Stephen P. Ruggles, Andrew Campbell, Moses S. Beach, and G. P. Gordon, as to printing presses; Samuel W. Collins and Elisha K. Root, as to ax making; Oliver Ames, as to shovels; William Woodworth, as to wood working; Thaddeus Fairbanks, as to scales; John J. Howe and Chauncey O. Crosby, as to pin making; Eliphalet Nott and Jordan L. Mott, as to stoves; Robert L. and Alexander Stuart, as to sugar refining; Matthew W. Baldwin and Ross Winans, as to locomotives; Cyrus H. McCormick and William P. Ketchum, as to mowing and reaping; Samuel Colt, Ethan Allen, Christian Sharps, Edmund Maynard, Rollin White, Christopher M. Spencer, Horace Smith, and Daniel P. Wesson, as to fire arms; Alonzo D. Phillips, as to friction matches; Henry A. Wells, as to hat making; Charles Goodyear, Nathaniel Hayward, and Horace H. Day, as to India rubber; John Ericsson, as to naval construction and hot air engines; Elias Howe, Jr., Allen B. Wilson, Isaac Singer, J. E. A Gibbs, William O. Grover, and William E. Baker, as to sewing machines; S. F. B. Morse, Royal E. House, and David E. Hughes, as to telegraphs; Henry B. Tatham, as to lead pipe; Cullen Whipple, as to wood screws; Jonas Chickering and Henry Steinway, Jr., as to pianos; Henry Burden, as to horseshoe machinery; Linus Yale, as to locks; John A. Roebling, as to cables, chains, and bridges; George H. Corliss, as to steam engines; Asa Whitney and Nathan Washburn, as to car wheels; Gail Borden, Jr., as to condensed milk; William and Coleman Sellers, as to shafting and iron working; Henry Disston, as to saws; James J. Mapes, as to fertilizers; John Stephenson, as to horse cars; R. P. Parrott, as to cannon; Richard J. Gatling, as to Gatling guns.

These men and thousands of others like them enjoyed for a little time the ownership of the property they produced by their own brains and their own hands, out of materials belonging to no one else, and that property of vast and peculiar value has been given to the American people forever. Even during the few years that they enjoyed the ownership of the property, which was theirs by the best and highest of all possible titles—that of creation—they realized but a small fraction of the benefits flowing from their improvements. Even during that limited period the lion's share inured to the public benefit in added comfort and lowered prices.

The patent law does not exist for the benefit of inventors. It exists for the benefit of the public. The enlightened public selfishness which called that act into being was expressed in the organic law—in the Constitution of the United States—when Congress was therein authorized to secure 'for limited times to authors and inventors the exclusive right to their respective writings and discoveries,' in order 'to promote the progress of science and useful arts.' The magnificent degree in which the progress of science and the useful arts has been promoted in America by wise patent laws ought to be clear to the dullest comprehension.

The benefits of the patent system are by no means confined to the manufacturing industries. It may well be doubted whether the larger benefits do not flow to that portion of our people who seem to have the least connection with those industries. It was Whitney's improvement in the cotton gin which made possible the marvelous cotton culture of the South, producing thirty-six hundred and twenty-two million pounds of the staple in 1889, which without the schoolmaster's invention would have required the labor of three millions of men for a year simply to clean it.

The settlement and cultivation of the great West have been made possible only by patented improvements in agriculture and in transportation. Under the old order of things it would have required the labor of all the men and boys in the United States, some twenty-four millions in number, to plant and till and harvest the American corn crop of 1889, it being more than two thousand millions of bushels, raised upon seventy-eight million acres of land, leaving to take care of itself meanwhile four hundred and ninety million bushels of wheat and seven hundred and fifty million bushels of oats produced in that same year. And under that old order of things the value of each bushel of this grain would have been consumed in transporting it three hundred miles, while now it is carried across a continent and across an ocean and still sold at a living profit.

There is no class or condition of men in the whole country which has not felt the blessings of American inventive genius, fostered into its fullest flower by wise and kindly patent laws.

That same inventive genius has greatly enlarged the employment of manual labor and enhanced its wage. Every calculation to the contrary, based upon doing a modern volume of business by the number of men who would have done it under the old order of things, has the fatal defect of forgetting the inevitable relation between lessened price and increased consumption. The man who, at the meeting of the American Social Science Association in 1878, calculated that on a single great modern daily newspaper a few men, using modern machinery, had practically displaced more than five thousand printers, using the press of Benjamin Franklin, omitted to note that the wages of this army would have so raised the cost of the journal as to annihilate its circulation and destroy the enterprise. It is an absolute condition of the doing of any modern volume of business that it shall be done in the way it is done.

"No greater labor-saving device than the sewing machine was ever invented, or is ever likely to be; but its introduction into common use greatly enlarged the field of manual labor. In 1838 Walter Hunt had all but perfected a practical sewing machine; but upon the protest of his wife as to its effect upon tailors and sewing women he gave his invention over to darkness and oblivion. Nevertheless, the sewing machine was made a common thing between 1850 and 1870—a period of time in our national life more important and interesting in most particulars than any other similar period. In 1850 there were fifty-two thousand tailors in a population of twenty-three millions, or one tailor to four hundred and forty-two inhabitants. In 1870 there were one hundred and six thousand tailors in a population of thirty-eight millions, or one tailor to three hundred and fifty-eight inhabitants. Population in these two decades increased sixty-five per cent; but the number of tailors increased more than one hundred per cent. Meanwhile the manufacture and sale of sewing machines had given profitable employment to at least forty thousand persons, and millions of sewing machines had gone into use in factories and families, effecting a saving well-nigh measureless in that labor which is performed with the needle.

"The locomotive is another immense labor-saver, which first became common in America in the period between 1850 and 1870, and while in those two decades the population increased sixty-five per cent, the makers of common carriages and wagons increased in number more than two hundred per cent.

"Among the English-speaking peoples, never, since they crept out of the twilight of the Middle Ages, has the beneficial effect of wise patent laws been seriously questioned."

The Whitening of Wool.

We owe to M. Hofmann, of Dresden, an interesting communication on the process employed for producing a pure white on wool. It is well known that it is impossible, even by the aid of the most active bleaching agents, to remove from the wool a faint shade of yellow, which becomes specially noticeable when the material is contrasted with silk or cotton. The neutralization of this yellow by a complementary blue, such as is used for cotton, linen, paper, etc., only gives poor and unsatisfactory results. Attempts have long been made to give wool a better white by means of white topping substances, such as magnesium carbonate. This method has had, however, to be given up on account of the dust formed after a short period of storage. The author proposes to obtain a better result by vegetalizing the wool, that is to say by impregnating it with a solution of cuprous oxide in ammonia, and then passing the fiber into a solution of sugar or dilute acid, which precipitates the cellulose in an insoluble form, and thus fixes it. To render the gelatinous cellulose thus deposited opaque and white, the material is dipped into ether. The same result is obtained by F. V. Hallah, by the use of hyposulphite (the old hydrosulphite) of soda and indigo. The effect produced is of two kinds: The hydrosulphite produces decolorization by its energetic reducing action, and by dissolving the indigo mechanically deposited on the surface of the tissue, causes the coloring matter to penetrate uniformly into the fiber. The blue color is restored to the indigo by a subsequent exposure to the air, and, being complementary to the yellow of the wool, completely destroys it. It is very doubtful whether, even under these conditions, a perfect equilibrium is attained between the yellow shade which is to be removed and the blue of the indigo. We have already observed that the numerous attempts previously made in this direction, with various coloring matters, have resulted in failure. However this may be, the method as given by the *Deutsche Farb. Zeit.* is as follows:

The hyposulphite solution should be prepared immediately before use. For this purpose, 7 parts of zinc dust, or 20 to 30 parts of granulated or sheet zinc, are digested with a concentrated solution of bisulphite of sodium, representing about 100 parts of the dry salt. The operation is carried on in a well closed vessel, which must be shaken up at intervals during an hour. The clear liquid is decanted, and contains hyposulphite of sodium, together with some of the zinc salt. The woolen material, carefully purified, washed, and freed from fat, etc., is thoroughly moistened in a bath of cold water, in which indigo is suspended in a very fine state of division. The best quality for the purpose is that which gives bright blues of a reddish shade in the vat process. The material emerges from the bath covered over with particles of indigo deposited on the surface. It is then passed into the bleaching solution, which is composed of water and hyposulphite solution at 1° to 4° Baume. Just before passing in the material, a quantity of acetic acid, equivalent to the hyposulphite present, is added. It is essential that the stuff be properly manipulated, so that the reduction of the indigo proceeds with perfect regularity.—*Le Mon. de la Teinture.*

Dr. Crerar's Cure for Influenza.

"There can be no question," says the London *Lancet*, "as to the advantage of having prompt recourse to rest in bed and a persevering administration of easily assimilable food, together with such special remedies as may be called for by the type of the disorder. Every practitioner knows that the manifestations of influenza are by no means uniform, that in some the headache, pains, and prostration, in others gastric or pulmonary catarrh, predominate, and he has to regulate his choice of remedies accordingly. Few are prepared to admit that, even with the adoption of all precautions, it is possible to ward off the supervention of severe bronchitis or pneumonia, which carries off so many of the weakly and the aged, or to prevent the protracted convalescence and the nervous sequelæ that characterize a certain number of cases. When, however, we attempt to realize the extent to which influenza prevails, and estimate its gravity in proportion to its morbidity, even the long list of fatalities dwindles to almost insignificant proportions. Still, this is but small consolation, and the demand for some truly specific or antidotal remedy is perhaps natural. Many such have been introduced—some, to be sure, with little reason, and all based more or less upon theoretical considerations. There is, however, one remedy which, from its simplicity and from the very confident opinion expressed by its introducer, may be singled out, in order, if possible, to get some more general opinion as to its merits. We refer to the use of large and repeated doses (thirty grains every two or three hours) of potassium bicarbonate, which Mr. Crerar, of Maryport, introduced to the notice of his fellow practitioners in an address he delivered in 1891, as president of the Border Counties Branch of the British Medical Association.

"We need not concern ourselves with the somewhat strained analogies and arguments adduced by Mr. Crerar in that paper, or dwell on the fact that it is not possible from his address to perceive why he should have come to the conclusion that the influenza poison could be neutralized by increasing the alkalinity of the blood. We may fail to be convinced of his logic, and yet not refuse to accept his facts; and the evident sincerity of his statements, which, in a paper he has just forwarded to us, are supported by the experience of others, and particularly by the personal testimony of a well known teacher in Edinburgh University, together with the results of the treatment in the wards of the Edinburgh Infirmary, seem to warrant some attention being paid to them. It is not necessary to give the text of this paper, which mainly consists in the citation of such testimony, but in justice to its author we may quote his conclusions as to the advantages of the method. They are:

"'1. If used before the attack, it prevents the disease. 2. It destroys the power of the disease within twenty-four hours, generally within four or six hours. 3. The strength is conserved, and the convalescence is short and satisfactory. 4. Sequelæ are conspicuous by their absence. 5. The death rate is reduced to a minimum. I have not had any death in more than one thousand cases. 6. It has more power over influenza than I have ever seen exerted by any method of treatment over any other disease, and I have had an extensive practice for upward of a quarter of a century. 7. If adopted by the whole profession, it would make influenza non-existent in one week. 8. It rests upon a sound scientific foundation.'

"The last two conclusions may be open to question, but the preceding are statements which no medical practitioner of standing would venture to put forward without good cause. Therefore, without in any way desiring to bias opinion, we have, after due consideration, deemed it only right to call attention to these statements in order that they may be put to the test. No doubt one's first impulse is toward incredulity, but *prima facie* it can hardly be asserted that the method is unreasonable, although the administration of such large doses of a salt that has undoubtedly a depressing action on the circulation is surely a step to be taken with circumspection and care, especially in a disease so characterized by depression as influenza."

The Earth an Outer Shell with a Fluid Filling.

Just why the magnetic needle, instead of pointing due northward, inclines to one side to a greater or less degree, and why the region toward which it is directed keeps shifting slowly, is a problem which has for ages baffled the wisest men. But a solution of it which, if it is not accepted by the scientific world as complete and final, at least has much to commend it to instant favor, is now offered by Henry Wilde, F.R.S. It is briefly discussed in the *American Meteorological Journal* for January by that new, though already eminent, authority on terrestrial magnetism, Professor Frank H. Bigelow.

Mr. Wilde has come to the conclusion that the outer shell of the earth and the great mass within rotate somewhat independently of each other. The interior portion, still in a liquid condition, he conceives as continuing to revolve about the axis which our planet had in its infancy; that is, one perpendicular to the plane of the ecliptic. Somehow, in the great cataclysm in which the moon was thrown off from the earth, the crust of our globe was, he thinks, skewed over to one side about twenty-three degrees; and this part of our sphere, therefore, revolves about what we call "the geographical pole." The inner mass, like the other planets and the sun, he regards as electro-dynamic; while the shell is electro-magnetic. Furthermore, two causes are supposed to render those portions of the earth's exterior underlying the oceans more highly magnetic than others: the permanent low temperatures at the bottom of the ocean, and the greater amount of iron here included, the crust being thicker under the seas than elsewhere.

For purposes of demonstration Mr. Wilde constructs a machine, consisting of one sphere within another slightly larger one, both converted into magnets by coils of wire encircling them. Upon those portions of the shell which correspond to the oceans he attaches magnetized sheet iron. And by means of proper gearing he makes the inner and outer spheres rotate on axes 23½ degrees apart. Finally, for test purposes, he provides for temporarily fixing a magnetic needle at any point on the surface of globe. With this ingenious apparatus, he declares he can reproduce every known variation of intensity and direction in terrestrial magnetism of which he can find a record; and, what is the convincing feature of his experiment, the real magnetic history of all parts of the world for the last four centuries, so far as he can learn it, is actually repeated in the minutest details when the inner sphere is made to fall behind the outer one, in their revolution, at the rate of 22½ minutes of an arc annually! That exceedingly well informed and cautious expert, Dr. Charles A. Schott, of the United States Coast and Geodetic Survey, tells Professor Bigelow that he has records of magnetic variations of which Mr. Wilde is evidently ignorant; and that when these are used as tests, in addition to the vast number of verifications Mr. Wilde has presented, the theory still holds good. The period of time here required for one whole "secular" change is 960 years, which agrees with the values of Sir William Thomson, though differing somewhat from tradition.

The only doubt which will remain in any scientific mind regarding the soundness of Mr. Wilde's explanations, after studying this magnificent demonstration, will probably spring from the notion, now widely entertained by physicists, that the earth is solid to its core. Sir William Thomson has expressed the belief that the whole globe is as rigid as glass, if not as firm as steel. Yet Mr. Wilde declares himself thus confidently: "From the various movements of the declination and inclination needles, correlated with each other in direction, time, and amount, on different parts of the earth's surface, the theory of a fluid interior may now be considered to be as firmly established as the doctrine of the diurnal rotation of the earth on its axis."—*N. Y. Tribune.*

Walter A. Wood.

The Hon. Walter Abbot Wood, the inventor, and founder of the manufactory of harvesting machines, well known all over the world, died, aged seventy-six, at his residence at Hoosick Falls, New York, on the 15th ult., from the effects of influenza and pneumonia. He was one of the earliest and largest makers of reaping and mowing machines, beginning in 1852, since which time he and the company of which he was president have made nearly a million machines. They made the first wire and string self-binders ever sold. Mr. Wood had had conferred upon him the Legion of Honor, by the Emperor Napoleon III., at Paris, in 1867, and the Francis Joseph Cross by the Emperor of Austria at Vienna, in 1873. He represented his district in Congress for four years from 1878 to 1882.

THE first theater in the United States was at Williamsburg, Va., in 1752.

NEW SYSTEM OF MARITIME NAVIGATION.

At a recent session of the French Academy of Sciences, Mr. Gustave Trouvé presented a paper upon a new system of maritime navigation with which he has for some time been experimenting. In this system locomotion is evidently possible only through the aid of floats, but as regards methods of propulsion there exists an infinite number. Now, Mr. Trouvé has always been struck with the great difference observed between the speeds of locomotives and ships. Although the latter are provided with engines that are much more powerful than those employed in terrestrial propulsion, they nevertheless attain a speed half less than that of the former. This great kinematic inferiority of ships he attributes to the enormous resistance offered to them by the water in which they are partially submerged, and it is to the diminishing of such resistance, by transforming the submerged floating portion, that he has devoted himself. But do the two functions of sustentation and propulsion each necessitate, in reality, its own particular organs? May not a single apparatus suffice for them both? It was in order to solve these questions experimentally that Mr. Trouvé, as long ago as 1885, designed the apparatus of which a side and front view is given in Fig. 1.

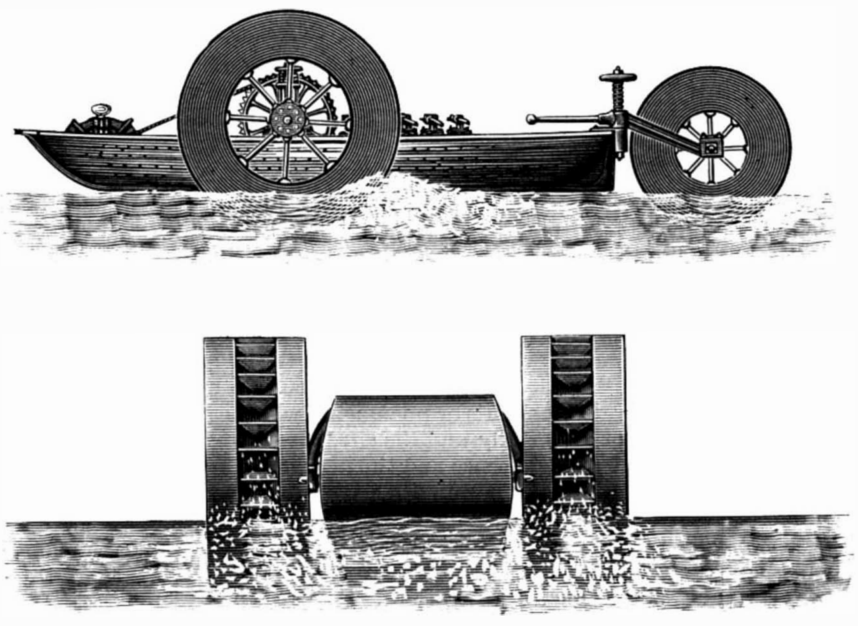


Fig. 1.—SIDE AND FRONT VIEWS OF TROUVE'S ELECTRIC BOAT, IN WHICH THE PROPELLER AND THE FLOAT ARE COMBINED.

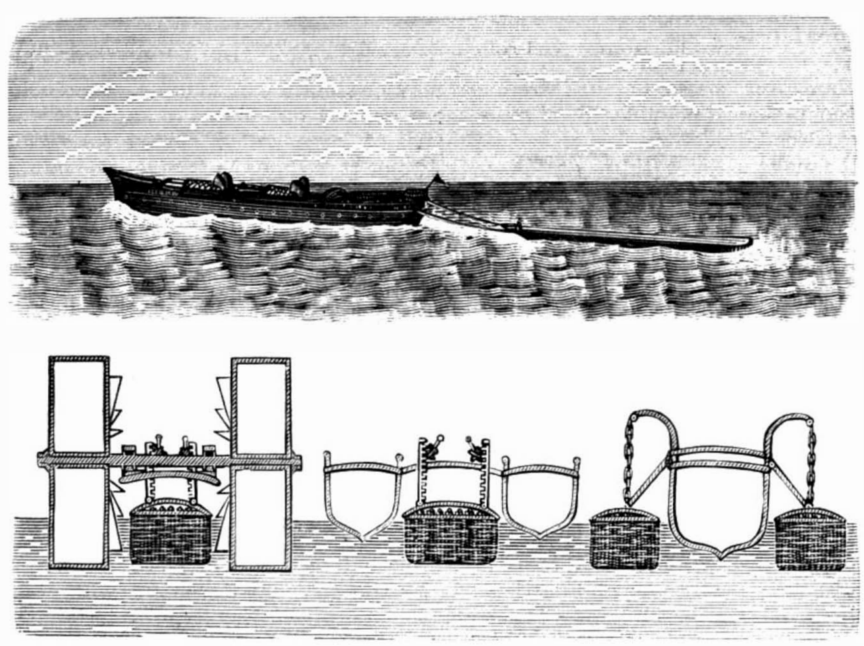


Fig. 2.—FLOATING BATTERY TOWED ASTERN OF A BOAT, OR ARRANGED UPON THE FLOAT PROPELLER.

A light boat is carried by a sort of tricycle, whose large wheels have a submerged volume sufficient to maintain, of themselves alone, the entire system upon the surface of the water. These wheels are hollow, and the circumference alone enters the water. In order the better to ascertain whether the thrust of sustentation should be divided between the boat and the wheels or reside solely in the propeller, and, if the first case is the best, in order to determine the exact ratio of the volume non-submerged, the small boat in which the experimenter is seated may, at the will of the pilot and by means of screws, be submerged by insensible degrees in the water, and the wheels thus be relieved, or it may be raised wholly above the water along with its passenger. The two large forward wheels are set in motion through the intermedium of an electric motor placed upon the boat. The third wheel is movable at the stern and serves as a rudder. All three are provided with paddles, after the fashion of mill wheels. The results obtained with this apparatus and an accident encouraged Mr. Trouvé to complete it. In fact, at a soirée at the Paris Observatory, he was exhibiting the propelling apparatus of his electric boats to Admiral Mouchez's guests, when he perceived that all his measurements had been badly made, and that his generators of electricity were too heavy for the little boat constructed for the occasion, and caused it to sink. As it was not possible to forego his exhibition, he resolved to have recourse to an artifice.

In the first place he suppressed the two heavy generators, and, under pretense of causing his boat to produce a useful effect, he formed, through alternate plates of zinc and copper supported by corks, a small float which he connected with the boat and propelling apparatus by the conducting wires themselves. As for the liquid, wishing on the one hand to allow it to preserve the aspect of ordinary limpid water, and, on another hand, recalling the fact that sea water had already been used as a liquid in certain batteries, he contented himself with saturating his liquid with sea salt. The boat and float then sailed as well as could be desired.

A short time afterward Mr. Trouvé renewed his experiments upon a larger scale, with a sea water battery, and his new experiments showed him that the water of the ocean furnished a much higher potential than did the artificial saline solution, the electro-motive force of a single element sensibly reaching one volt. They taught him also that the water of the Mediterranean was more electrogenic than that of the ocean, owing to a greater evaporation under the influence of a warmer climate, and consequently to a more perfect saturation than that of the Atlantic, the mean temperature of which is lower. He found that the electro-motive force is, moreover, variable from day to day for the same source, and that the solubility of the salts plays here again the principal if not the only role.

In the application of this system on a large scale, a battery float is placed astern of the vessel (Fig. 2), and the elements, united in a battery, being submerged, the current is led to the motor on the vessel through the aid of two cables containing the conductors. At least five or six volts are thus obtained without any trouble. Moreover, in order to prevent breakage, care must be taken to render the connecting cables and the conductors independent, as the latter never have to undergo direct traction. During a violent tempest, and in all cases where a stoppage is usually made, the battery may be taken on board, its weight being relatively light. In order to lighten the weight of the elements in the water, Mr. Trouvé bends the copper plates upon themselves and closes the hollow mass thus formed, so that the thrust of the liquid perfectly balances the total weight of the couples.

As for the floating battery, that possesses a great advantage over steam, in that it can be immediately exchanged in a port of supplies. The exchange is effected much more quickly than is the ordinary loading with coal. Floating batteries already prepared may await the ships in a dry place.

The power of such a battery is much greater than might be thought at first sight. In fact, if we take, for example, a vessel 100 meters in length and 16 in breadth, and suppose that the elements and their electrodes are 1 decimeter distant from each other, and that they plunge to a depth of 4 meters in the sea, the total active superficies will be 800 square meters (since the two surfaces are utilized), or, at the rate of five plates per running meter of width of float, 4,000 square meters, and, for the 16 meters of breadth, 64,000 square meters. Admitting, now, that we have at our disposal an electromotive force (and it is minimum) of 6 volts, and of an intensity of 10 amperes per square meter, let us say, in a word, 60 watts per meter of superficies, or practically 6 kilogrammeters, and we shall have at our disposal a power of more than 5,000 horses. Mr. Trouvé remarks that the energy discharged can but increase with the speed, since the hydrogen of the electrolyte is driven away by the current of water that is created between the elements, and induced currents have hardly the time to form. There is, then, in short, no polarization, and this redoubling of energy is comparable to that which we observe in a battery when the liquid is agitated.

Mr. Trouvé asserts, in conclusion, that his new system of maritime navigation with sea water battery is based upon solid data verified by the experiments that he has made, in company with Mr. De Nabat, on a boat 8 meters in length running at a speed of 8 kilometers per hour. He employs the geometrically perfect screw constructed after a new process that he presented to the Academy of Sciences on the 12th of July, 1886.

Electricity in Paper.

No discovery has yet been made, and no contrivance has been introduced, says the *American Art Printer*, that will absolutely dissipate or nullify the disturbing effects of electricity in paper, either latent or generated by the revolutions of the press. Many employers have paid out considerable money to electrical experts and others who claimed to have discovered or to be in possession of infallible remedies for this trouble; but not one of them has squarely fulfilled the terms of this contract. We have studied the effect of wires connected with batteries and of wires connected with gas or other pipes leading to the ground; the latter on the principle of the lightning rod. While these do to a certain extent help to modify the action of electricity or the generation of it, they fall far short of doing it effectively and completely, and for that reason do not justify the outlay of much money upon them.

Again, many printeries throughout the country, beyond the reach of those who could help them with the appliances described, are at an expense which, as we have just said, the modicum of benefit that would be desired would not justify. It is for this reason that we recommend to all who have trouble with electricity in paper the adoption of the simple and inexpensive but surprisingly effective remedy we now present.

In nearly every printery a bottle of glycerine is kept for one purpose or another. Take this bottle and a clean rag or other cloth, wet the cloth with water and wring it out well until it is only damp, then pour a little glycerine upon the damp cloth, and wipe the surface of the tympan sheet with it, only on that part of the sheet where the impression is, as it is there that the reaction is effected—at the point of pressure. Do not put on too much glycerine, as it will wrinkle the sheet too much. Simply go over it as you would in oiling the sheet to prevent offset, but do not saturate it. If you find that one application or wiping will not stop the trouble, go over the impression parts again in the same manner. Some kinds of stock are more susceptible than others, and call for an additional application.

This is the simplest and cheapest of all the remedies, and as good as any hitherto known.—*American Art Printer.*

Irrigation in Montana.

Census Bulletin, No. 153, the fifth of the series devoted to irrigation in the arid States and Territories, has been prepared Mr. F. H. Newell, special agent of the Census Office for the collection of statistics of irrigation, under the direction of Mr. John Hyde, special agent in charge of the Division of Agriculture, and relates to the State of Montana, in which there are 3,706 farms that are irrigated out of a total number of 5,664. The total area of land upon which crops were raised by irrigation in the census year ending May 31, 1890, was 350,582 acres, in addition to which there were approximately 217,000 acres irrigated for grazing purposes. The average size of the irrigated farms, or, more strictly, of irrigated portions of farms on which crops were raised, is 95 acres. The average first cost of water right is $4.63 per acre, and the average cost of preparing the soil for cultivation, including the purchase price of the land, is $9.54 per acre. The average present value of the irrigated land of the State, including buildings, etc., is reported as $49.50 per acre, showing an apparent profit, less cost of buildings, of $35.33 per acre. The average annual cost of water is $0.95 per acre, which, deducted from the average annual value of products per acre, leaves an average annual return of $12.01 per acre.

The farms or stock ranches in Montana irrigated merely for grazing purposes have therefore not been taken into account in this bulletin beyond the foregoing statement as to their approximate total area.

The Proposed Columbian Tower.

We have received from Chs. Baillargé, C.E., one of the competing architects for the London tower, a communication favoring the idea of a gigantic globe for a monument instead of the servile imitation of the Eiffel tower. By inclining the axis so as to lie in parallelism with that of the earth the visitor would, at the highest point, emerge out at Chicago, and see near him the models of Columbus' galleys approaching the unknown coast. He proposes that the interior should represent the firmament, with incandescent lamps of varying power representing the stars.

A STRAINING AND MEASURING POT.

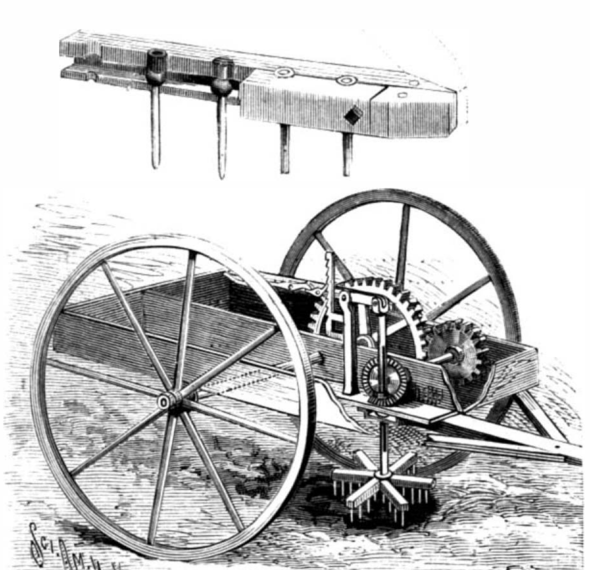
The straining and measuring pot shown in the illustration is designed to be especially useful and convenient in families, drug stores, etc. Upon its body, at spaced distances, are ribs or rings to afford means of measuring the contents of the vessel. A removable funnel strainer, A, has a flange or rim fitting in an annular recess around the top of the pot, to offer no obstruction to the closing of the cover, and the liquid with which the pot is supplied is passed through this strainer. The funnel-shaped outlet is also supplied with a strainer, B, by which the contents are strained while being poured out, two strainings being thus effected. The spout of the discharge pipe has a cap stopper to prevent the entrance of insects, dust, etc.

STANTON'S STRAINING AND MEASURING POT.

This improvement has been patented in the United States, Great Britain, and France, by Mr. George C. Stanton, of New Iberia, La., to whom application may be made for further particulars.

AN IMPROVED CULTIVATOR.

A cultivator especially adapted for working sugar cane and similar plants is shown in the illustration. It is of simple and durable construction, and the rotary hoe consists of a series of teeth whose upper ends are elastically secured, so that when the teeth come in contact with the cane stalks they will yield sufficiently to prevent injury. The improvement has been patented by Mr. William H. Waggoner, of Patterson, La. The frame of the machine is centrally braced by a longitudinal angle beam, and on each end of the axle, near the supporting wheels, are ratchets engaged by spring-pressed dogs on the wheel hubs, the dogs being readily held out of engagement with the ratchets by bolts when desired, as when taking the machine to or from the field, etc. Just front of the axle, journaled in the longitudinal brace beam and one of the sides of the frame, is a transverse shaft, on which is a pinion meshing with a spur gear on the axle, the transverse shaft having on its inner end a bevel gear meshing with a bevel pinion on a vertical shaft, to the lower end of which the hoe is secured. The hub of the bevel pinion turns in a suitable opening, and has a bearing at its lower end upon a yoke rigidly held to the bottom of the frame, the vertical shaft having a longitudinal key-slot and the hub of the pinion having a key extending into the slot, whereby the shaft may be vertically adjusted to raise or lower the hoe. The adjustment is effected by a lever fulcrumed on a standard, the lever having a spring-pressed pawl and auxiliary thumb lever, and the pawl engaging the teeth of a vertical rack. The hoe consists of a series of radial arms, as shown in the small figure, each of the arms consisting of two longitudinal sections, each having a longitudinal channel in its inner edge, with semicircular upper and lower aligning recesses for the teeth, the upper recesses being larger than the lower ones. The teeth are round, each having near its upper end a collar, and in the upper recesses of one section rubber sockets are placed, into which are introduced the upper ends of the teeth, the collars being located in the channels, and the other section being then bolted to place. With this arrangement the teeth will yield as they come in contact with obstacles, and may be swung in any direction, automatically returning to their normal upright position after passing the obstructions.



WAGGONER'S ROTARY CULTIVATOR.

A Wreck-Indicating Buoy.

A new device to indicate the position of wrecks by Mr. A. F. Ward, of Detroit, Mich., consists of a hollow ball of two halves, the bottom one being attached to a bed by a soluble glue joint. This bed is fixed to an iron plate which is screwed to the deck of the vessel or in any suitable position. As soon as the dissolution takes place the buoy rises, a cord, which can be of any length —1,000 feet and upward—and which is fixed on a reel in the hollow ball, reels off through the bottom of the ball. As soon as the latter reaches the surface the line stops paying out, the core of the reel being controlled by springs. The soluble joint is protected by a flange, which prevents water reaching it before the buoy has been submerged for some time, seas washing over the deck having no effect on it. The soluble joint can be arranged to dissolve within any time desired from 24 to 48 hours, and the cord may be replaced by copper wire when used in salt water.

AN ENSILAGE HARVESTER AND CHOPPER.

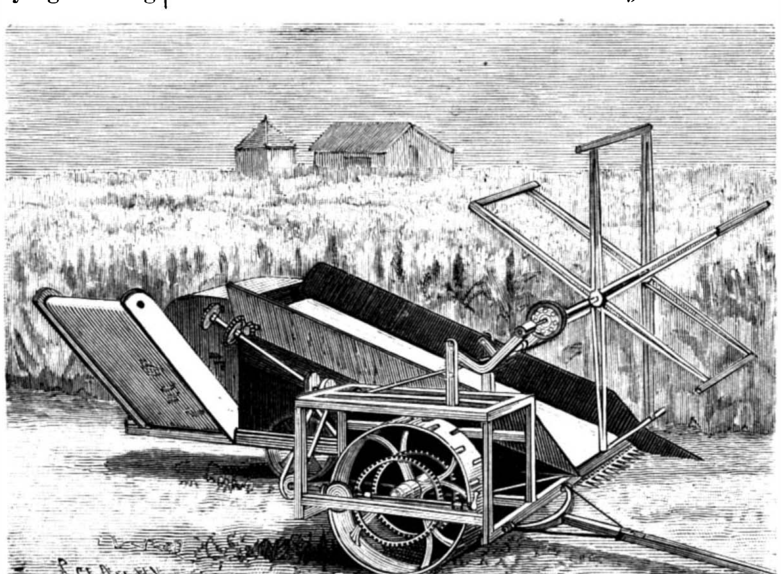
The illustration represents a machine designed to be taken out into a field of standing corn, and, with three horses and two men, cut down the corn, elevate it to chopping knives, cut it into half inch lengths, and then convey the product into a cart accompanying the machine. This work is designed to be effected at the rate of speed of a self-binder—from eight to ten acres, or 150 to 200 tons per day—thus practically putting ensilage within reach of farmers of very moderate means.

Cutting or harvesting knives are located at the front of the main frame, at the foot of a conveyer connecting at its upper end with a chopping box supported on a rear extension of the frame. Within the chopping box, immediately behind the upper conveyer-shaft, are two horizontal feed-rollers adapted to grasp and carry the fodder to a series of cutting blades, spirally arranged in a manner to form an open cylinder.

An inclined chute is located in the chopping-box, just below the knife cylinder, and carried downward and outward near the bottom, its projecting end extending nearly to a second rear conveyer leading upward and outward, in position to permit of a cart being driven beneath it to receive the chopped feed for transportation to the silo. All the mechanism is actuated by the drive-wheel journaled at the right hand side of the center of the main frame, there being erected around the wheel an upright framing, on the front upper portion of which is a bracket in which is journaled a reel shaft, the reel being of any approved construction and adapted to feed the standing grain to the harvester knives. The harvester knives are also actuated by a crank and pitman connected through the medium of shafts having bevel pinions and gears with one of the two spur wheels on the drive axle. The pinions may be readily disengaged from the gears to discontinue the motion of the harvesting knives and reel, as well as that of the chopping knives and both conveyers.

This one machine is intended to take the place and do the work of several machines now used in harvesting and chopping corn, oats, or other green fodder for ensilage. It is adapted to be drawn by horses or propelled by steam power, any farmer employing it being able, with his own help, to fill his silo at his leisure, and at far lower cost than at present. It is also adapted for use as a soiling machine, cutting all kinds of green crops for soiling cattle with the greatest ease.

For further information relative to this improvement, address W. J. Conroy, the patentee, Aylmer, Quebec, Canada.



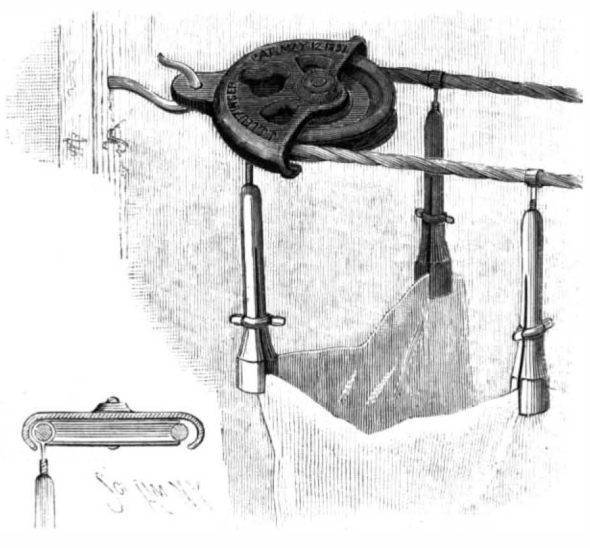
CONROY'S ENSILAGE HARVESTER AND CHOPPER.

Beet Sugar in Canada.

Following the example of the United States, the Canadian government has passed a law offering a bounty of one cent per pound on all beet root sugar produced in the Dominion between July 1, 1891, and July 1, 1893, with an additional bounty of three and one-third cents per one hundred pounds for each degree, or fraction of degree, over 70 degrees polariscope test.

AN IMPROVED CLOTHES LINE PULLEY.

The device shown in the illustration is of simple and durable construction, the line passing freely around the pulley and carrying with it a hanger to which the clothes are attached. The improvement has been patented by Mr. John J. Leuzinger, of West New Brighton, N. Y. The block in which the grooved pulley is pivoted has a semicircular recess in its under face, the recess extending through one edge of the block, and its side walls being concave. The pulley is of slightly less diameter than the diameter of the recess, leaving sufficient space between the peripheral surface of the pulley and the edges of the concaved walls for the line with the hanger to pass freely. The head of the bolt on which the pulley is pivoted is at the upper face of the block, and its lower end is provided with a suitable washer and a nut. The block has at one edge a lug or ear, with an eye or aperture, by means of which it may be secured to a hook or staple in a pole or other proper support, the pulley being on the under side of the device, while to the other support an ordinary pulley block may be attached. The hangers, any desired number of which may be secured upon the line, are of very simple construction, and may consist, as shown, of a ring screw, the ring of the required size for the line and the screw adapted to screw into the top of an ordinary spring clothes pin, the clothes being clamped in the pin by moving down upon it a clamping ring.



LEUZINGER'S CLOTHES LINE PULLEY.

Traced Lantern Slides.

When dealing with the production of lantern slides from book illustrations, it has occurred to me that were I to relate a very neat and simple way in which a particular class of illustrations may be readily produced by a mere tracing operation, it might tend to cause some beginners to practice this neat way of turning out a hand-made slide.

In my practice I always keep a stock of gelatinized glasses ready for my collodion work, and I find that with such I can trace over and make excellent productions by using a fine etching pen and ticketing ink. If any of my readers should have difficulty in procuring this kind of ink, they can make a very good substitute by dissolving a piece of lump sugar in ordinary writing ink. When doing this tracing operation the main thing is to get the ink to take kindly to the glass. If a worker will prepare a very weak solution of gelatine and flood the face of the glass plate, and then carefully dry the same free from dust, he will find he can write or sketch with the greatest of ease on its surface, and this being so it becomes a very easy matter to copy some rough sketches by hand, which, when projected on the screen in the shape of a lantern slide, will give unbounded satisfaction.—*T. N. Armstrong.*

Correspondence.

The Progress of Electrical Science.

To the Editor of the Scientific American:

I have been almost a constant reader of your most valuable paper covering a period of more than twenty years. I have always taken great interest in your "Notes and Queries" department. Twenty years ago the most important queries and answers related to steam power, boilers, etc., interspersed with how to make cements, inks, paints, comparative velocity of the rim of a buggy wheel as compared with the hub, etc. While admitting that the queries and answers were interesting and valuable, and highly appreciated at the time, I would ask your readers to compare the twenty years' ago SCIENTIFIC AMERICAN with to-day and note the wonderful change that time has wrought. Take any number of the SCIENTIFIC AMERICAN issued during the last six months, and from five to fifteen queries and items will be found bearing on electricity and electrical machinery in some form. If I am to judge from the great interest taken in electrical currents and machinery, a vast army of men are to-day engaged on electrical inventions alone. The inventive genius of almost the entire world seems to have centered on electricity, and it is endeavoring to solve further hidden mysteries. Such being a fact, what may we not expect during the next decade? I predict that electrical inventions will be brought forward that will astonish the world. Are we not only just now in the dawn of great inventions?

The SCIENTIFIC AMERICAN has certainly done its full share in the good work. WM. M. SCHROCK.

Somerset, Pa., Jan. 26, 1892.

Ferns: Their Preservative Properties and Varied Uses.

MRS. N. PIKE.

People generally speak of the beauty of ferns, delight in collecting them for a herbarium or for ornamental purposes, and when the splendid specimens are exhibited in flower shows or conservatories, they deservedly call forth expressions of pleasure and admiration. They are known for their exquisitely formed and often daintily delicate fronds, but they are not generally credited with possessing economic value.

Ferns, lightly as they are valued, have always held an exalted rank in the community of plants; in fact, a dominant place in the past ages of the earth, when they formed one-fourth of the flora in the carboniferous period. Their use began early, for they entered largely into the formation of the coal we now use in so many ways, and on which so many industries depend.

To come down to modern times: every farmer is familiar with the common fern, the brake or bracken that grows so abundantly on open waste lands. Doubtless it is mostly only looked at as a weed to be rooted out. Yet, like many another simple wild plant, it has infinite uses in other countries, and perhaps, with a more extended knowledge of them, some of them might advantageously be adopted here.

The bracken, *Pteris aquilina*, has most wonderful preservative powers. The peculiar odor of this fern, like many others, renders it repugnant to insect life, and must be familiar to every one who has wandered among them, especially in open land on the border of woods, where it luxuriates in the bright sunlight, so different from many of its order, that prefer shade and seclusion. This Pteris possesses, moreover, some subtile quality inimical to the growth of the varied fungi known as mould. Both the odor and the anti-fungoid qualities are said to emanate from a peculiar essential oil and resin which very probably render the fern distasteful to most insects. Bees have, however, been seen to suck the moisture exuding from the stems of the young, undeveloped fronds.

It is well known that essential oils prevent fungoid growths, as may be easily seen by mixing a few drops in a common flour paste, and they will keep it from mould sporules for a long time. It has been suggested that a frond of the bracken be boiled in the paste and it would answer the same purpose.

The above mentioned properties are so well known in Europe that they are taken advantage of in many ways. In the shops of fruiterers in London and Paris and elsewhere, apples and pears are packed in hampers containing fern leaves, the venders all asserting that they preserve the fruit fresh and good, and free from mould and decay. In the Isle of Man the bracken is in great demand for packing fresh caught herrings to be sent to the Liverpool market, and in Cheshire the farmers put up their new potatoes in hampers lined with bracken to send to Manchester and other cities.

The custom of keeping potatoes for winter in a "hog" or "bury" is general all over England. A large hole is dug and lined with straw and then filled with potatoes, a thick layer of the straw is also put over them and then covered with earth well sodded and packed down to keep out rain and frost. A gentleman who had been studying the qualities of the bracken recommended a farmer to line his "hog" with the fern instead of straw. The old fellow was skeptical about any new-fangled notion. So he made two "hogs," one with straw and the other with fern. The winter proved a very severe one, and when he opened out his potatoes he was disgusted to find that those in the former were so badly decayed they were not worth the trouble of removing, while the others were, to his great astonishment, good and sound. In Somersetshire they use bracken altogether for their "buries."

In many parts of Germany and Denmark beech leaves and bracken fronds are used to stuff mattresses and cushions. Fleas and bugs, the household pests of the poor people, they say, cannot exist in such beds. Would it not be well for our farmers' wives to try bracken for their mattresses in change for corn husks, and be free from their midnight tormentors? In some of the country places in France small beds are stuffed with fern for children affected with scrofula. In the Western Highlands of Scotland the cottages are thatched with bracken fronds, but in other parts only the strong stems are used that are bound on by ropes made of either birch bark or heather. The Scotch peasantry burn great quantities and sell the ashes to the manufacturers of soap and glass, and the thrifty housewives burn the dried fronds in their ovens, as it makes so quick and brisk a fire, especially for their oaten cakes, as it has no offensive qualities when well dried.

At Pont-y-Pool in Wales, where it grows most abundantly on the mountain sides, it is cut down in summer and burned in large heaps, then sprinkled with enough water to make the ashes adhere, rolled into small balls and sold in the market for its valuable alkali. The washerwomen prize it greatly, as it economizes soap. When used a ball is put in the fire till red hot, and then thrown into a tub of water, which in an hour becomes lye and is fit for use. Though the first frosts of autumn turn the bracken brown, it stands erect all winter without decaying. The hardy Welshwomen are often seen going out in sleighs to bring home loads of bracken. It is used as litter for the horses and mules employed on the tram roads, and is chopped up in their food also. When this fern is young it is greedily eaten by the far-famed Exmoor ponies, and donkeys delight in it. Swine also are fed by the cottagers in some counties on the boiled roots mixed in their wash, which is very serviceable in spring, when garden produce is scarce.

The bracken was put to a singular use in ancient times. In the Isle of Anglesea, North Wales, an urn was dug up many years ago containing the bones of a woman and child. Certain filaments were found adhering to the sides of the urn, and when microscopically examined they proved to be the remains of bracken fronds, that had evidently been used as a lining to the urn and covering for the bones. This fern grows in great abundance in the district where the urn was buried. In Normandy, France, the very poor peasants mix the succulent rhizomes with their bread in times of scarcity, and in Siberia they are used with malt when brewing beer. In some places it is used for dressing kid and chamois leather.

The bracken grows in every quarter of the globe. In North America it extends across Canada and is in every State of the Union as far as Mexico, south. According to locality it grows from one to ten and twelve feet high. If cut while green and left to rot on the ground, it improves the land and is very good for potatoes. Here the fronds are mostly tripinnate or winged. The name Pteris is derived from *pteryx*, a wing; and *aquilina*, from a supposed resemblance to a spread eagle, when the vessels in a transverse section of the underground stem are cut across. Everywhere legends linger round ferns—they sang of them in Eastern lore as emblems of secrecy and friendship; and the solemn Druids of old used them in their incantations.

Many kinds of ferns besides the bracken are eaten in India, especially by the hill tribes, but not as a staple article of diet, only as an accompaniment to other food. The *Asplenium nidus*, or birds' nest fern, is eaten in all the islands of the Indian Ocean, the young uncurled fronds being boiled in bundles like asparagus, and eaten as a salad. One of the *Polypodiums* mixed with barley and milk is used as a drink for persons recovering from inflammatory maladies. The common adder's tongue fern serves in the preparation of an ointment; a *Scolopendrum* as a pectoral and for spitting of blood; *Gleichinia* roots are full of fecula, slightly bitter and aromatic, and are used in Japan, Persia, and Australia for food. The poor of most nations seem to turn to ferns in some sort as a substitute for other lacking necessaries of life.

Many of these plants have astringent as well as aromatic properties, especially some of the *Adiantums*. From the Canadian maiden hair, sirup of capillaire is said to be made with an infusion of orange flower water and sugar. Not alone are ferns in use in modern days. In Pliny's time the frail stems of *Adiantums* received the name of *Cheveux de Venus*, and were used by ladies for strengthening and increasing the growth of their hair, and he tells how ladies beautified themselves by using some preparation of these dainty ferns as a cosmetic. I believe no poisonous plants are known in the order.

The Sandwich Islands have always been noted for their ferns, among others a *Cibotrum*, that grows very tall, and the foliage of the perfect ones, as they wave in the balmy winds, resembles an Oriental palm. From this noble tree the natives gather a soft, silky yellow substance resembling the finest merino wool, called *pulu*, and this they stuff their pillows and cushions with. A *Polypodium* is said to be of service in the preparation of cocoanut oil by the South Sea Islanders, and the bruised leaves of the fragrant *Angiopteris erecta*, also a graceful tree fern, are employed to perfume the oil.

Some of the *Blechnums* are used in making beer. The *Lastrœa filixmas*, the male shield fern, is looked upon as a powerful vermifuge, for certain parasites of the human body. The Yakoots, of Siberia, take the fragrant wood fern, *Aspidium fragrans*, and make a decoction of it in place of more expensive Chinese tea. The *Asp. noveboracense*, the New York shield fern, has a sweet-scented variety, and if plants are taken and dried out of doors, they can be used to perfume a room, and the odor will last a long while.

The *Ceterach officinarum* cures affections of the chest; the down of *P. barometz* effectually stops hemorrhages; another of the Lastrœas contains starch, saccharine matter, tannin, green fixed oil and resin. The rhizome has been used for tanning, and the ashes contain carbonate of potash.

One could go on *ad infinitum*, but enough has been said to prove of how much use the ferns are and have been. Truly one-half the world does not know how the other half lives—and it is very doubtful if doctors allow all the curative powers said by the natives of various nations to reside in ferns. I will only mention one more, viz., the *Osmunda regalis*.

This fine fern is well known as the "king fern." Several interpretations of the name are given from the old Saxon. Osmunda is said to come from Osmund, meaning "domestic peace," and the roots of the fern were boiled and put into some kind of liquor and given to those who were wounded or bruised. The name also signified mind and strength, in allusion to its invigorating qualities. A pretty legend is told of how it got the name of *regalis*. At the time the Danes were ravaging England, after burning the monastery of Avondale, they destroyed all the surrounding country. Osmund, the Waterman, took his beautiful wife and child to an island to hide them from the Danes. There were no caves, but the whole place was covered with this fern that grew very tall. He took provisions, and made mother and child lie hidden in the ferns while he went to help King Alfred to drive out the Danes. His arms at this time were successful and Osmund returned in triumph. When all had settled down again in peace, Osmund's fair child named the fern after her father and called it the king fern after Alfred. It is also said that the heart of the waterman may be seen in a section of the root.

Hops.

Census Bulletin 143 shows the production of hops for the year 1889 to be 39,171,270 pounds, grown upon 50,212 acres of land in seventeen States. The five leading States in the production of hops are:

	Acres.	Pounds.
New York	36,670	20,063,029
Washington	5,113	8,313,280
California	3,974	6,547,338
Oregon	3,130	3,613,726
Wisconsin	967	428,547

The aggregate production of these five States was 38,965,920 pounds, being 99·48 per cent of the entire crop of the United States. New York produced 51·22 per cent of the entire yield from 73·03 per cent of the entire acreage. California produced the highest average per acre, 1,648 pounds. Washington followed closely, with an average of 1,626 pounds, and Oregon stands third in rank with 1,155 pounds. New York produced an average per acre of 547 pounds, or less than one-third that of California, while Wisconsin, with 443 pounds, stands the lowest of the five hop-growing States. The value of the crop of the United States for 1889 was $4,059,697.

The crop of 1890 amounted to 36,872,854 pounds, which was worth $11,105,424, or nearly three times the value of the crop of the previous year. This great advance in value is due to the fact that the average price of hops in 1889 was about 10 cents per pound, while in 1890 it was over 30 cents.

Freckles.

Some people are born freckled and other have freckles thrust upon them. The former class might as well accept their freckles as a dispensation of Providence, for nothing can be done for them. The latter can always get rid of their affliction by using a couple of drachms of sal ammoniac with an ounce of German cologne, the solution mixed with a pint of distilled water. Applied two or three times a day, states one of our contemporaries, it will cure the worst case of acquired freckles on record.

DR. S. P. LANGLEY'S EXPERIMENTS IN AERODYNAMICS.*

"So far as the mere power to sustain heavy bodies in the air by mechanical flight goes, *such mechanical flight is possible with engines we now possess.*" These words, coming as they do from the Secretary of the Smithsonian Institution, a gentleman who prominently represents the dignity of official science in this country, and who is everywhere recognized as a physicist of known reputation, carry with them a weight of authority. Nearly five years ago Prof. S. P. Langley, then the director of the Observatory at Allegheny, Pa., commenced there a series of experiments in aerodynamics, the results of which he has recently placed before the public, and of which we here give abstracts.

Mr. Hiram S. Maxim, inventor of the well known Maxim machine gun, has been conducting in England within the past two years experiments in some respects similar, and has independently and with remarkable coincidence reached some of the same important conclusions as Dr. Langley. The experiments common to each have been to determine the lifting power of inclined aeroplanes when driven horizontally through the air at high velocities. In the experiments of Mr. Maxim the aeroplane used had a spread of 12 feet, and was thus relatively large with respect to the radius (30 feet) of the circle in which it was moved. In Dr. Langley's experiments, though the whirling arm was of approximately the same length, the aeroplanes were designedly made so small that, for any small portion of their path, the whole would move approximately in a straight line, and the disturbing effects of centrifugal force be rendered quite negligible.

As only Dr. Langley's novel experiments and discoveries are as yet before the public in any detailed form, these only can here be particularly described. They were made with the object of taking nothing on trust, but of putting everything to the test of actual trial, even at the risk of superfluous experiment, and they were concerned with the scientific aspect of the subject rather than with the particular new art of aerodromics or air-running which they pointed to.

The whirling table which was used as an auxiliary in all the experiments (see engravings) consisted essentially of a horizontal arm thirty feet long, driven ordinarily by a 10 horse power engine, at varying speeds up to one hundred feet per second, or about 70 miles an hour, its rate of rotation being registered on a stationary chronograph, by the action of quadrant electric contacts placed around the axis of the revolving arm. The chronograph sheets, therefore, preserved a permanent exact record of the velocity of rotation for every revolution and quarter of a revolution throughout every series of experiments. By means of a series of step pulleys, all velocities at the end of the arm from rest up to this 70 miles an hour were actually attained in experiment. It was also possible by means of the reaction of the wind from a small propeller at the end of the arm to drive it independently of the engine, but the latter was generally used.

With this apparatus a number of different accessory pieces of mechanism were devised for measuring the power expended, and for recording resistances overcome while driving through the air aeroplanes placed at the end of the rotating arm. The subjects of investigation covered phases of pressure and resistance on inclined planes of different form, size, and weight, together with power necessary to sustain and propel them through the air.

The description may be inaugurated with an illustrative experiment giving one factor of demonstration. In this case a heavy metal plane was suspended from the movable horizontal arm by a spring balance, which, when all was at rest, was drawn out a distance corresponding to the weight. It had been a tacit assumption underlying the calculation of previous investigators that when such a plane surface was not only suspended, but also dragged along in rapid motion, the tension or strain would be increased, and that the spring balance would be drawn out still further. Applying this idea to the flight of birds, Navier and other eminent men of science had calculated that it would take nearly fifty times the power which a bird expended in sustaining its own weight in the air by hovering over one spot, to not only sustain the weight, but move it along in rapid flight; and on this very natural but erroneous assumption they reached the conclusion that it would take one-thirteenth of a horse power to sustain the flight of a model no bigger than a swallow, and by implication it followed plainly enough that no known mechanical power could be strong enough consistent with the necessary lightness to ever make a flying-machine. In Dr. Langley's illustration, which is essentially an introduction to more demonstrative experiments, the heavy metal plane suspended by a spring from the motionless arm drew out that spring to a carefully noted distance by its dead weight; but, as soon as the whirling table was put in motion, and the plane was not only suspended but dragged along with the lateral movement, the spring was seen to *contract* more and more instead of lengthening, showing that the pull *diminished* with each increment of speed.

It does not appear that this experiment, simple as it is, has ever before been tried, though, as soon as it has been tried, the result is seen to be so immediate a consequence of a known principle that it is apt to appear self-evident and superfluous. It becomes evident, by Dr. Langley's experiment, that the faster the motion in the air the less is the pull, contrary to what is obtained in transport on land or in water. The faster the inclined plane goes, the more it tips forward, and the smaller is the effective resisting surface that it offers.

Now, since the power exerted is measured, not by the tension alone, but by the product of tension into the distance through which this is exerted in a given time, this experiment, while noteworthy for the simplicity of its illustration, proves only that one of these factors diminishes while the other increases, as higher velocities are attained, and is so far incomplete. But it suggested to Dr. Langley the inquiry whether the second factor might not increase less rapidly than the first diminished, so that the product of the two factors, stress and distance, namely, the *power* expended, might not also diminish with increasing speed, with the startling consequence that, except for friction with such heavy planes, the greater the horizontal speed, the *less* would be the power required to maintain it, a conclusion which, if reached, would be apparently paradoxical in its novelty and of far-reaching importance in its consequences.

So novel a conception as that there might exist a practicable mode of transport in which, through a wide range of velocities of horizontal motion, the greater the speed, the less the power required to maintain it, evidently demands the most convincing experimental demonstration. For this purpose a number of pieces of special apparatus were devised so as to test the fact, if true, and repeat the demonstration in numerous different ways. The first quantitative experiments were made with an instrument devised by Dr. Langley and called by him the "resultant pressure recorder" (see cut), for measuring the total normal pressure on an inclined plane moving in the air, and to examine an assumption made by Newton, which had stood in the way of previous investigators. This assumption (see Principia, proposition xxxiv, book ii) was that this pressure varies with the square of the sine of the angle between the surface and the direction of advance. From the results obtained by it, Newton's assumption is shown to be widely erroneous.

It has always been known that an inclined plane can be supported in the air by being pulled along on it, as a kite by its string, and it is theoretically possible that the kite could be moved without a string by propellers or other means worked by an engine, if the latter were light enough, in proportion to its strength, to be supported by the upward air pressure in question. By Newton's formula and Smeaton's constant of wind pressure, each square foot of a kite or plane held at the angle of five degrees with the horizon, and moved along at a rate of 35 miles an hour, would support, by the reaction of the air, a weight of only about one-twentieth of a pound. If the engine, then, weighed even an ounce for each foot of supporting surface, it could not sustain its own weight. One conclusion of the experiments with the Langley resultant pressure recorder was that Newton's assumption was wrong, and that in the supposed case the actual weight capable of being supported is twenty times as great as that so computed, while for smaller angles and better disposed rectangles the error is still larger. It followed, then, that if reasonably light engines could be built, what was before impossible now becomes possible; and to demonstrate that within certain limits the power required for horizontal flight actually diminished as the speed increased, a piece of apparatus called the "plane dropper" was devised (see cut). It is designed to show (1) that a horizontal plane falls slower in horizontal motion than when at rest; (2) to make actual measurements of the time of fall of variously shaped planes; (3) to determine for different angles of inclination the speed necessary in order to derive an upward thrust from the air just sufficient for sustaining the planes.

With this apparatus, with planes horizontally disposed, a plane 30 inches long, 4 inches wide, and of 1 pound weight, was driven horizontally in the direction of its width. When allowed to fall from rest, the time of falling was 0·53 second, the retardation due to the resistance of the air being 0·03 second. When driven forward through the air, the time of fall increased until with a velocity of 66 feet per second (45 miles an hour) the time of fall was 2 seconds. The results with the planes inclined at various angles are presented in Dr. Langley's memoir in graphic curves which show at a glance, for the differently shaped planes used, the speed necessary in order that they shall be supported in the air at angles of inclination ranging from 2° to 30°. The resistance of these planes to advance while thus supported, and the horse power necessary for maintaining the motion, are derived from the preceding experiments. These results confirm by experimental demonstration, up to velocities of 50 miles an hour, the proposition of which the first experiments with the suspended plane gave a prevision, namely, that in the horizontal flight of an aeroplane it takes less power to maintain a high speed than a low one.

For further demonstration an entirely different instrument, called the component pressure recorder, (see cut) was next devised. This instrument gave a direct measurement of the horizontal resistance to the inclined planes while being driven through the air with speeds at which the vertical pressure of the air sustained the weight ("soaring speeds"), and the motion became as if they were entirely free from support or constraint. A long series of experiments was made with this apparatus in which hundreds of observations were obtained, the quantitative data of which render the conclusions very striking. Dr. Langley observes: "Since effective steam engines have lately been built weighing less than 10 pounds to one horse power, and the experiments show that if we multiply the small planes which have been actually used, or assume a larger plane to have approximately the properties of similar small ones, one horse power rightly applied can sustain over 200 pounds in the air at a horizontal velocity of over 20 meters per second (about 45 miles an hour), and still more at still higher velocities."

Having determined the power necessary to be expended in driving forward differently shaped aeroplanes, at soaring speeds, methods and apparatus were devised for investigating the efficiency of propellers in furnishing the end thrust shown to be requisite. This is accomplished by means of the "dynamometer chronograph" (see cut) used in connection with the component pressure recorder. The former instrument is a complete, self-registering dynamometer (placed at the end of the arm of the turntable with the propeller), which gives indicator diagrams, showing the amount of power expended in driving the propeller and the return in end thrust which this gives back. The power for driving was furnished by a small electro motor, located on the rotary arm, but actuated by a stationary dynamo. For this experiment, it is necessary that the propeller shall drive itself through the air at high speeds, while attached to the heavy, massive arm of the turntable, this latter offering a resistance out of all proportion to that of an aerodrome, such as the little propeller is adapted to drive. In the auxiliary use of the component pressure recorder, mounted at the end of the great whirling arm, Dr. Langley has overcome this last difficulty. The instrument has an arm of its own, six feet long, susceptible of oscillation about a vertical axis. Upon the end of *this* arm is placed the dynamometer and propeller, and the whole is set in motion at a high speed by the rotation of the great whirling arm. Then the propeller is actuated by the dynamo at increasing speeds, until its end thrust is so great as to actually begin to drive it ahead of the turntable, this critical instant being observed and recorded by the motion of the recorder's arm about the vertical axis. At this instant, then, the propeller and its aeroplane are no longer being carried forward by the turntable, but the propeller is driving itself ahead independently of it, but at exactly the same speed. The product of this speed by the end thrust, measured on the dynamometer, furnishes the performance of the propeller, and when compared with the power expended, shows its efficiency.

This is an outline of the principal steps in the investigations. Dr. Langley concludes his memoir with the following words: "I am not prepared to say that the relations of power, area, weight, and speed, here experimentally established for planes of small area, will hold for indefinitely large ones; but from all the circumstances of experiment, I can entertain no doubt that they do so hold far enough to afford assurance that we can transport (with fuel for a considerable journey and at speeds high enough to make us independent of ordinary winds) weights many times greater than that of a man. In this mode of supporting a body in the air, its specific gravity, instead of being as heretofore a matter of primary importance, is a matter of indifference, the support being derived essentially from the inertia and elasticity of the air on which the body is made to rapidly run. . . . . I wish, however, to put on record my belief that the time has come for these questions to engage the serious attention, not only of engineers, but of all interested in the possibly near practical solution of a problem, one of the most important in its consequences of any which has ever presented itself in mechanics; for this solution, it is here shown, cannot longer be considered beyond our capacity to reach."

* In the preparation of this article the editor has been placed under obligations to Mr. George E. Curtis, of the Smithsonian Institution, who has exhibited apparatus and placed at his disposal the literature of the subject. Among the latter the following have been freely consulted: "Recherches Experimentales Aerodynamiques et donnees d'experience," S. P. Langley, extracted from *Comptes Rendus des seances de l'Academie des Sciences*, seance du 13 juillet, 1891; small 4to, 4 pp. "Experiments in Aerodynamics." S. P. Langley, *Smithsonian Contributions to Knowledge*, 801, Aug., 1891; large 4to, 115 pp., 10 plates. "The Possibility of Mechanical Flight," S. P. Langley, *Century*, Sept., 1891; 3 pp. "Aerial Navigation; the Power Required," Hiram S. Maxim, *Century*, Oct., 1891; 5 pp., illus.

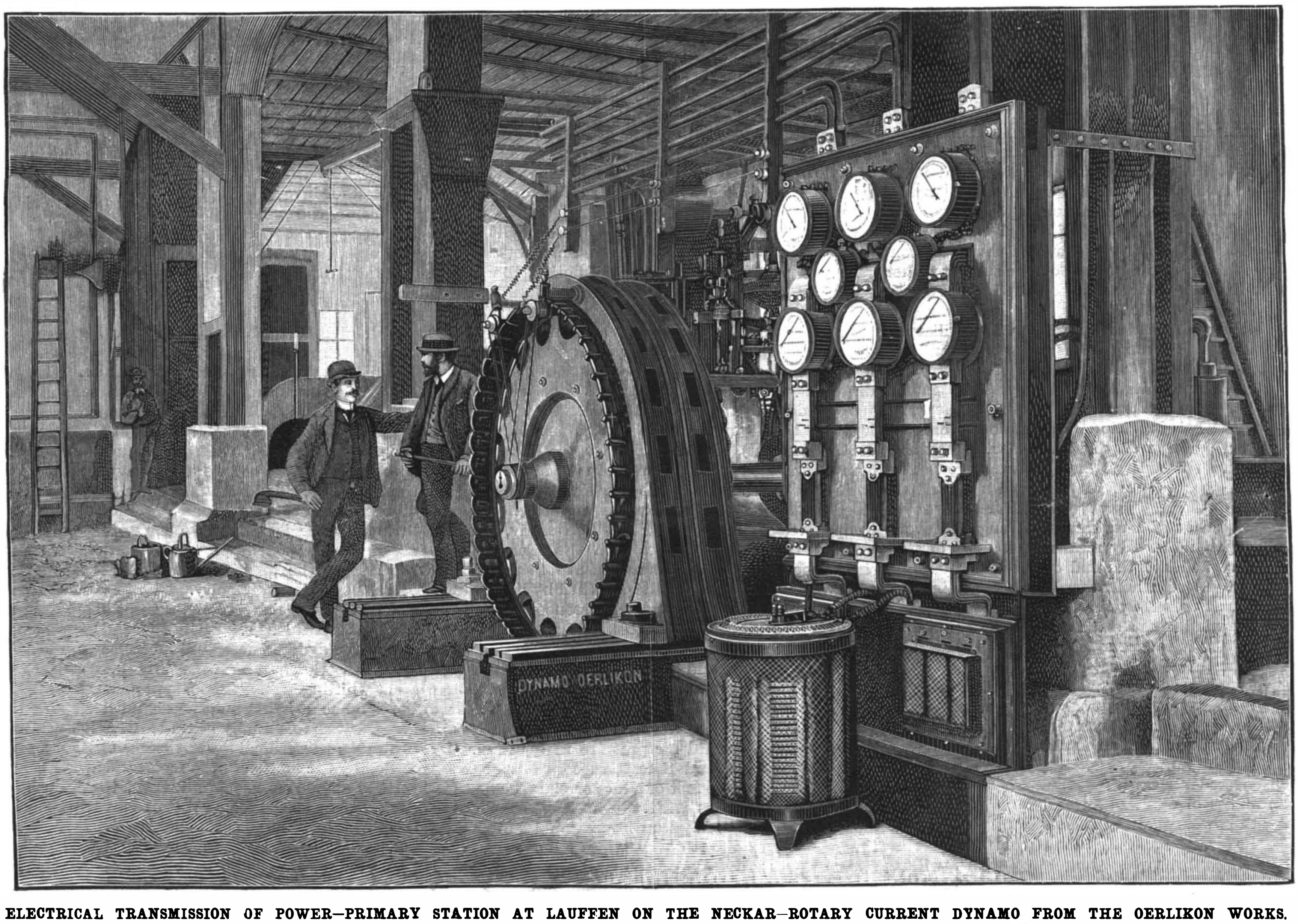
ACCORDING to Dr. H. A. Kelly, permanganate of potassium and oxalic acid are harmless to the hands and are germicidal. Soap and water plus the permanganate of potassium and oxalic acid are the only true germicides, and the best disinfectants we possess to-day.

THE ELECTRICAL TRANSMISSION OF POWER BETWEEN LAUFFEN ON THE NECKAR AND FRANKFORT ON THE MAIN.

Among the many important exhibits at the recent Frankfort Electrical Exposition, a prominent place was given to the arrangements for the transmission of power between Frankfort and Lauffen. It formed the main feature of the exhibition, and is an important step in the development of electricity.

As is well known, we understand transmission of power to mean the methods which utilize the electric current for carrying any energy—whether derived from coal, from falling water, from the force of the wind, or from the ebb and flow of the tide—any required distance.

If, for instance, the energy of great waterfalls is to be transmitted, the following arrangement is usually employed: By means of turbines the falling water is made to drive the queen of all mechanisms, the dynamo; the latter generates electricity, which is carried to a distant station by wire conductors. There it enters a second dynamo, causing the movable part, the armature, to operate. In this way machinery can be driven or the electric current can be used for lighting, etc.



ELECTRICAL TRANSMISSION OF POWER—PRIMARY STATION AT LAUFFEN ON THE NECKAR—ROTARY CURRENT DYNAMO FROM THE OERLIKON WORKS.

The transmission of power over such long distances is a new thing for the electrician, and from it he has gained the idea of utilizing the water power which is supplied so abundantly by nature in some countries—as, for instance, in Switzerland—throughout whole districts, and at great distances from the source. A notable instance of this was the transmission of the energy of Niagara Falls to Buffalo, a distance of nineteen miles. The last obstacles to work of this kind have been removed by the achievements of the Frankfort Exposition, by which a force of falling water equal to 300 h. p. is transmitted a distance of about 108 miles to Frankfort, and the experiment has proved a brilliant success.

Connected with the realization of this plan there are a great number of important innovations, to which we will briefly refer.

Dynamo machines generate two different kinds of currents according to their construction: the continuous current and the alternating current. The continuous current machine, which generates a current that flows continuously in one direction, has surpassed, in many respects, its sister, the alternating current machine, the impulses of which change their direction many times in a minute. When the direct current is used for the transmission of power a conductor having a special cross section is required, but, although the alternating current is much more economical in this respect, it has not been possible heretofore to utilize it for driving motors. To the direct and alternating current already described has lately been added the rotary current, which is generated by a dynamo in which the field magnet rotates. Its discoverer is the Italian Professor Ferraris, of Turin, and among the constructors who have brought it into notice by building practical machines, we will mention the following engineers: Tesla, Hasselwander, and Von Dobrowolsky.

The rotary current may be described as a system of connected alternating currents of different phases. The invention of the rotary current motors makes it possible to use also the economical alternating current for driving motors. On the Lauffen-Frankfort line about 300 h. p. have been effectively transmitted by means of an alternating current of very high tension (30,000 volts), and this energy is applied by means of the new rotary current motors. This striking experiment can scarcely have been tried before. The entire cost is about $20,000. The three conductors which carry the current to Frankfort have a total length of about 310 miles, and about 13,200 lb. of copper were used in their manufacture; 1,500 lb. of oil are used for filling the insulators over which the conductors pass. All this goes to prove that the technologist is now prepared to transmit strong currents over great distances, bringing the power which is now wasted in regions remote from the channels of trade to the machinery which is busy in the service of man in the large cities. —*Ueber Land und Meer.*

Areas for Chimneys.

The old rule about chimneys was that they ought to have the flue tapered to the top, on the theory that, as the hot gases in them ascended, they cooled, and, in cooling, contracted; and that it was important to reduce the size of the flue in proportion to the reduction in volume of the gases, as otherwise cold air from the top would descend to fill the vacancy left by the contraction of the gases, and the draught would be checked. Reasonable as this theory seemed, practice has shown that cylindrical boiler or furnace flues are at least as good as the tapered ones, and within a few years practical engineers and architects of experience in such matters have inclined to make them slightly larger at the top than the bottom, the increase in diameter being, perhaps, half an inch to ten or twelve feet. Recently, a Swiss engineer has made experiments to see whether the facts bear out the old rule or support the more modern practice. To make the test, he built a chimney over a furnace grate, the stack having two flues. One flue tapered upward and the other downward, and the flues opened side by side over the grate, with openings of the same size. On lighting a fire on the grate, with unlimited access of air under it, the smoke was seen to issue nearly equally from the top of both the flues, but with an unmistakable preponderance in favor of the flue which enlarged toward the top. On partially shutting off the access of air to the fire, the difference became much more marked; the current in the flue tapering upward diminished, and finally stopped altogether, the smoke finding its way entirely through the flue with the wider top.—*The Builder and Decorator.*

The Ruling of Diffraction Gratings.

A word should be said as to the difficulties of ruling gratings which may explain why so many orders for gratings remain unfilled. It takes months to make a perfect screw for the ruling engine, but a year may easily be spent in search of a suitable diamond point. The patience and skill required can be imagined. Most points make more than one "furrow" at a time, thus giving a great deal of diffused light. Moreover, few diamond points rule with equal ease and accuracy up hill and down. This defect of unequal ruling is especially noticeable in small gratings, which should not be used for accurate work. Again, a grating never gives symmetrical spectra; and often one or two particular spectra take all the light. This is of course desirable if these bright spectra are the ones which are to be used. Generally it is not so. It is not easy to tell when a good ruling point is found, for a "scratchy" grating is often a good one, and a bright ruling point always gives a "scratchy" grating. When all goes well, it takes five days and nights to rule a 6 inch grating having 20,000 lines to the inch. Comparatively no difficulty is found in ruling 14,000 lines to the inch. It is much harder to rule a glass grating than a metallic one; for to all of the above difficulties is added the one of the diamond point continually breaking down. For this reason, Professor Rowland has ruled only three glass gratings. One of them has been lost, and the other two are kept in his own laboratory. These two were used by Dr. Bell in his determination of the absolute wave length of the *D* lines.—*Joseph Sweetman Ames, in Astronomy and Astro-Physics.*

ACCORDING to the report of the statistician of the Interstate Commerce Commission, the total number of persons reported killed on the railroads of the United States during the year ending June 30, 1890, was 6,334, of whom 2,451 were employes, 286 were passengers, and 3,597 were classed as "other persons," the last class including suicides. The total number reported injured was 29,025, of whom 22,394 were employes, 2,425 were passengers, and 4,206 were unclassified.

During the year 369 employes were killed and 7,842 injured in coupling and uncoupling cars. There can be no doubt that a large proportion of these fatalities and injuries would not have occurred if automatic couplers had been in universal use.

CALIFORNIA'S FAMOUS BIG TREES.

In some twenty irregular groups, extending through a distance of about two hundred miles on the western slope of the Sierra Nevadas, from Calaveras through Tulare County, California, are found what are known as the famous "big trees" of California, one of which forms the subject of our illustration, and, wonderful to relate, although a passageway has been cut through it through which stages regularly pass, the tree still lives. This tree is in the Mariposa grove, and is 28 feet in diameter. A still larger tree in the same grove is known as the "Grizzly Giant." It is 34 feet in diameter. The highest of these trees is in the Calaveras grove, and it is 325 feet high.

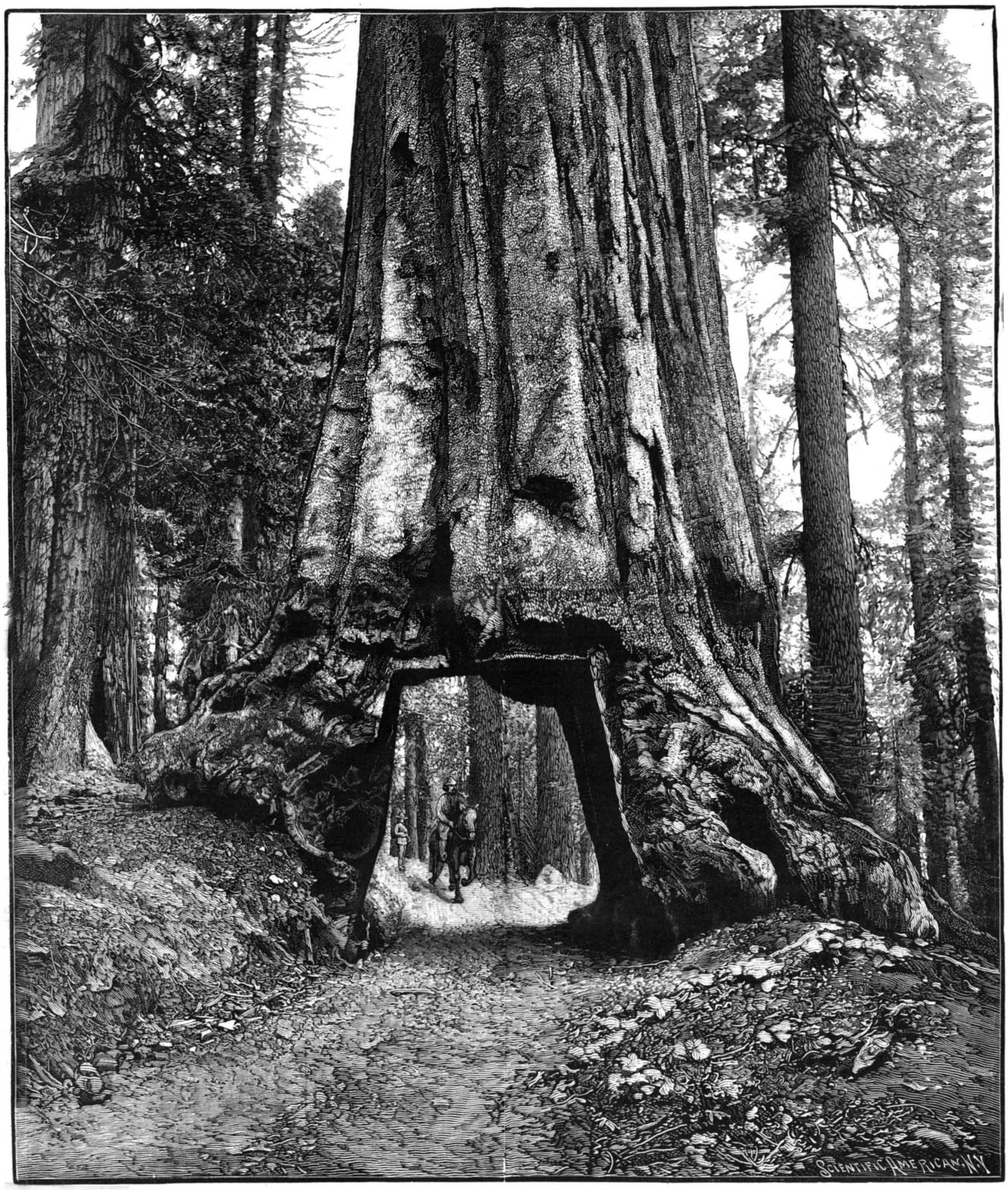
This tree, the *Sequoia gigantea*, should not be confounded with the California redwood *Sequoia sempervirens*, a tree which quite frequently reaches a diameter exceeding 15 feet and a height of 300 feet. The largest specimen of this tree is seven miles south of Santa Cruz; it is 20 feet in diameter and 366 feet high. The redwood is found from the boundary of Mexico northward, forming vast forests upon the Coast Range of mountains, never very far from the Pacific. The wood is light and close grained, much resembling red cedar in appearance; it splits with remarkable facility, is eminently durable, and is used for building purposes, cabinet work, and almost every variety of general wood work, forming the principal staple of the California lumber trade.

With such abundant supplies, therefore, of one of the finest varieties of lumber, it seems something more than a pity, but rather a matter calling for severe criticism, that the lumbermen should be permitted to destroy, as they are doing, with a few exceptions, these groves of *Sequoia gigantea*. These trees grow nowhere else in the world, and their beauty, grandeur, and marvelous age combine to make them objects of such surpassing interest that the folly and neglect of the government in permitting their present destruction will pass the comprehension of succeeding generations. The Calaveras grove, north of Yosemite valley, is still untouched, and the Mariposa grove, thirty-five miles south of the valley, is safe, because included in the Yosemite grant, but the Fresno Flats grove, the next one in the belt, is a scene of destruction. It belongs to the California Lumber Company, of San Jose. Their policy has been to slaughter the trees without regard to age or size, beauty or grandeur. This was once one of the most beautiful of the groves, but to-day it is a pitiful wreck. Giants of the forest, fifteen, twenty, and thirty feet in diameter, lie on the ground in every direction. The largest trunks, those that are too large to be handled easily with the saw, have been shattered with blasting powder. Stumps of the trees, six, ten, or a dozen feet high, are all about, an army of witnesses to the malevolent avarice of men. Occasionally there is a mighty tree still standing, with a great gash, perhaps five feet deep, cut and sawed into one side. This grove has been almost annihilated. When the company cleans up the trunks and limbs that now cover the ground, its work of destruction will be just about completed. It has been engaged on this grove for a number of years, and has turned its attention almost entirely to the sequoias.

If the big tree lumber brought higher prices than any other sort, the zeal which is shown in the destruction of the groves could be understood. But it rates no higher in the market than the sugar pine, with which the mountain slopes are densely covered. The lumber companies could have made just as much money and been at no expense for blasting powder if they had let the big trees alone and turned to the sugar pines.

In the groves further south the same scene is repeated time after time. In that portion of the sequoia belt between the north and south boundaries of Tulare County alone there are at least ten mills, every one of which is industriously working away at the big trees. Their owners evidently fear that the national government will some day awaken to the wisdom of throwing protection around these unique groves, and they are determined to get just as much money out of them as possible before that day comes.

In the Fresno grove, which is on the line between Fresno and Tulare Counties, the General Grant National Park preserves a few of the big trees. It is only a square mile in extent, and does not include the whole of the grove. The rest of it is rapidly disappearing. A little to the southeast the Sequoia National Park includes the North Kaweah and South Kaweah groves, which were withdrawn from sale in time to save them from destruction. Through the remainder of the groves one comes upon the same scene again



THE TREE "WAWONA" (SEQUOIA GIGANTEA) IN MARIPOSA GROVE, CAL.

and again. Everywhere ax, saw, and blasting powder are doing their detestable work with speed and thoroughness.

It has been proposed to extend the boundaries of the Sequoia Park so that it will embrace all the sequoia groves in Tulare County and cover the mountain slope from the summit of the Sierras nearly to the lower timber line. If the proposition included the whole belt of the sequoias from the most northern grove to the most southern tree, it would be still more heartily approved by all those—excepting always the mill owners—who have visited the groves and know how hopeless is their preservation in any other way.

For an excellent photograph from which our picture is made we are indebted to Mr. I. West Taber, a Yosemite commissioner, of No. 8 Montgomery Street, San Francisco.

Allotropism in Alloys.

In his presidential address before the chemical section of the British Association, Prof. Roberts Austen spoke of the consequences of allotropic changes which result in alteration of structure as being very great. The case of the tin regimental buttons which fell into a shapeless heap when exposed to the rigorous winter of St. Petersburg is well known. The recent remarkable discovery by Hopkinson of the changes in the density of nickel steel (containing twenty-two per cent of nickel) which are produced by cooling to 30 deg. affords another instance. This variety of steel, after being frozen, is readily magnetizable, although it was not so before; its density, moreover, is permanently reduced by no less than two per cent by the exposure to cold; and it is startling to contemplate the effect which would be produced by a visit to the arctic regions of a ship of war built in a temperate climate of ordinary steel, and clad with some three thousand tons of such nickel steel armor; the shearing which would result from the expansion of the armor by exposure to cold would destroy the ship. The molecular behavior of alloys is, indeed, most interesting. Mr. W. Spring has shown, in a long series of investigations, that alloys may be formed at the ordinary temperature, provided that minute particles of the constituent elements are submitted to great pressure. Mr. W. Hallock has recently given strong evidence in favor of the view that an alloy can be produced from its constituent metals with but slight pressure, if the temperature to which the mass is submitted be above the melting point of the alloy, even though it be far below the melting point of the more easily fusible constituent. A further instance is thus afforded of the fact that a variation of either temperature or pressure will effect the union of solids.—*Popular Science Monthly.*

The First Locomotive Run in America.

It was in 1829, the same year in which Stephenson, with his Rocket, demonstrated the practicability of rapid steam traction on railways. The engine was named the Stourbridge Lion. It was made in England and imported by the Delaware and Hudson Canal Company, and designed to draw coal from their mines in Carbondale to the head of their canal in Honesdale, Penn. On its arrival, it was placed on the railway and run from Honesdale to Seeleyville, a little over a mile. It was found to be too tall to go under a highway bridge over the track at that place, and was reversed and run back to Honesdale. All parts of the railway above the surface of the ground were built on trestles, and the heavy engine racked them so much as to endanger safety. For these reasons the locomotive was set off by the side of the track, and a board shed built over it. The railway was planked, and horses employed to draw the cars. The engine stood there safe for several years.

The writer was personally acquainted with these facts. Two men who rode on that trip are living at this time.

In 1840 and 1841, while I was a student in the Honesdale Academy, I found the boards on one side of the shed torn off and the engine exposed to view. I spent many hours in trying to study out its mechanism and movement. No published description of a steam engine was then within my reach. The Stourbridge Lion had four wheels, three or three and a half feet in diameter, and the boiler rested directly on the axles. The cylinders were vertical, one on each side of the boiler near the hind wheels. There were two heavy iron walking beams a few feet above the boiler, and to one end of each a piston rod was attached by Watt's parallelogram. The other ends of the beams were joined by swinging rods to cranks at right angles to each other on the forward wheels. There was no whistle or bell, I think. The engineer stood on a small platform behind the boiler.

Soon after 1841, the engine began to be carried off piece by piece, mostly by blacksmiths and machinists; and I am told that only one small piece of the iron is now in existence in its primitive form. If the engine had been kept intact, it would be worth almost its weight in silver for exhibition in Chicago in 1893.—*M. H., Science.*

Modern Progress in Naval Engineering.

Sir Edward J. Reed, in a recent address to the Junior Engineering Society, said:

Prior to 1863, the consumption of fuel in H. M. ships was 4 pounds per I. H. P. per hour. In the case of the Sultan it was 1½ pounds when developing the full power with forced draught. Now, a vessel with the old type of engine, weighing 920 tons, would develop about 4,900 I. H. P., and burn in four days of her fullest steaming 840 tons of coal. The total weight which her designer had to provide for was 1,760 tons, to enable her to develop say 5,000 horse power for four days continuously. But in the case of the modern vessel, just before referred to, if her indicated horse power were to be the same, viz., 5,000, the weight of her machinery would only need to be one-twelfth of this, say 420 tons, and this with the same aggregate weight of machinery and fuel (viz., 1,760 tons) would leave 1,340 tons available for fuel. But her consumption would be only 80 tons per day, so that she would carry fuel enough to steam for no less than 16 days at the fullest speed, or more than four times the time, and therefore more than four times the distance over which the earlier vessel could have steamed. During the period over which my own responsibility for large steamships extends, I have, therefore, seen the steaming power multiplied more than fourfold.

This single illustration furnishes, I think, so striking an example of recent progress that it will not be necessary for me to trouble you with references to the many other examples of like nature with which marine experience abounds, otherwise I might adduce, as one of the most interesting among them, that elfish creation (due to the genius and perseverance of Mr. Thornycroft) the swift torpedo boat, which animates the military harbors of the world by its lightning-like movements. In this case we have developed to a degree never dreamed of until quite recent years the principle of securing a very large development of power with a very small weight of machinery, by means of an immense number of revolutions.

These are some of the things which were before me, although but dimly seen, if seen at all, when I commenced my public work. What may not be before you who are now of the age that I was then? I remember that many years ago, when presenting prizes to the Science School at Liverpool, I pointed, as to a dream that might be realized, to the possible reduction of weight of material in a vessel and her machinery so great in amount as to provide for the complete lifting of the vessel to be propelled above the surface of the water, by means of a set of propellers with inclined axes, which should simultaneously elevate her and force her head through the air only. I admit that, notwithstanding the great advances in this direction to which we have just been attending, we are still far from this result; but I for one am satisfied that we are advancing rapidly toward a time when the transformation which steam and steel and electricity have already effected will be looked back upon as but the initial stages of the transformations that are to come, and are to come soon.

Roads in France.

The excellence of French roads is well known. The United States consul at Bordeaux describes how they are made. The materials are brought from the nearest quarries and placed at either side of the route surveyed. In order that the full amount contracted for may be delivered, the stone must be heaped in angular piles of prismatic shape and fixed dimensions. These heaps, placed at a given distance from one another, are afterward visited by an official inspector, and must in all instances fit exactly beneath a skeleton frame carried by him. The material is usually marble, flint, stone, or gravel, and whatever is used must be of the best quality and cleansed from all foreign substances. The stone must be broken so that each piece may pass through a ring 2½ inches in diameter. It is then spread evenly over the road, the interstices being carefully filled in with smaller pieces, so that the whole is smooth and free from abrupt eminences and depressions. A steam roller then crushes and further evens the whole, after which a superficial layer of clay and earth completes the work. Roads are classed as national roads, which are the main arteries of the system connecting most distant parts of the country, and are constructed and maintained by the government; department roads, which connect different points of the same department or of two adjoining departments, and are constructed and maintained by the department; highways and public roads, which are the property of the commune through which they run, but are in practice made and repaired by the department from taxes levied on the commune, supplemented by a department subsidy; cross roads, which are maintained by sums derived from the ordinary revenues of the commune, occasionally supplemented by additional taxation; and country roads, which are kept in order by the commune, except they are injured by unusual traffic, when an indemnity may be claimed by the communal administration. For the purpose of maintaining the common roads the inhabitants living in the district are obliged to work three days in each year or pay an amount equivalent to the compensation of a laborer for three days. The consul at Havre says that French pavements increase in excellence with age. In France, he says, all roads have perpetual attention. If from weight, rain or other causes a hollow, rut or sink is formed, it is repaired at once. Where the space to be repaired is of limited area, the rolling of the new coating is left to the wide tires of the heavy carts, but in the case of extended areas a steam roller is brought into use. Every carrying and market cart in France is a road maker instead of a rut maker, for it has tires usually from 4 inches to 6 inches in width.

The Meeting of Jupiter and Venus.

Everybody must have noticed during the past few weeks the gradual drawing together of the brilliant planets Jupiter and Venus. Outshining all the other stars, they have added greatly to the beauty of the evening sky. During the present week they will continue to approach one another, until on Saturday morning, February 6, they will be so close that to the naked eye they will actually seem blended into one. Unfortunately the hemisphere of the earth which we inhabit will be turned away from the place they occupy in the sky at that time, so that we shall be unable to witness this interesting conjunction. But on Friday evening the two planets will already have drawn so near together that their aspect will be that of a most splendid double star.

The observer will notice at once the unquestionable superiority of Venus to her giant brother in brilliancy. This, of course, is an effect of distance, for although apparently so near together that they almost touch, the two planets are really more than four hundred millions of miles apart, their conjunction in the sky arising simply from the fact that Venus, in swinging around its orbit, happens to come almost exactly into the line of sight from the earth to Jupiter. Jupiter is more than 1,400 times as large as Venus, and if it were really placed side by side with Venus, would be at least 130 times as bright as the latter is. In short, it would resemble a small but dazzling moon.

But it is only when one considers what these two planets are that the true interest of this week's celestial spectacle is developed. They represent respectively the two great types or groups into which the sun's family of worlds may be divided—the terrestrial group, whose members, like the earth, are of comparatively moderate dimensions, while th [illegible] faces have become cool and encrusted with a [illegible] d, on which a great variety of life flourishes, [illegible] y flourish, and the Jovian group, to adopt a name from their greatest representative, Jupiter, in which a much earlier stage of planetary development evidently exists, so that their surfaces have not yet cooled down or assumed a permanent form. These half-developed globes are all of gigantic dimensions and low specific gravity.

During the past year Jupiter has shown signs of tremendous disturbance in the dense cloudy atmosphere by which it is surrounded, and the fact has been noted that such disturbances upon Jupiter show a tendency to coincidence with the return of the maximum sun-spot period. Just now the sun is becoming from month to month the scene of more violent activity than it has displayed since 1883 or 1884, and at the same time the great belts and spots upon Jupiter brighten and glow with color, and exhibit changes of wonderful rapidity and variety. We cannot yet precisely interpret the processes of world making which are going on there, but they are intensely interesting to watch.

Venus, too, attracts particular attention just now, because observations to be made during its present visit to our side of the sun may settle the question that has been raised as to the correctness of Schiaparelli's conclusion, announced less than two years ago, that Venus always keeps one side turned sunward, or makes but one rotation on its axis in the course of a revolution around the sun. If this strange state of things really exists upon a planet whose size entitles it to be called the twin of the earth, so many consequences follow bearing upon the question of its habitability, that there is hardly any direction in which investigation and discovery could prove more fruitful and interesting.

They are in every way a wonderful pair of planets which now attract all eyes to the sunset sky.—*N. Y. Sun.*

Coloring for Glass.

A substance apparently used for imparting a yellow color to glass had the following composition:

Moisture	1·71
Carbon	29·96
Silica	10·65
Ferric oxide and alumina	4·38
Manganese dioxide	37·92
Sodium chloride	13·55
Sulphuric acid	0·22
Magnesia	0·23
Lime, traces of baryta, and loss	1·38

It is probably compounded of 45 parts of graphite, 41 parts of pyrolusite, and 14 parts of common salt.—*G. Hattensaur, Chem. Zeit.*

TROUVE'S AVIATOR.

At one of the August sessions of the French Academy of Sciences, Mr. Gustave Trouvé presented a memoir, the principal object of which was to show what motor, in order to solve the question of aerial navigation, is best qualified to simultaneously fulfill those two conditions of great power and extreme lightness which are so difficult to reconcile, and which, nevertheless, are strictly exacted by the very nature of the problem.

In the first place, after discussing their value, Mr. Trouvé eliminated steam motors, electric motors, accumulators of energy, such as rubber and steel, and compressed air and gas motors, since none of them completely answered the questions and none of them fulfilled the desired conditions. There does not to-day, added he, exist any motor provided with its accessories, generator and propeller, that we can immediately employ, or at least complete for the object proposed. Now since the generator and propeller are both absolutely necessary, and consequently cannot be done away with, Mr. Trouvé has conceived the idea of merging them into the motor and of thus creating a new organism dependent upon itself, which he has named a "generator-motor-propeller." This organism is constituted through the aid of the well known Bourdon tube, the essential part of the manometer of the same name. Electricity plays merely a secondary although necessary role in it.

We know that if the pressure of the gas that this tube contains increases, the tube bends and tends to spread its branches, but if the pressure decreases, on the contrary, the phenomenon is reversed and the branches approach each other. If, then, through any means whatever, we cause a series of alternately condensed and dilated pressures in the interior of the tube, the latter will undergo a series of oscillations, of powerful vibrations, utilizable as a motive power. For the purpose of still further increasing the energy of the tube, and also for diminishing the volume of the chamber in which the explosions of the detonating mixture take place, Mr. Trouvé has fitted in the interior a second tube similar to the first. This addition increases the elastic force of the gases engendered, and, at the same time, diminishes the consumption of the combustible. To the vibrating extremities of the tube are fixed directly, but with a rotary motion, the wings, A and B, of the apparatus, so as to suppress all intermediate frictional or rotary transmission gearings. The lowering of the wings corresponds to the condensed pressures, and their elevation to the dilated pressures. The chemical combination utilized is the oxidation of hydrogen. This gas is easily and quickly obtained in large quantity, even in a pure state, and oxygen, its combustive, is found already prepared, so to speak, in the atmosphere. The artificial bird (or aviator-generator-motor-propeller as the inventor styles it), like the genuine bird, thus draws a large part of its aliment from the air. The detonating mixture is regulated at will, but it is of very nearly the following proportions: hydrogen 25 per cent, atmospheric air 75 per cent. The ignition of the mixture is effected by electricity, as in gas motors.

In the small model constructed by the inventor, the generator of the explosions is a revolver magazine loaded with twelve cartridges, the charge of which is determined with care. Two clicks cause it to revolve automatically, but in order that these may operate and the magazine may revolve, it is indispensable to leave the aviator to itself, for the hammer is kept cocked only by the weight of the apparatus.

The starting is effected in the following manner: The aviator (Fig. 2) is suspended by a thread from the arm of a support, and the pendulum thus formed is moved from the vertical and is held by a second thread against the support. Two candles, one of them (A) movable, and the other (B) fixed, placed in the vertical of the point of attachment, serve to set fire to the two threads. If, with the first flame, A, the first thread be burned, the aviator, like the Foucault pendulum, will begin an oscillation. It will move from the position, 1, to the position, 2, in describing an arc of a circle, but, having reached this point, its acquired velocity is horizontal, and the flame, B, will burn the other thread. The hammer, at liberty, immediately falls, the cartridge explodes, the tube vibrates violently, and consequently the wings strike the air energetically on lowering. At the same time the aviator leaves the original horizontal plane, and, owing to the inclination of the tail, takes an ascensional motion, that is to say, the position, 3. Then the disengaged gases escape into the atmosphere in a direction opposite that of the motion, and exert a force of reaction. The vibrating tube resumes its original form and the wings rise a little more slowly than they descended. The magazine, moved forward by its click work, promptly brings a cartridge to the hammer, which drops and causes a second explosion, and the same phenomena occur again in the same order. During the third, fourth, and following explosions up to the twelfth the aviator travels a horizontal distance comprised between 245 and 260 feet, in struggling against gravity and progressively ascending. Finally, having reached the end of its flight, the aviator does not fall perpendicularly,

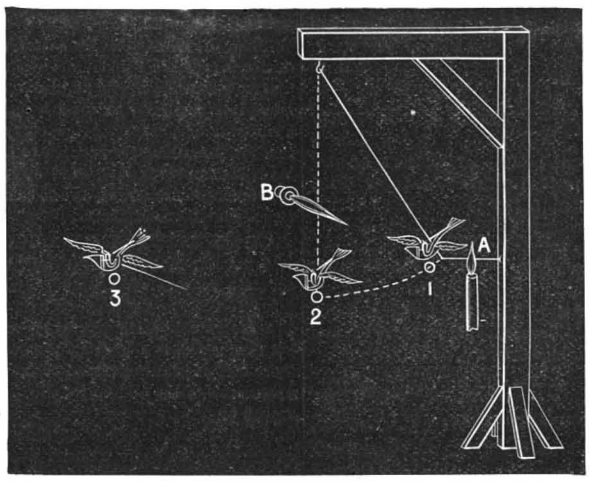


Fig. 2.—METHOD OF STARTING THE AVIATOR.

but the wings, kept raised by the approaching of the branches of the tube and by the silk aeroplane, C (Fig. 1), whose surface is proportional to the weight of the apparatus, act like a parachute, so that the apparatus descends obliquely and slowly to the ground. The aeroplane, represented by dotted lines, connects the rudder with the head, the first joint of the wings and the tail of the aviator. Mr. Trouvé thinks that in the future, whatever be the power of the motor, the use of the aeroplane will remain very serviceable, since its surface, constantly proportionate to the total weight of the apparatus, must prevent any accident in case of a sudden stoppage of the motor.

In an apparatus of large dimensions a reservoir of compressed hydrogen would be substituted for the cartridges of the small model, and the use of aluminum would be indicated, as much by its lightness as by its reasonable price. It should be remarked that the wide cooling surface of the vibrating tube and its contact with the air (which is so much the more intimate in proportion as the velocity is greater) would keep it at a medium temperature.

Upon the whole, Mr. Trouvé considers his apparatus as the lightest aviator that it is at present possible to construct, as its weight does not exceed 7¾ pounds, and as possessing every guarantee of ascensional power and performance.

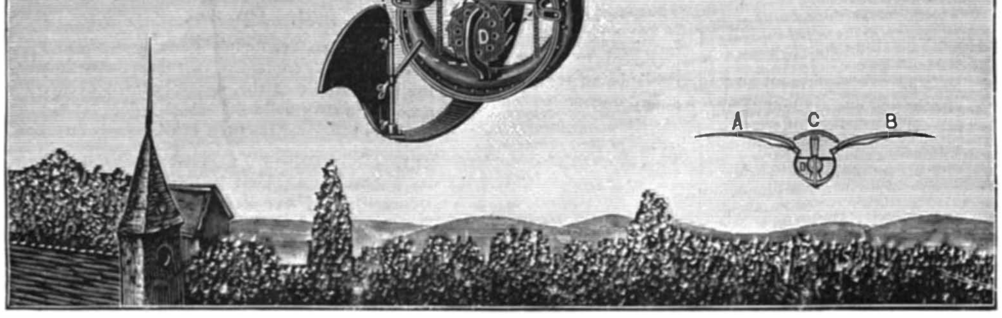


Fig. 1.—TROUVÉ'S AVIATOR.

The Art of Drawing.

To be able to draw well imparts to a person accuracy and correctness of observation; it is a valuable adjunct to an education; it conduces to make us more correct and certain as to what we do; it is a great helpmeet to the memory. How frequently it happens that in making an explanation of a new idea or object, if immediately placed on paper in the shape of a rough sketch or diagram, the whole thing appears clearer to the mind than if described without anything to give an idea of the shape of the object. To the young we say employ all your spare time in learning to draw. Allow no idle minutes.

Scientific Hydraulic Gold Mining.

In 1856 I was chosen as one of a committee of three to witness a test of hydraulic mining, for the purpose of deciding a dispute which had arisen between different manufacturers of hose nozzles. One of the parties had more than a half dozen made, in order to satisfy himself which was the best. The nozzleman generally stood from 20 to 30 feet from the gravel bank. On this occasion the water came down through wrought iron pipe about 8 inches in diameter, which ran down a steep hillside; to this was attached a canvas hose of eight thicknesses, and this was wound solid with about a ¾ inch manila rope, the lower end being tapered for say 50 feet to about 4 inches at the lower end; to this the strong rubber-lined woven hose of eight or ten thicknesses, and to the end of this the brass hose. The hoseman on this occasion was a short-set, very strongly built man, with a strap of leather over his shoulders and attached to the hose. The perpendicular fall of the water on this occasion was 196 feet, this being the most powerful pressure ever used for the purpose to that date. The gravel was what we called cement gravel, so hard that it could scarcely be picked up. The extreme end of each nozzle was from 1¼ to 1½ inches in diameter, varying in order to determine which would do the best work, or rather the most of it. In addition to the gravel the ground contained large bowlders of various sizes. One of the contesting parties claimed that the best results would be obtained by having the brass hose tapering from the canvas to within about 6 inches of the end, and that 6 inches to be of exact size; but the other party contended that the best results would be produced by having the nozzle tapered from the butt to the point as a true radial from 20 to 30 feet from butt to point; and that, if the radius was shorter than this, that the water would scatter after it reached the radial point. The man holding or operating the nozzle would quiver and tremble as the water poured from the nozzle and be compelled to stand with his feet braced apart to keep from being thrown down. On the bank stood a knurly white oak, about 18 inches through. Some gravel had been washed from under the roots of it. I suggested to the nozzleman to try each nozzle at 25 feet distant on the bark of the oak. This he did. The first nozzle with the 6 inch parallel point took off some of the coarse outside bark. We then took the nozzle tapered to a radius of 25 feet, and it peeled the tree wherever it struck it, even cutting into the wood and tearing out small splinters. This nozzle we decided to be the best for hard gravel washings. The victor published our decision all over the State and sent out circulars. He offered each of us $100 in gold, which we, of course, declined, we only allowing him to pay our expenses and $10.

I lost $5 of that $10 on a bet with a gentleman who knew more than I did. I bet him $5 that I could split the stream at the end of the nozzle with my penknife blade. So I went into the blacksmith shop and on an oilstone whet my knife as sharp as it could be. I scratched the end of the nozzle across the center so as to have a channel for my knife to run in, but after working for over half an hour and getting as wet as a drowned rat, and rather a laughing stock, I gave it up and handed him his $5 gold piece. It was singular to put one's hand against the stream at the very end of the nozzle, for it seemed as smooth as oil, and the end of one's finger merely made an apparent dent in it.

Many miners were badly hurt, and some of them killed, by being careless in using hose, by being knocked down, by stumbling over rock, and getting caught in front of the stream and driven against the banks or into the gravel. On this trial I saw immense bowlders turned over by the water from the nozzle of the hose that I do not think five men could roll over by hand.

J. E. EMERSON.

THE Compagnie des Hauts-Fourneaux, Forges et Acieries de la Marine et des Chemins de Fer, are experimenting with a new alloy for armor plates, projectiles, and guns, viz., a steel containing 1 per cent of chromium, 2 per cent of nickel, and not more than 0·4 per cent of carbon. The steel is first melted in an open hearth, and in the ordinary way. When the silicon and manganese in the metal have attained their proper proportions, the nickel and chromium are added successively in the form of ferro-nickels and ferro-chromes, or in the shape of a double ferro-chrome and nickel.

THE average annual rainfall in the United States is 29·6 in., the variations ranging from 0 to about 125 in.

RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM GENERATOR.—Frank C. Romkey, Toledo, Ohio. This invention consists principally of a gas-producing furnace, the fuel in an incandescent state resting upon a revolving grate, while connected with the combustion chamber is one or more evaporators, and a water jacket held on the furnace discharges into the evaporators. The construction is designed to be simple and durable, and the water in jets is evaporated to mix with the products of combustion arising from the burning fuel in the furnace.

GENERATING MOTIVE POWER. — The same inventor has been granted another patent on an improved method and apparatus for economically generating motive power from oil, gas and water, for driving engines or other motors. It consists in compressing and mixing air with a liquid fuel, such as oil, in an air compressor, then forcing this mixture under pressure into a burner in which it is burned, passing the products of combustion into water to generate steam, and mixing the latter with the products of combustion. The apparatus consists principally of a boiler connected with a water supply and a burner, and a compressor forcing a mixture of air and oil or gas into the burner to be burned, the products of combustion passing into the boiler.

SCREEN AND CONVEYER.—Micajah T. Singleton, Arcadia, Fla. This is a combination apparatus for screening sand, gravel, etc., washing, screening, and conveying the material at one and the same time. The screen, mounted on a suitable frame, is formed of series of longitudinally aligned wedge-shaped links, rabbeted and overlapped at their adjacent ends, rods extending through the ends and connecting the links of the several series, while tubular washers on the rods space the series of links apart, the outer series being spaced by wider links. A transverse imperforate carrier belt extends between the upper and lower runs of the endless screen, and the entire apparatus is adapted to be boxed in to prevent waste. The screen is universal in its application and may be placed upon a cylindrical frame and used as a revolving screen.

DITCHING MACHINE. — Ottis Hughes, Lock Spring, Ind. A machine designed to automatically dig a ditch and lay tile in it is provided by this invention, a vertically movable bit and shovel being mounted in a portable frame, and a scraper arranged to push the earth from the shovel, with earth shields pivoted on the sides of the frame. An engine and boiler are located on the front portion of the main frame, and the shovel blade is caused to elevate the earth from the bottom of the trench and carry it opposite the ejector or shovel scraper. The tiles are laid by being adjusted and dropped down through a depending spout pivoted to the rear portion of the machine.

COFFER DAM.—Elmo G. Harris, Little Rock, Ark. This improvement is designed to combine the simplicity and economy of the open coffer dam with the efficiency of the pneumatic caisson. The dam has at the bottom of its walls a continuous chamber open at the bottom, the outer wall reaching to a greater depth than the inner wall, and connections are provided by which air can be forced into the chamber to drive down the water and enable men to enter and operate. By this means it is designed that subaqueous structures may be more readily and more economically built, and existing submerged structures conveniently strengthened or enlarged.

WATER WHEEL. — James C. Walker, Waco, Texas. The wheel casing, according to this improvement, has two inlet ports arranged side by side and opening into the same inlet pipe, there being two hinged gates with valves for opening the ports alternately by the action of the gates, and a wheel having inclines upon its periphery for acting upon the gates. The wheel is a solid steel disk, with buckets attached to its outer edge and supported by inclined webs or flanges. According to this improvement it is designed that the energy of the water shall act upon a series of peripheral buckets on the principle of hydraulic pressure, in contradistinction to that of mere impact and momentum.

Railway Appliances.

CAR COUPLING. — Alfred R. Heath, Covington, Ind. This improvement relates to that class of couplers in which a pivotal coupling hook is employed having a vertical movement for engaging a transverse pin or shaft on an opposing car. The coupling hook is carried by a rock shaft on which are weighted arms to normally maintain the hook in position to couple, and a presser arm or cam on the shaft at the point engaged by the hook of an opposing coupling, the rocking of the shaft serving to depress the hook thereon, while the presser arm on the shaft serves to disengage therefrom the hook of an opposing car, the invention also embracing other novel features.

RAIL CROSSING. — Smith S. Leach, Cambridge, Mass. This invention is designed to provide a simple practical device adapted to form a rail crossing at any angle, making each rail of such crossing continuous when in service and also connectable to a switch or signal stand for manipulation. Combined with a base plate and intersecting track rails thereon, there being spaces between aligning track ends at points of intersection, is a sliding block for each rail intersection and a triangular projection which may be moved with the block to align with either of the crossed rails on their inner edges, guide flanges being connected to the rail sections and blocks and devices that will coact to move all the blocks and flanges simultaneously.

Agricultural.

PLOW.—Ocran D. Bunt, Bowdon, Ga. A spring fender which will readily accommodate itself to the varying surface of the soil is provided by this invention, the fender being quickly and easily attached to and adjusted upon a plow or removed therefrom. Upon a bar projecting laterally from the beam is adjustably secured the rearwardly bent portion of the spring fender bar, which is bent vertically upward and rearward at its forward end the fender being carried upon the rear end of the bar, and being vertically, transversely, and longitudinally adjustable to accommodate itself to all irregularities of the soil.

HAY STACKER. — Thomas Collins, Forks, Pa. Combined with a post upon which is swiveled a frame is a platform adapted to receive hay pivoted on the frame, and having a sliding and extension frame to which cables are attached, one drawing the frame outward and the other forcing it upward, while a locking mechanism connects the platform with the swiveled frame. The device is adapted to be erected in a mow or shed, or in a barn, or wherever hay or straw is to be stacked, receiving the latter directly from the fork, and being manipulated from the wagon to distribute the hay or straw to any side of the stack, without the assistance of a man on the stack to direct the distribution.

CALF WEANER.—Francis G. Powers, New Salem, Kansas. This device consists of a skeleton spring frame, the upper portion of which is divided and the extremities provided with soft pads or balls, while an apron is pivoted to the lower portion of the frame, and a spring-controlled shaft is held therein, whereby the two pads may be carried outward or inward in direction of each other. When placed in position the apron falls down over the mouth and effectually prevents the animal from nursing, but when the animal holds its head in the natural position for feeding or grazing the apron swings outward, out of the way.

Miscellaneous.

MUSIC RECORDER.—Juan B. Calcano i Paniza, Caracas, Venezuela. This is a recording mechanism for musical instruments, pianos and organs especially, in which a series of levers have link connection with the keys and are provided with marking blocks or crayons, fingers extending downwardly between the levers, and a tape being held to revolve under tension beneath the crayons. As each key is pressed a mark indicating the note produced is made upon the tape, and the length or duration of the sound is indicated by the graduations. A key is provided whereby the marks made may be quickly and conveniently read and transcribed in the usual notes employed in reading and writing music.

DISTANCE MEASURER AND REGISTER. --Victor Ml. Armenta, Santa Marta, Colombia. This invention relates to surveying instruments, and provides an instrument in which a wheel, journaled in a suitable frame, has on one or both faces a graduation indicating linear measurement in meters and subdivisions or yards and subdivisions, whereby accurate measurements are made as the wheel is moved over the ground. On every revolution of the wheel a projection engages a lever forming part of a registering device, another projection operating a striker, so that a bell is sounded simultaneously with the actuating of the registering device. The frame may be connected with or form part of a vehicle moved by animal or other power over the ground.

CARPENTER'S LEVEL. — Herman R. Winkelmann, Oakland, Fla., and Adam C. Perkins, Macon, Ga. This is a combination plumb and level with an adjustable inclinometer and novel brace scale therefor, to indicate the degree of bevel to be given to the ends of diagonal braces in framed structures, and the slope of cuts for the ends of rafters having different elevations from a horizontal plane, while a compass is also provided to facilitate the location of foundation walls, side walls, etc. The level stock is preferably made of hard wood, two feet long, longitudinally divided into two pieces of equal thickness, detachably secured together.

DRAWING BOARD.—Junius D. McCabe, Coraopolis, Penn. This board consists of a stationary frame provided with a head supporting a quadrant adjacent to the edge of a circular drawing board turning on the frame, and provided at its outer edge at each ninety degree point with a vernier reading to minutes. The board is designed to be simple and durable in construction, arranged to conveniently plot surveys from notes, using either bearings or angles, while also serving as a revolving drawing board for different purposes.

FRAME BUILDING. — John A. Boyd, Houston, Texas. This invention provides a method of construction designed to be inexpensive, the frame of the structure consisting essentially of studs, wall plates, sills, joists, tie beams and rafters, so formed that the several parts may be readily detached one from the other and packed for transportation. The building thus formed is substantial and adapted to either temporary or permanent purposes, while being readily erected and quickly taken down without injury. It is especially adapted for erection in out of the way places where skilled labor is not to be had, as skilled workmen are not required to locate the parts and put up the work.

VAPOR BURNER.—Logan W. Everhart, Chanute, Kansas. This improvement comprises a retort having attached burners which may be readily placed in the fire pot of a stove, range, or boiler furnace, for cooking and water-heating purposes. The retort is also arranged for the vaporization of water flowing in passages therein, with exit in a discharge pipe adjacent to the vapor discharge pipe, the steam issuing in jets into the vapor jets, and the vapor, steam, and external atmosphere intimately commingling to form a good suction draught and produce an intense and smokeless flame. The generator is of simple construction, very easy to clean, and can be manufactured at a small cost.

DISH WASHER. — Eliza A. H. Wood (deceased; John P. Gallaway, Tavares, Fla., administrator) and Minnie Wood Gordon, Bloomfield, Fla. This is an oblong sheet metal receptacle, having a closely fitting removable cover, and a heavy loose lid sliding inside and adapted to rest upon the dishes to bind them sufficiently to prevent disarrangement. A low-down faucet is provided for the drainage of water, and the receptacle is adapted for ready connection with a simple form of cradle, with the aid of which the entire device is rocked, so as to cause a thorough and rapid circulation of hot soapy water through the dishes and other ware being washed, thus effecting a thorough cleansing with safety and in a convenient manner.

SHOVEL.—Hanford Reynolds, Gifford, Ill. This is a special form of shovel adapted for use in cleaning out tank heaters and feed cookers. It has a base plate having a flange or side wall on its back and one end, the flange or wall having beveled ends, and a handle extending vertically from the base. The shovel is strong, durable and cheaply made, and is adapted to be easily inserted beneath the grate of a heater and cooker to scoop up the ashes.

TAG HOLDER.—John W. Barton and William J. McNabb, Blue Rapids, Kansas. This device is preferably made of sheet metal in the form of a narrow fluted strip, bent over at its ends, and fashioned intermediately to form a tag-holding plate, with a slideway or pocket for the entry of a card or other tag. It is particularly adapted to be slipped on pantaloons kept in stock and piled up for sale, promoting convenience of handling by the salesman, and forming also a pantaloons protector.

CONSTRUCTION OF LEGGED ARTICLES. —William J. Humphreys, Crozet, Va. This invention covers a mechanism to render tables and other articles self-adjusting to floor inequalities, comprising two separate and independent vertically sliding rods, between which is a horizontal equalizing bar or lever, there being operating devices at the ends of the bar and upper ends of the sliding rods to permit the bar to be moved by one rod when the other rod moves oppositely to the first rod. The use of the device is designed to cause tables, bureaus, washstands, etc., to rest evenly and solidly upon the floor at all times.

VEHICLE SPRING SEAT ATTACHMENT. —John W. Haney and William A. Owens, Garden Valley, Texas. This improvement is designed to be readily applied and afford a simple means of holding spring seats perfectly steady without in the least interfering with the action of the springs, such seats generally wearing out quickly because the bolts and springs become displaced or broken by the lateral motion of the seat. On the inner sides of the spring bars are keepers through which slide vertically uprights, and diagonal braces extend from the uprights to the under side of the seat, the braces moving through slots in the keepers when the seat is moved vertically.

WAGON.—Paul H. Munroe, Plainfield, Ill. The body of this wagon is mounted on crank axles carried in the wheels, the cranks of the rear axle being connected directly with the wagon body by spiral springs, a novel form of fifth wheel being mounted on the forward axle and supporting the body, while spiral springs are secured to the cranks of the forward axle and to a frame on the fifth wheel. The spiral springs are adjustably connected to the body, which has the advantages of being low down and open at the sides, so that the wagon may be easily loaded and unloaded. The construction of the fifth wheel and the frame and springs connected with it is designed keep the springs always in a definite position in relation to the axle.

SLEIGH. — Olaus A. Normann, St. Oloff, Minn. The body of this sleigh has on its under side a bolster to which the knees are pivoted, springs being secured to the ends of the bolster and connected by cross bars secured to the body, while there are rods secured to the runners and links pivoted to the rods and springs, springs being also hinged to the upper ends of the runners and to the forward part of the body. This sleigh is designed to be cheaply built, not to capsize easily, and to conform to the inequalities of the road without jumping, while being so flexible that it will ride very easily.

SIDE APRON FOR BUGGIES, ETC. — Thomas H. Joyce, Bath Beach P. O. (Unionville), N. Y. This is an apron designed to be attached to the bows and seat of buggies and light vehicles, to protect the occupants, the aprons being so hung as to be independent of the lap robe, etc., while being easily moved out of the way.

NOTE.—Copies of any of the above patents be will furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE CENTENNIAL ANNIVERSARY OF THE CITY OF GALLIPOLIS, O., October 16-19, 1890. Columbus, O.: The Ohio Archæological and Historical Society. Vol. III. 1891. Pp. 326.

The report of the recent centennial celebration of this growing Western city is contained in this volume, the third of the publications of the society named, and a good testimonial to the good work which it does in recording the early history of the State of Ohio.

CORNELL UNIVERSITY: HER GENERAL AND TECHNICAL COURSES. By Frank C. Perkins. New York: John Wiley & Sons, 53 East Tenth St. 1891. Pp. 77. Price $1.50.

By the liberal use of very beautiful photogravures, this little manual presents us with an excellent view of life and work at Cornell University. It includes views and description of the prominent lecture rooms, laboratories, etc., with portraits of many of the professors, instructors, and founders. A short description accompanies each plate.

THE SEPARATE SYSTEM OF SEWERAGE: ITS THEORY AND CONSTRUCTION. By Cadey Staley and George S. Pierson. Second edition. Revised and enlarged. New York: D. Van Nostrand. 1891. Pp. 281. Price $3.

The essence of the separate system of sewerage is the use of sewers for sewage only, except so far as the introduction of a certain amount of roof or surface water may appear desirable for flushing purposes. This work, with its numerous tables, illustrations, rules of good practice and examples of specifications, seems eminently practical and well adapted for the practical engineer. The financial question receives, too, ample treatment, it being recognized that finance and good engineering are very intimately related. The agitation for sewage systems is fast spreading among our smaller towns, hitherto deprived of such adjuncts to health and convenience. It is believed that this work is most timely, and will prove of the greatest value.

ELECTRIC TOY MAKING FOR AMATEURS. By T. O'Conor Sloane, Ph.D. New York: Norman W. Henley & Co. Pp. 140. Price $1.

This is a little book designed to be very helpful to the amateur in the line of experimentation and construction, pointing out the best means and methods of following out special ideas in many directions, and showing the limitations within which electric toy making is at present pursued. The book has chapters giving comprehensive and concise information upon batteries, magnets, motors, spark and induction coils, etc. Among the toys specially described are the electric dancer, magnetic toys, the electric hammer, and electric insects. A very practical portion treats of electric batteries from common materials, and how to manage them so as to secure good results.

PRACTICAL TYPEWRITING. By Bates Torrey. New York: Fowler & Wells. Pp. 156. 8vo. Price $1.

This is a book arranged for self-instruction, school use, and lessons by mail, containing also general advice, typewriter expedients and information relating to allied subjects. The book is primarily devoted to a lucid presentation of the "all finger" method, which leads to operation by touch. Many forms and examples are given of reportorial, legal, business and figure work, and there is a chapter on typewriting for the blind.

CATALOGUE OF THE T. H. CHUBB ROD CO. Post Mills, Vt. 1892. Pp. 93. Price 25 cents.

This elegantly illustrated catalogue will, we believe, be warmly welcomed by the world of fishers. The manufacture of the Chubb rods has already been treated of in our columns. In the present catalogue not only rods and the miscellaneous goods of the gentle art are described, but eight colored plates of artificial flies give a standard value, which it is unusual to find in catalogues. Nearly three hundred artificial flies are beautifully portrayed in chromo-lithographs.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(4007) M. L. asks: 1. What is a good charge for tin assays? A. Tin ore 5 grammes, potassium cyanide in powder 25 grammes. Besides this the crucible is lined with a layer of the cyanide, and the charge is covered with the same. Fuse and keep fused for 10 minutes. The cyanide is one of the worst poisons known, but this gives about the best results of any of the fire assays. A non-poisonous charge is: Tin ore 5 grammes, charcoal 1 gramme (mixed with the ore), 12·5 to 15 grammes black flux, 1 to 1·25 grammes borax glass. Cover with salt and a small piece of coal. Fuse three-quarters to one hour. 2. Is it possible for mercury to soak through a copper plate in a mill so as to ooze out in drops underneath? A. Yes. 3. Why are old plates so valuable? A. On account of the precious metal they retain. 4. It is stated that horse power will be furnished (or can be) over the distance from the Niagara to Chicago for about half the cost of steam power. Is this true? A. The exact proportion cannot be given. The interest on the installation and cost of maintenance will probably make it impossible. 5. What size current is necessary and how is it used to remove superfluous hair by electrolysis? See our SUPPLEMENT, Nos. 176, 353, 834.

(4008) A. E. G. writes: In the SCIENTIFIC AMERICAN for August 1, Professor Henry Rowland is quoted as saying "the voltage of stroke of lightning is roughly estimated at about 6,000,000,000 volts." What is the amperage of a stroke as nearly as may be judged by a similar estimate? A. Carl Hering, in his "Dynamo-Electric Machines," says that the E. M. F. of lightning is 3,500,000 volts, and the current is about 14,000,000 amperes. The energy is estimated to be equal to a 100 horse power engine working 10 hours. 2. Where can I learn the tonic sol-fa notation or system of writing music? I would like to buy a book to learn it from. A. In most schools where music is taught. 3. As the patent laws are now, can any one make a patented article or machine, if they make it themselves and use it exclusively for their own benefit, without becoming liable for infringement? A. No. 4. How is the carbon deposited on carbon paper? A. It is applied with a brush or sponge, the carbon or other pigment being mixed with glycerin or vaselin, with a mixture of beeswax and oil or some similar medium. 5. When a metallic spring is compressed it contains latent energy, representing the power expended in compressing it. If it is dissolved in acid while still in a compressed state, what becomes of the latent mechanical energy it contained? A. The energy expended in compression is given out in heat, which is dissipated.

(4009) L. M. C. asks (1) how to make a storage battery suitable to run a ½ or ¼ candle power electric light in a necktie and small enough to carry in a coat pocket? If this subject has been discussed in any of your papers, will you please refer me to such? A. We expect to publish a description of a storage battery suited to your purpose at an early date. 2. What is the fluid used in those "electric inhaler" bottles? Consist of a small bottle with a screw top, and a piece of copper separated from a piece of zinc by a strip of flannel. The fluid completes it. When placed near the nostrils a strange sensation is felt, extending to the back of the head. A. Oil of mustard is the principal ingredient. 3. Is there any acidproof paste that can be mixed like cement and will harden in a few minutes? A. For weak acids use oxide of zinc and a solution of chloride of zinc. Chloride of zinc is poisonous, but the cement is inert after hardening and washing. For strong acids melt together pitch 1 part, resin 1 part, and plaster of Paris 1 part; all the ingredients must be dry. 4. Will you please tell me how to compute the quantity of wire required to get the greatest magnetism out of a bar of soft iron? A. For this information we refer you to Sloane's "Arithmetic of Electricity," $1, and Thompson's "Electro-magnets," $6, by mail.

(4010) Subscriber wishes to know the following: At his place of business there is a 20 horse electric motor, 500 volts. The writer while thoughtlessly adjusting brushes caught hold of all the lower brushes and pressed them upward, this having the desired effect. He also took hold of the upper set and was quickly thrown backward. Now what amount of current passed through me, the machine running a load of about 12 horse power? After catching hold of brushes I felt nothing except the after effect, which was a slight shaking of the hand and a slight soreness of finger ends. A. It is impossible to form any idea from the data sent as to the amount of current passing through your body, as it is wholly a question of resistance. The condition of your hands may have been such as to have prevented anything more than a small fraction of the current from passing through you. For instance your hands may have been very dry or very oily. On the other hand, your hands may have been moist and the contact with the brushes good, in which case you would have received the amount of current due to the normal resistance of your body, which would have been only a fraction of the output of the machine.

(4011) H. W. G. asks how to construct a steel triangle to be used in lieu of a bell. I want it with sides from 3 to 4 ft. long. Please state what kind of steel to use? What shape, whether square or round? Proper form of construction, and should angles be bent sharp or rounding? How should it be hung, and with what should it be struck to obtain the best sound? I am informed that to strike a bell with wrought iron will ruin the bell. Is this true, and would the same effect be produced upon a triangle by use of a similar striker? A. For a steel triangle with sides as stated, use a square bar of tool steel one inch diameter and from 10 to 12 feet long. Balance the bar in two loops of strong twine about one-third of its length from each end. Strike the bar between the end and one of the strings. Move both strings toward the center a little at a time to get the tone that suits you, and when the proper bearings are found, mark them with chalk and bend to a triangle at the marked points with an easy bend. A wrought iron hammer would not injure a triangle more than a hammer of any other metal.

(4012) J. E. H. writes: I wish to make a storage battery. Battery is to have 10 plates 6 inches long and 8 inches wide; plates are to be of lead one-twelfth inch thick marked in squares of one-eighth inch, with holes punched at each corner of squares and covered with a coating of red lead paste made by mixing red lead with diluted sulphuric acid. In what proportions with water will I dilute the sulphuric acid? A. Use 1 part of acid to 10 of water. 2. About how much current will such a battery yield for three hours, working constantly, after being charged? A. About 20 amperes. 3. How many gravity batteries should I use in forming the plates and afterward in charging the battery? I only wish to use storage battery once in two days. The zinc and copper of the primary battery each has an active surface of about 18 square inches. Sulphate of copper and sulphate of zinc are used in charging the cells. A. The forming as well as the charging may be done with four cells. The forming however could be facilitated by the use of four times that number.

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the number therein given:

(3889) Referring to Notes and Queries No. 3889, C. E. H. has no cause for alarm, as the milky appearance in the water from his hot water boiler is caused by a foaming from the air it contains. This is readily shown by drawing a tumblerful and holding it up to the light, when it will be seen that the water clears from the bottom, and what appear to the eye to be white particles rises instead of falls.—W. G. BLISH.—[It is well known that the vesicles of air and steam rise in the clearing of water drawn from the hot water faucet. This does not account for the sediment that settles from hot water drawn from a galvanized iron boiler. This goes to the bottom every time.—ED.]

C. A. G. asks for a black ink.—J. H. G. asks for an acid-proof cement for nickel-plating tanks.—L. B. asks for a receipt to give a steel-blue on brass.—A. O. asks for a receipt for fining wine.—T. T. M. asks how to make and ink typewriter ribbons.—A. C. G. asks for a cement or mucilage to stick labels to tin.—C. W. F. asks for a stain for Russian tan shoes.—G. E. P. asks for a good bay rum and sea foam.—G. F. L. asks for pastes for mounting photographs.—F. C. C. asks how to make a dipping solution for silvering.

Answers to all of the above queries will be found in the "Scientific American Cyclopedia of Receipts, Notes and Queries," to which our correspondents are referred. The advertisement of this book is printed in another column. A new circular is now ready.

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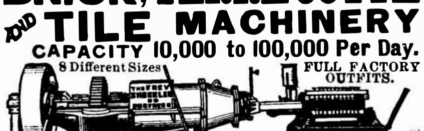

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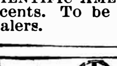

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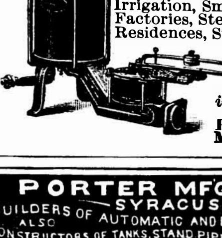

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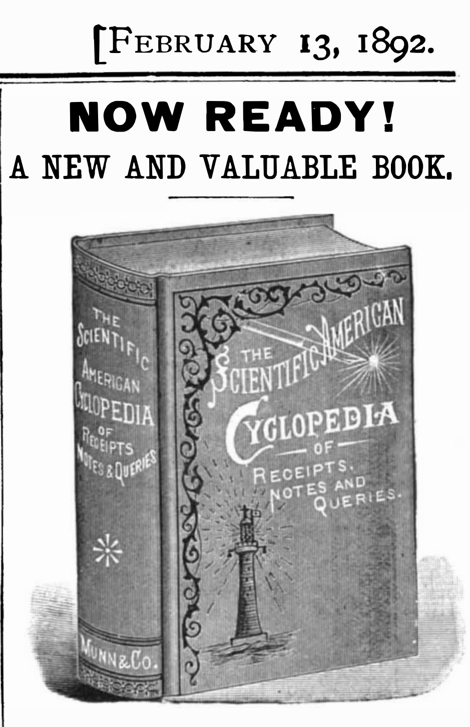

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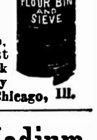

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