SCIENTIFIC AMERICAN

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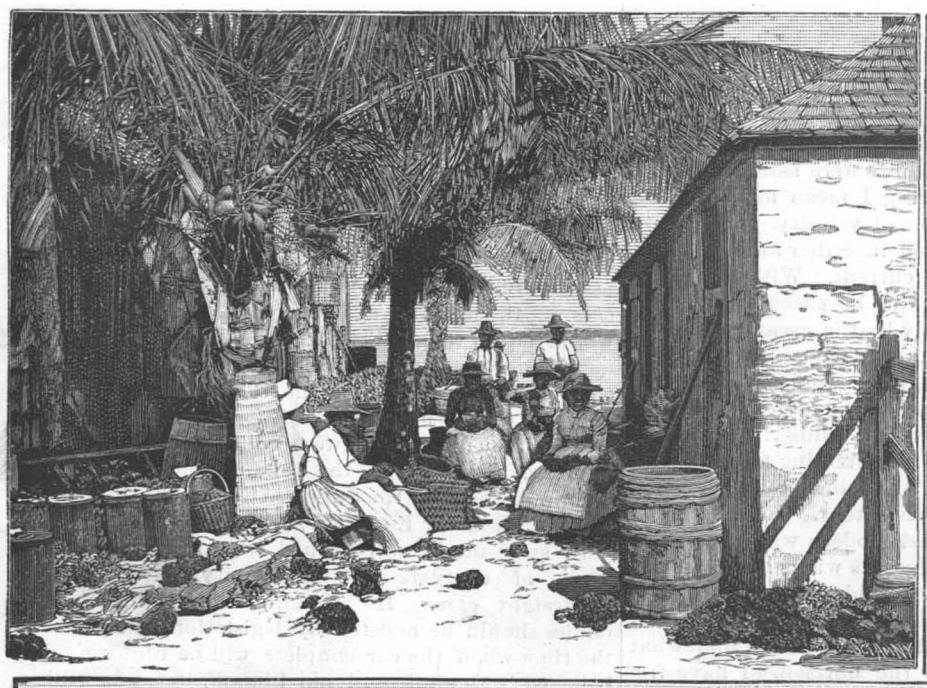
THE SPONGE FISHERIES OF THE BAHAMAS.

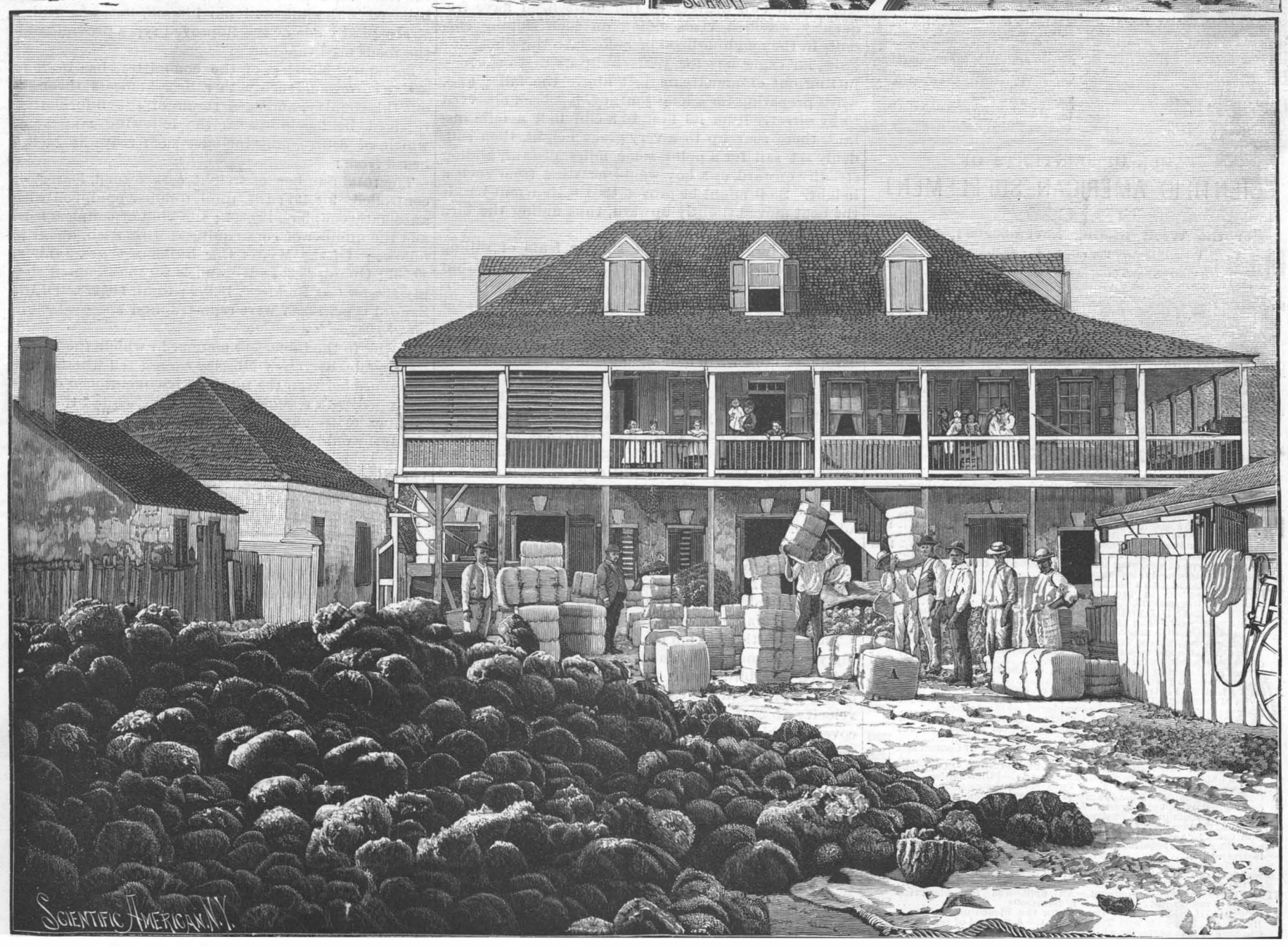
BY J. F. COONLEY.

The sponge fisheries of the Bahamas cover a large extent of territory, give employment to about six thousand men and boys, and are a source of revenue to the colony larger than any other industry pursued there. There are no seasons of the year but sponges may be taken, and are taken, by the men engaged in the pursuit. Sponges are always plenty at one place or another around these islands. They are always growing, and the supply is never short if they are sought for in the right localities. There is also always a lively demand for good sponges, and at prices that are not liable to change materially from year to year. The quantity shipped from these islands during the year 1890 was 623,317 pounds, the local value of which amounted to $31,500. I have often asked this question: What becomes of all the sponges? The immense quantities sent from here seem more than enough to supply the world, yet outside of the sponge-producing region we see very few, if any, going to waste. Whatever becomes of them, the demand is about the same from year to year, the supply never fails, and prices maintain a very even scale.

There are about 550 schooners and sloops of from 5 to 20 tons and about 2,500 open boats engaged in the

(*Continued on page* 326.)





TRIMMING SPONGES.

PACKING SPONGES IN A SPONGE YARD.

DRYING AND BALING SPONGES.

THE SPONGE FISHERIES OF THE BAHAMAS.

Scientific American.

ESTABLISHED 1845.

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NEW YORK, SATURDAY, NOVEMBER 21, 1891.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 829.

For the Week Ending November 21, 1891.

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ECONOMY OF FLIGHT.

During a voyage from San Francisco to Portland, my attention was attracted to the remarkable sailing of the sea gulls. In their search for food these birds are obliged to hover near the vessel; and they usually select a place three or four yards above and out from the railing, where they remain on motionless wings. What seemed so remarkable was the length of time they could follow without movement of wing or feather. I know they moved neither, because I could see and count each feather, see the vanes of the feathers, see the shadows of the coverlets of the wing, see each movement of the head and eye. The wings remained absolutely motionless and as nearly level as the eye could distinguish, yet the birds glided on with apparently more ease than a sled on ice. Timing them with my watch, I found that they could easily float for one minute without descending and with a loss of only about 120 feet on their original position with reference to the boat. During this one minute they must have passed over more than one thousand feet of space, for the vessel was moving at no less than fifteen miles per hour. If, then, my observations were correct, we have the singular fact of a bird traveling through the air with an economy of energy rivaling that of the sleigh on ice, the car on a good track, or the fish in water. I should like to learn of similar observations with measurements and circumstances accurately determined.

Of course this performance is remarkable only on the supposition that the birds were sailing but not soaring. By the term soaring I mean ascending on motionless wings without loss of velocity. Soaring in general can be accomplished in either an up current or in a variable horizontal current. With a variable horizontal current soaring can be executed only by continuous cycling and only by the great masters of flight. In an up current any bird can soar, and without cycling. As these birds, then, were not cycling, I knew that they could not be soaring unless there were something of an up current of air beside the boat; but as I had no better means of determining the direction of the breeze than that of throwing out paper wads, my conclusions were unsatisfactory. Judging from the conclusions of the ablest modern writers on aviation, that a good sailor inclines its wings less than two degrees to the horizon, it would seem that a bird should ride steadily forward against and slowly ascend on a breeze blowing upward at an angle of somewhat more than two degrees to the horizon. I have frequently watched birds riding on such sloping currents in the neighborhood of cliffs. At the Shoshone Falls, an eagle has for years built its nest on a rock jutting out of midstream just above the falls; and, when preparing for a long journey, has been observed to fly directly from its nest to a cliff half a mile distant, there soar up to a very great height, then suddenly set sail for a point some miles distant, gliding steadily onward as a boy would coasting from such a height. So it might be proved that the current beside the boat moved slightly upward, thus aiding the bird forward and upward.

Having, however, observed similar feats of sailing near the earth and in calm air, I have thought that this kind of locomotion must be effected with wonderful economy; in other words, that the air passed over must be almost equivalent to a solid frictionless plane. It was pointed out many years ago that a horizontal aeroplane falls, when moving horizontally, more slowly than when not so moving, and the greater the horizontal speed, the less the vertical velocity of fall. This fact has been fully confirmed by recent experiments. The unqualified statement, however, that flight may be effected with less power at high speeds than at low speeds is not true. Neglecting skin friction and the slight resistance of edges, the economy of transportation of an aeroplane depends solely upon the angle of advance. Velocity is a factor of economy only in so far as it permits a favorable diminution of the angle of advance; and when this angle becomes so small that the horizontal component of air pressure equals the combined other resistances to progression, the limit of favorable velocity is reached.

That both the friction and angle of flight are exceedingly small may be argued from the great distance covered by a bird during the period of hovering. If, for example, as in the case cited, a bird with an initial velocity of 22 ft. per second hover for one minute, and cover in this time a distance of 1,200 ft., the average velocity is 20 ft. per second, the final velocity 18, and the kinetic energy lost, $M\frac{(22^{-2}-18^{-2})}{2}=\frac{M\ 160}{2}$, M being the mass of the bird. This lost energy, $\frac{M\ 160}{2}$, is equivalent to an ascent of the bird's weight through a vertical distance of $\frac{160}{2g}$ ft. = 2·484 ft. nearly. If all this loss were due to the component alone of air pressure against the lower surface of the wing, the angle of advance would be that of a triangle with base equal to 1,200 ft. and perpendicular equal to 2·484 ft., or an angle of about 7′. If we charge one-half the above loss to skin friction and other hurtful resistances, the above angle must be halved very nearly. This calculation assumes that the bird is not helped by a favorable current, but moves in calm air, and I give it for what it is worth, trusting that the observations of some one else may confirm or contradict it. The result, if true, indicates that a bird can sail indefinitely down an incline of eleven feet per mile—economical traveling indeed!

ALBERT F. ZAHM.

Improved Car Couplers.

A meeting of railway people took place in the Chamber of Commerce, New York, on November 10, being a hearing before the special committee appointed to promote congressional action with reference to the adoption of safety devices on railways. Quite a number of railway superintendents were present, also commissioners, representatives of locomotive engineers, conductors, trainmen, switchmen, yard masters, car builders, *et al.*

The statement was made that the American Railway Association, which represents about 125,000 out of the 160,000 miles of railroads in this country, had passed a resolution favoring a vertical plane, automatic coupler.

Representatives of the yard switchmen did not mince words in denouncing the present state of affairs. Mr. Frank Sweeny, Grand Master of the Switchmen's Mutual Aid Society, said that the great variety of car couplers, or "draught irons," as he called them, were an imposition on the switchmen. By introducing so many different kinds of couplers the railroad companies have made the duties of the switchmen extra hazardous. If there was only one kind of coupler, the number of fatalities among switchmen would be lessened materially. Mr. Sweeny said that if he had all of the cars in the country absolutely under his control he would equip them all with the old link and pin. A national convention of switchmen held last year adopted a resolution favoring the link and pin. Another member of the switchmen's fraternity said that the new-fashioned couplers were continually getting out of order. He preferred the link and pin.

John A. Hall, of the Supreme Council of the United Order of Railway Employes, explained the duties of a yard switchman, and argued for uniformity in the types of couplers and uniformity in the height of freight cars. He thought the railroad companies should be assisted by legislation in hastening the time when the car couplers will be uniform. He believed in the link and pin himself, but was willing to accept any one of the improved types providing all the roads used that one.

Secretary Moseley, of the committee, has been in active correspondence with railroad officers throughout this country, and as a result of the information received he has prepared the following statement, which, of course, only includes such roads as he has heard from:

The total number of freight cars owned, leased, or controlled, 978,161; the total number equipped with automatic couplers, 129,304; the kind of couplers used and the number of cars equipped with each, about as follows: Of the Master Car Builders' types, Janney, 40,231; Gould, 23,357; Hinson, 42,061; designated simply Master Car Builders', 13,279; total, 118,928. Of the Safford type, 12,207 were reported, and specified couplers, 38,955.

Owing to the imperfect manner in which the replies were made, Secretary Moseley cannot tell whether the difference between the totals above mentioned of cars equipped with specified couplers (170,090) and the total number of freight cars owned, leased, or controlled (978,161) would make the number having the link and pin 888,071. Of the total number of cars reported, 110,127 are equipped with train brakes, as follows: Westinghouse, 97,238; Eames, 30; Boyden, 304; other types, 12,555.

New Planet.

Dr. Palisa, of Vienna, who but the other day discovered a new minor planet, No. 320, now announces another, No. 321. Its right ascension was 2 h. 18 min. 48 sec., with a daily motion of —48 sec., and its north polar distance 76° 47′ 26″, with a daily motion of +3′. It was observed on October 15 at 11 h. 6·8 min., and appeared like a star of the 12th magnitude. The list of these small denizens of the solar system is increasing so rapidly, and the orbits pursued by them are so eccentric, that it is no light task to keep pace with the movements of those already discovered.

The Deadly Alternating Current.

One of the engineers employed at the Lauffen (Swiss) generating station recently met with a fatal accident through touching a wire through which a high tension current was passing. The deceased, whose name was Rau, was discovered lying dead on the floor of the transformer-house by the engineer-in-chief. It appears that Rau, in defiance of the instructions given him, entered the transformer-room to attend to a defective lamp, and coming into contact with a high-tension wire, was killed instantaneously.

Artificial Coffee Beans.

The manufacture of artificial coffee beans has, it appears, assumed some importance in this country, and specimens of the spurious beans have been sent to Kew, by Dr. Brown Goode, the secretary of the Smithsonian Institution. The idea of preparing artificial coffee beans for the purpose of mixing with the genuine beans is, however, not entirely new. As long ago as 1860 coffee beans, made from finely powdered chiccory, were sent to the Kew Museums. The American beans are supposed to be composed of rye flour, glucose, and water, they are made to resemble, in size and color, a moderately good sample of roasted coffee beans, and, by the introduction of a few genuine beans, are made to possess the aroma of coffee. In the specimens we have seen the modeling is sufficiently good to deceive the ordinary public, but if the product is at all critically examined it is noticed that the groove on the flat surface is broad and shallow, and that it does not extend into the heart of the bean by a long narrow slit as in the real article, and, also, that there is no trace of the silvery skin at the mouth of the slit.

The introduction of spurious coffee beans as an article of commerce in the United States is described in the following article from the New York *World*, reproduced in the Kew *Bulletin:*

"The average bulk of the genuine coffee imported into the United States is 8,000,000 bags, or 180,000,000 pounds, per annum. Experts estimate that fully twenty per cent of the coffee sold to consumers is bogus, which raises the consumption to 216,000,000 pounds. Taking thirty cents per pound as the average retail price, the people of America pay $65,000,000 every year for this one article of food, of which $13,000,000 is paid for roasted and ground beans, pease, rye, or a manufactured article in no way resembling the Brazilian berry. To this must be added the production and sale of what are called 'coffee substitutes.' So extensive is this business that it is quite safe to say that consumers pay $12,000,000 for what they believe to be cheap coffee. This raises the total expenditure to $77,000,000, and it represents a sale of 276,000,000 pounds, for the 'substitute coffee' usually sells at twenty cents per pound. It will thus be seen that 96,000,000 pounds of bogus coffee are sold in the United States every year, and some estimates place it at 120,000,000 pounds. Taking the lowest figures, $25,000,000 are received for substances which can be profitably placed on the market at six cents a pound. The manufacturers, therefore, receive $6,000,000 for their goods, while retailers gain a profit of $18,000,000. There are two kinds of bogus coffee, an imitation bean and the ground article. The bean is the most difficult to produce, and it is only recently that actual success in this direction has been attained. The bogus bean must not only look like the genuine berry when raw, but it should be capable of taking a proper color when roasted. A very good specimen is now manufactured in Philadelphia and Trenton, being composed of rye flour, glucose and water. The soft paste is then moulded and carefully dried. To the eye of an expert the presence of this imitation is easy of detection and it cannot be used to any great extent among wholesalers. But when coffee goes to the retailer, adulteration begins. Sometimes the retailer is deceived, but nine times out of ten he is the one who introduces adulteration. The ground article is very easily produced in the proper color, and an aroma is infused by using strong decoctions of coffee essence.

"When mixed with real coffee even the expert eye and tongue may be deceived, while to the ordinary consumer it seems to be the genuine product. Bogus coffee beans have only a slight resemblance to the natural berry, for though they possess proper form, the cicatrice on the inner face is too smooth. Then again the gray color of the raw bean is not quite up to the mark, but when these manufactured beans are roasted with five per cent of genuine coffee they find a ready sale. These bogus beans can be made at a cost of $30 per 1,000 pounds, and when mixed with fifty pounds of pure coffee the whole 1,050 pounds cost $37.50, or 3¾ cents per pound, so that a profit of nearly 100 per cent is the result. There are any number of 'coffee substitutes,' the Hillis variety being the most successful. This company is already manufacturing 10,000 pounds per week, it being sold by the barrel to retailers in nearly all of the New England, Middle and Western States. The profits of this concern are supposed to be $300 per day, and its operations have reached such a scale that the stockholders were recently offered nearly $1,000,000 for their secret and business, but it was declined. No one accustomed to coffee drinking would imagine that a decoction of this stuff was like either Mocha or Rio, but when mixed with four times its bulk of genuine coffee only an expert could detect the imposition. The manufacturers of these 'coffee substitutes' claim that they are not violating the law of adulteration of food products, because they do not sell their goods as coffee, but simply as a substitute. While this may be true, it does not apply to the retailer, who mixes the bogus stuff with good coffee, and sells the whole as the genuine article. Though manufactories may be beyond the penalties of the adulteration law, they should be suppressed, for without them coffee adulteration by retailers would be impossible. When it is remembered the American people are compelled to pay $25,000,000 for ingredients that can be manufactured for one-fifth the sum received by coffee growers, the necessity for the suppression of this nefarious trade is apparent. Oleomargarine cannot be sold as butter, neither should 'coffee substitutes' be made to masquerade under the name of Java, Mocha or Rio."

The production of artificial coffee has also received some attention in Germany, where an imperial decree has been issued forbidding the manufacture and sale of the machines for producing the artificial beans, which certain German newspapers have recently advertised. These artificial German beans are not intended in themselves as a beverage, but are to be used in trade for mixing with the genuine article.

High Railway Speeds.

Within the last few weeks a good deal has been heard in this country of exceptionally fast runs made on American railroads. So long as the evidence that these runs were really made and the stated speeds actually attained was confined to daily newspaper paragraphs we paid little attention to them, preferring to wait for the utterances of the American technical press on the subject. The railway journals appear to accept without much question what has been said on the subject, and we are therefore justified in bringing the matter before our readers. Three notable runs have, it seems, been made. The first of these took place in connection with a special effort, to which we have already referred, to accelerate the transport of mails from Yokohama to Queenstown. The steamer Empress of Japan left Yokohama on the 19th of August at 8:45 A. M., and arrived at Vancouver about noon on August 29. A special train on the Canadian Pacific Railway, consisting of one mail and baggage car and one sleeping car, started at 1 P. M. with thirty-three bags of mails, and ran to Brockville, a distance of 2,792 miles, in 76 hours 31 minutes actual time, the average speed being thus 36·22 miles an hour. At Brockville the train crossed the ferry to Morristown, where it entered the Rome, Watertown, and Ogdensburg line, and ran to Utica. There it got on the New York Central and Hudson River systems, and reached New York on September 2. From Morristown to New York the distance is 361 miles, which was traversed in 6·58 hours, the rate being 51·81 miles an hour. The mails were put on board the City of New York, which sailed at 6:30 A. M. on September 2, and were delivered in London at 10 A. M. September 9, the whole time being thus under twenty-one days. It will be seen that there was no exceptionally fast railway traveling done, but the performance, taken as a whole, is very remarkable and without precedent.

The second run took place on August 27. It was made by a special train on the Philadelphia and Reading Railroad. This train was run for the purpose of ascertaining how fast it was possible to go, and the quick running was made on the section between Jenkintown and Langhorne, a distance of 12 miles. The road is undulating, the maximum gradient being 1 in 143. The total weight of the engine and a train of three cars was 150 English tons, and the average speed over the 12 miles is given as 82·7 miles an hour, while one mile is said to have been traversed in 39⅘ seconds, or very nearly 90·5 miles an hour. This was at the end of an incline of 143 in favor of the train. The engine was a Wooten locomotive, with 18·5 inch cylinders, 22 inch stroke, and four driving wheels 5 feet 8 inches in diameter. We regard this report with considerable suspicion; not because we believe there was any intention to deceive, but because the arrangements for taking the time were untrustworthy. The time of passing each mile post was recorded by observers working with chronographs marking fifths of seconds. We do not hesitate to say that no man living could be certain of his time, under the conditions, to one-fifth of a second. However, we do not doubt that a very high speed indeed was attained. At 90 miles an hour the wheels must have made 445 revolutions per minute. What this means our readers will not be slow to perceive. As the velocity per minute would be 7,920 feet, for each 4·16 pounds pull on the draw bar, 1 indicated horse power would be required. If we assume the whole resistance of engine, tender, and train to have been but 20 pounds a ton, the indicated horse power must have reached $\frac{150 \times 20}{4 \cdot 16} = 721$. But at very high speeds the internal resistance of locomotives, especially the back pressure, becomes enormous, and even if we credit the train with the full advantage of the down grade, it still remains certain that the power exerted must have been very great, or that, as there is reason to think, the resistance of a train augments very slowly indeed with the speed.

The third run was by far the most noteworthy of the three. It took place on Monday, September 14, on the New York Central and Hudson River Railroad, from New York to East Buffalo, a distance of 436⅛ miles. The train consisted of an engine and three cars; the total weight being 230 American tons. The distance was traversed in 439½ minutes. The engines were changed three times, and there was a short delay caused by the heating of an axle box. The actual running time was 425 minutes 12 seconds, and, excluding stops, the average speed was 61·56 miles an hour. This performance has never been equaled. The speed was very uniform, the quickest mile being done at the rate of 76·5 miles an hour. The locomotives used were very powerful, weighing 60 American tons, or say 53·6 English tons. The tenders weighed 40 tons of 2,000 pounds, or nearly 36 English tons; and the cars 130 American, or 116 English tons; the total load moved being thus, in round numbers, 206 tons. The engines were all alike, save that two of them had 5 feet 9 inches drivers and the third 6 feet 6 inches. The cylinders are 19 inches by 24 inches stroke. The boilers are of great size, having no less than 1,821 square feet of heating surface and 27·3 square feet of grate. They are thus nearly twice as powerful as the Lady of the Lake class, which ran the fast Scotch express to Crewe during "the race to the North," hauling a train weighing about 80 tons, at an average speed of 57·1 miles an hour. The Waverley has 16 inch cylinders; stroke, 24 inches. The grate area is 15 square feet, and the total heating surface 1,098 square feet. The weight of the engine is 27 tons, and of the tender 17½ tons, or together 44½ tons, or nearly 10 tons less than the weight of the American engine alone. The weight of the engine and tender was about 55 per cent that of the train, whereas the weight of the American engine and tender was very nearly 77 per cent of that of the train. The speed attained was only four and a half miles an hour better than that of the Waverley.

Taking the American run as a whole, it constitutes a distinct departure in railway work. Not the least remarkable feature about it is that it shows that it is possible to attain very high speeds with comparatively small coupled wheels. It by no means follows, however, that it is advisable to retain them for very fast trains. On the other hand, we believe that very high wheels are equally out of place if very long runs are to be made, because on such runs it is certain that more or less steep inclines will have to be surmounted. If the average speed of a train is to be about fifty to fifty-five miles an hour, then banks may be ascended at forty miles an hour, or even less, and descended at sixty to sixty-five miles an hour. But when an average speed of over sixty miles an hour must be made, we cannot rely on descents to compensate for ascents, because enormous velocities would be required, and the cost and wear and tear would be out of all proportion to the advantage gained. The engine must, therefore, be competent to maintain a high speed when running up hill, and this is almost impossible if very high wheels are used, unless the cylinders are too large for the rest of the road. As these high-speed long-distance trains cannot be heavy, it appears to us that the best type of engine would be one with 18 inches cylinders, 26 inches stroke, 1,400 square feet of heating surface, 20 square feet of grate, and single drivers, carrying about 18 tons, and 6 feet 8 inches in diameter, provided with the sand blast. Such an engine would be an admirable hill climber, and would run about as fast as any locomotive made. When the runs are over comparatively level roads, then a big wheel, such as Mr. Stirling proposes, is no doubt good, because its use reduces wear and tear.

Whether any extremely fast running will be done in this country remains to be seen. Any speed that can be attained in the United States can, of course, be got here on our better roads. But it is more than questionable that these excessive speeds pay. Whether they do or not is really the whole question. The problem is not one for the locomotive superintendent, but for the general manager.—*The Engineer.*

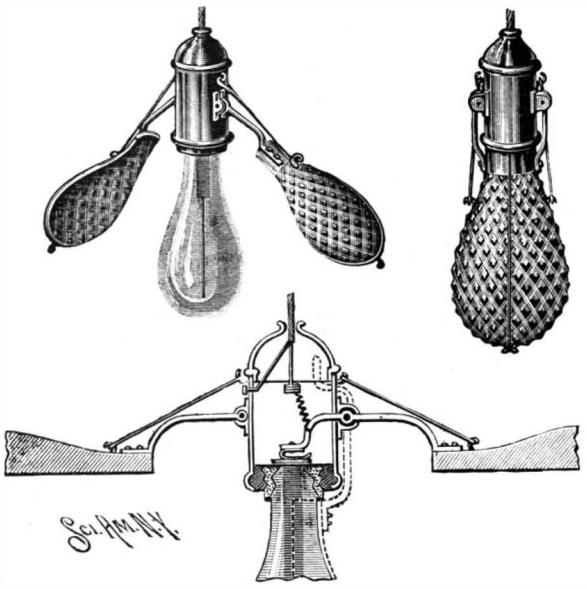
To Clean a Dirty Engine.

Dissolve a pound of concentrated lye in about two gallons of water, and with a mop saturate the engine with the liquid—being careful that it does not get into the oil holes of the journals and bearings. After the lye has eaten all the grease and gum from surfaces, clean perfectly by scraping and brushing, and apply after the iron is dry and free from grease a thin coat of lead paint. And after this is thoroughly "set," paint the iron a deep black, and varnish heavily—coloring, striping or decorating according to taste can be done afterward. Then the greater part of the works can be easily and quickly cleaned with a dusting brush or cloth, and escaped oil can be mopped off thoroughly with but little trouble.

OWING to the improvements made in the manufacture of wood or smokeless powder during the past twelve months, by the American Wood Powder Company, of this city, their output has more than doubled. It is a matter of congratulation to American sportsmen that they can now use an article of American manufacture equal to the best foreign nitro compounds, which are so popular with the sportsmen of England and France, at a much less cost than the imported article.

AN ELECTRIC LAMP COVER AND SWITCH.

The improved cover shown in the illustration, for inclosing and protecting an electric lamp, is so constructed that the lamp will always be extinguished when the covers are closed upon it. The improvement has been patented by Mr. Emil T. Mueller, La Crosse, Wis. The socket receiving the lamp base has its opposite end closed by a vulcanite cap, through an aperture in which extends the flexible conductor. In ears at each side of the socket are pivoted arms carrying the lamp covers, there being a short stud at the outer end



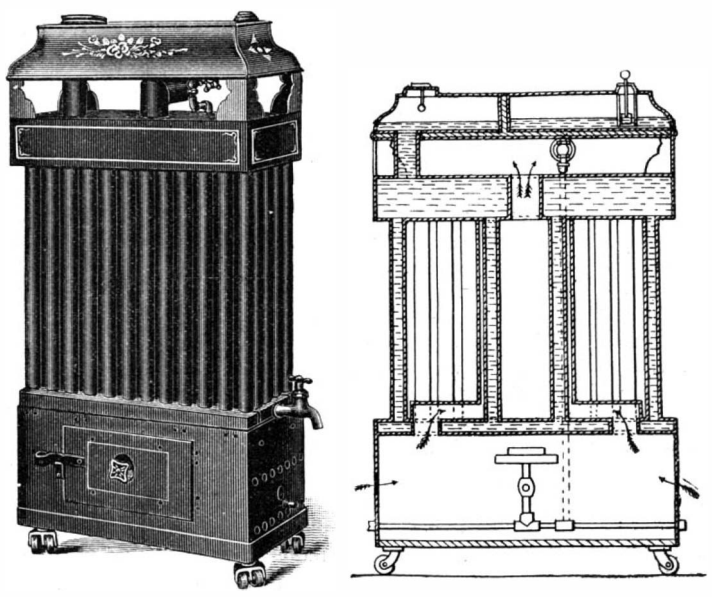
MUELLER'S LAMP COVER AND SWITCH.

of each cover, whereby the covers will be locked when closed on the lamp. An elastic rubber or other spring connects the covers with the sides of the socket, and tends to hold them in an elevated position, as shown in the sectional view. One of the cover-supporting arms is provided with an insulating bushing and washer, and is prolonged in curved form within the socket, having at its inner end a contact spring adapted to form an electrical contact with a button on the base of the lamp. A bracket of insulating material on the inner wall of the lamp socket carries a metallic arm, to which is attached one strand of the conductor, a screw in the arm connecting with a metallic spring whose other end is connected with the projecting inner end of the cover-supporting arm, while the other strand of the conductor is connected with a screw in the wall of the socket. When the covers are closed the contact spring is held away from the button, as shown in dotted lines in the sectional view, and the circuit is broken; but when the covers are in open position, as shown in the full lines, the current flows from one strand of the conductor through the lamp filament to the socket, and thence to the other strand of the conductor.

For further information relative to this improvement address Mr. Charles B. Miller, No. 329 Main Street, La Crosse, Wis.

A PORTABLE HOT WATER OR STEAM HEATER.

The portable heater, patented by Mr. A. White, shown in perspective and in section in the illustration,



WHITE'S PORTABLE HEAT GENERATOR.

is designed for use with gas, oil, or gasoline, as fuel, without waste or smoke, and with an entire absence of odor. The heater is mounted on wheels or casters, to facilitate moving it from one room to another. The top of the fire box is formed by a hollow base, which is part of the boiler proper, and the base is connected by pipes with the under side of a hollow top, from which a pipe connects with a steam chamber above. In this chamber is a safety valve, and a portion of the top casing also constitutes a reservoir for liquid fuel, a valved pipe leads from which to the burner in the fire box. In the base are openings leading to a central vertical flue, forming hot air passages, as indicated by the arrows. When the heater is used to heat water, the base vertical pipes, upper water chamber, and part of the top steam chamber, are filled with water, the heat from the burner on the under side of the base then causing a thorough circulation of the water in the boiler. When steam is to be generated, only the base and lower portions of the vertical pipes are filled with water, the remainder of the space then being occupied by steam. When gas is to be used the burner is connected by any suitable means with the gas supply, and special burners are supplied, as desired, for either kind of fuel.

Further information relative to this heater may be obtained of Messrs. A. White & Co., box 456, Geneseo, Ill.

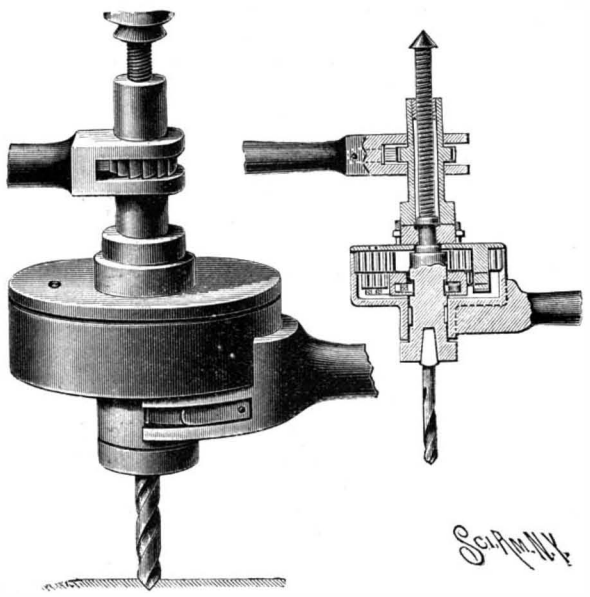
American Workshops.

An interesting paper on some of the leading American workshops was read before the members of the Manchester Association of Engineers recently by Mr. Hans Renold. After expressing his opinion, says the *Engineer*, that the English people did not sufficiently look about them or try to understand what other nations were doing, Mr. Renold stated that he had visited that portion of America known as New England, and the works he had inspected were among the best in the United States. Among the many special features he had noticed he mentioned that in a Boston establishment where milling machine cutters were made he had found that £1 spent in wages produced as much as £30 to £40 worth of goods, the cutters being made at the rate of about sixty-four per hour by about a dozen men. Another noticeable feature was the exceptional care taken in storing tools in American workshops. These, in fact, were treated as if they were worth their weight in gold; they were stored in safes much in the same manner as we in England stored our money. He was, however, impressed by the fact that the mere understanding of the method of American working would not enable them to do likewise in England, because the American workmen had gone through a special training, and a similar training would be necessary to enable English workmen to adapt themselves to American machines.

One very noticeable feature in American engineering shops which he visited was that all the machine men and turners were seated on blocks or stools at their machines, and the question naturally arose in his mind what would English engineers say if such a practice were adopted in their shops. In other ways he was also struck by the special attention devoted to the comfort of the workmen, and he was much impressed by the healthy condition of the emery polishing shops as compared with similar shops in this country. In England these shops in most cases were simply death-traps to the workmen, and he urged that the superior method of ventilation carried out in the States should be adopted in this country by introducing a fan to each wheel to take away the particles, etc., which were so injurious. One very special feature in the United States was that works were devoted to the manufacture of one particular article to an almost inconceivable extent, and that heavy machine tools complete and ready to be dispatched were kept in stock in large numbers. American enterprise was not hampered, as it too frequently was in England, by want of capital; while in England we were ready to put our savings in South American railways or fictitious gold mines, but very chary about investing capital which would assist an engineer in bringing out an honest improvement, in America, on the other hand, it was a common practice among the best firms to invest their savings over and over again in their works, which were thus kept in a high state of perfection.

A CONTINUOUS DRIVING RATCHET DRILL.

The improved drill shown in perspective and in section in the illustration is adapted to drive the bit continuously on both the forward and backward strokes of the handle. It has been patented by Mr. George L. Evatt, of Port Hope, Ontario, Canada. The stock holding the bit has a shank turning in a hub in the bottom of the casing, a collar on the shank abutting against the under side of the hub, while farther up on the shank are two ratchet wheels, one above the other, the reduced upper end of the shank having an annular groove and extending through a cover held on top of the casing. The operating handle to work the drill extends outward from the casing. Formed on top of the casing cover is also a hub having threads or a fixed nut in its upper end, in which screws the feed screw, and on this hub turns loosely a handle carrying a spring-pressed pawl engaging a ratchet wheel to turn the hub and cover to screw up the feed screw when feeding the device. The lower ratchet wheel on the shank is engaged by a spring-pressed pawl pivoted in the handle of the casing, and the other ratchet wheel farther upon the shank within the casing is engaged by one, two, or more spring-pressed pawls pivoted in a gear wheel turning loosely on the shank, the wheel being in mesh with a number of pinions journaled in an annular flange, and each of the pinions carrying a larger gear wheel in mesh with an internal gear wheel formed on the inside of the casing. On the backward movement of the handle, when the pawl glides over the lower ratchet wheel, the internal gear causes the rotation of the stock and its bit, the pawl of this gear sliding back on the inner ratchet



EVATT'S RATCHET DRILL.

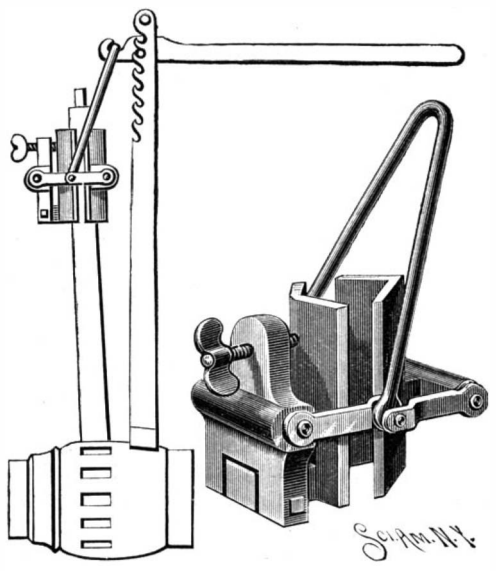
as the handle is drawn forward, and the lower pawl then engaging the lower ratchet to rotate the stock. It is not necessary to hold either handle stationary, but the upper handle should be moved from the operator while the other one is being drawn toward him.

To Improve the Roadways.

The Road Congress, which is to meet in Pittsburg on November 23, has for its object, it is said, "the discussion of plans for the improvement of highway roads throughout the country." It is stated that delegations from twenty-five States will be present, and the congress will include many men of ability and standing. "Discussion and the education of public opinion on this subject are needed," says *Railroad and Engineering Journal*, "and there is much which can be done by such an assembly as that which is expected in Pittsburg."

A WAGON MAKER'S SPOKE PULLER.

The device shown in the illustration is designed to afford a simple and efficient appliance for use in carriage repairing and similar work, for easily and quickly pulling spokes from the hub of a wheel. It has been patented by Mr. Henry Dahlman, of Dalstrop, Minn. One of the jaws of the device has at its bottom a rearwardly extending lug, on which is pivoted a plate, through the upper end of which passes a thumb screw impinging on the back of the jaw, whereby the jaw may be tilted, so that the device will fit spokes of any size. The jaws are connected together by arms whose

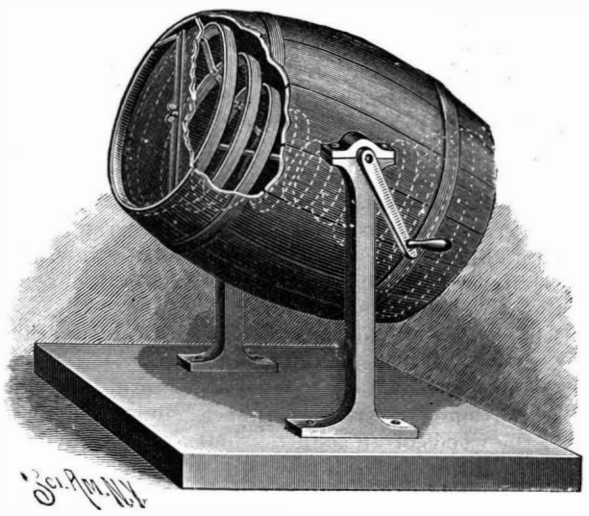


DAHLMAN'S SPOKE PULLER.

inner ends are pivoted to a bail adapted to be placed on a hook on the end of a lever, as shown in one of the views, where the spoke puller is represented applied to a spoke on a wheel hub. A pin in the side of the lever is adapted to rest in one of a series of sockets in the upper end of a post whose lower end is adapted to rest on the wheel hub. By pressing down upon the lever an upward pull is exerted upon the bail, and the jaws are tilted inward so that they will clamp the spoke with a pressure which is greater according as the force applied to the lever is increased.

AN IMPROVED CHURN.

The illustration represents a barrel churn of simple construction, adapted to be rotated upon trunnions, and so made that the interior parts may be quickly removed for cleansing and readily replaced in operative position. The improvement has been patented by Mr. John T. Mark, of Strawn, Kansas. The cream agitator of this churn is composed of a series of thin rings, successively diminished in diameter from each end ring to the center ring, the rings being secured to each other at short distances apart by bracket plates,



MARK'S CHURN.

leaving spaces between the rings to permit air and liquid to pass freely through the dasher, the cream striking on the edges of the rings, when the churn is operated. This skeleton dasher is of such size that its end rings will loosely fit against the interior surface of the churn body, to avoid objectionable rattle sidewise or endwise when the churn is in operation, while at the same time the dasher may be readily withdrawn, when the removable head is taken off. The cleaning of the parts is readily effected by introducing hot water and then operating the churn in the same manner as in making butter.

Further information relative to this invention may be had of Mr. Frank Bucher, Hartford, Kansas.

AN IMPROVED TYPEWRITING MACHINE.

The machine shown in the illustration, invented and patented by Mr. Austin Lowe, of Minneapolis, Kansas, besides being a standard typewriter for all ordinary work, is adapted for successful work in bound books of any size, as the machine can be readily clasped upon a book of any breadth or thickness for the recording of a deed or other instrument of writing. It has seventy-four characters, including all carried by any standard machine, while there are but twenty-seven keys to be operated. It strikes downward and travels over the page or paper from left to right along a spacing bar, the printing mechanism moving along the bar weighing only 4½ pounds, while the clasps and the entire machine weigh only 9¾ pounds. The machine has a novel lining device, suitable for application also to other typewriters, insuring perfect regulation of the distances between lines until the machine is worn out. The machine is designed to wear well, without needing repairs, and for ordinary service it is clasped upon a table in any convenient location for the work in hand. Further information relative to this machine may be obtained by addressing Mr. Austin Lowe, Secretary of the Minneapolis Typewriter Company, Minneapolis, Kansas. The other officers of the company are: President, J. E. Ewart; Directors, R. A. McPherson, C. S. Bishoff, and T. E. L. Bishoff.

Historical American Exhibition in Madrid.

An Historical American Exhibition is to be held at Madrid in 1892, to commemorate the fourth centenary of the discovery of America by Columbus in 1492. The exhibition is to consist of objects tending in any way to illustrate the history of America at the period of its discovery.

The exhibition will take place in Madrid in the palace destined for the library and national museum, which will be inaugurated on this occasion, as well as in the park of Madrid. It will be opened to the public on September 12, 1892, and close on December 31 following.

For the examination and adjudication on the merits of the objects exposed, an international jury will be appointed, and the number of its members will be determined in proportion to the number of exhibitors and the importance of the objects exhibited.

The prizes to be granted will consist of diplomas of the following grades: First prize of honor, gold medal, silver medal, brass medal, honorable mention.

The diplomas will be accompanied by a medal commemorative of the exhibition, and will be the same for every kind of prize.

This exhibition will be in connection with a congress arranged to commemorate the discovery of America, which offers prizes for essays on the subject.

Influenza Brought from Russia.

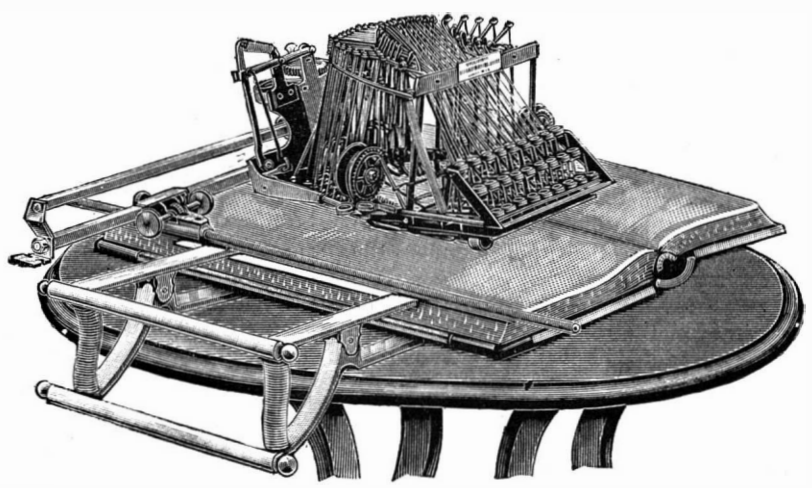
It is the opinion of Professor Meiklejohn that influenza in Russia originates in the churches.

I have just returned from Russia (he writes), and I think I can throw some light on the origin of the plague which has visited us during the last two years, and which wrought such havoc in the House of Commons. I believe I can also make a suggestion toward diminishing its ravages in this country. The most frequented buildings in Russia are the churches and cathedrals, and they are frequented by crowds of the poorest classes. They are "open" from morning till night; but this being "open" is strictly limited by the two or three doors which separate the porch from the main body of the building. The windows, too, are closed; they cannot be opened, and it is doubtful if a cubic foot of fresh air succeeds in making its way inside in the course of twenty-four hours. Just inside the doors the floor of the church is beset by a number of beggars infected with various kinds of loathsome disease. The air of these cathedrals is effete, dead, clay-cold, and especially in the corners and side chapels. The air, such as it is, has been breathed over and over again thousands of times by the dirtiest and most depressed people in Europe, and hence it forms the appropriate *nidus* for the germs of such diseases as attack the mucous membrane and the breathing apparatus. A poison of the intensest virulence is brewed and rebrewed by the inhalations and exhalations of these miserable people. The *bis decies* distilled result is imported into this country by the steamers that carry the trade of the Baltic. You will remember that Hull was the first place attacked and that Parliamentary witnesses from Hull imported the disease into the House of Commons. Brewed in Russia, conveyed in Baltic ships, imported into Hull, distributed in the House of Commons—that is the short story of the Russian influenza.

Now the Houses of Parliament, considered as a whole, are not much better ventilated than the cathedrals of Russia. There are at present no means of sending a wave of fresh air through the various rooms in the building so as to clear out the poisonous germs that lurk in the numerous corners which are provided by its architectural structure. If a great sweep of fresh air could be driven through each room every morning, the dead atmosphere in which disease germs grow and multiply would be expelled, and the rooms would be tolerably healthy for the rest of the day. I have frequently observed the presence of dead air even in the lobby of the House of Commons, and, till this is remedied, there will always be a danger of the return of the influenza and other depressing diseases.

Power of the Bee.

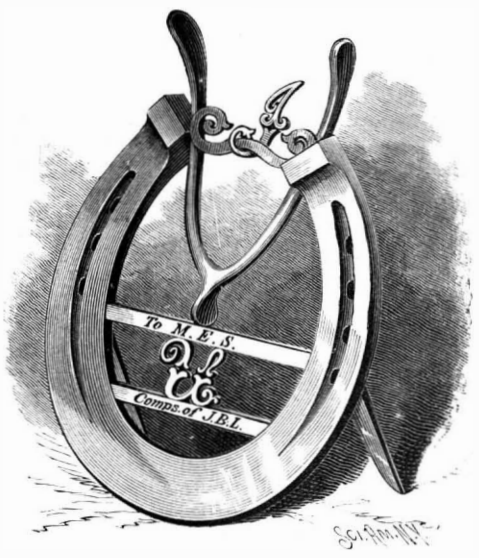
In a recent work on the bee, Mr. T. W. Cowan states that the insect can draw twenty times its own weight, can fly more than four miles an hour, and will seek food at a distance of four miles. By a beautiful mechanical adaptation its wings bear it forward or backward, with upward, downward or suddenly arrested course. Its threefold voice organs are the vibrating wings, the vibrating rings of the abdomen and a true vocal apparatus in the breathing apparatus or spiracle. The buzz is produced by the first two, and the hum, which may be "surly, cheerful, or colloquial significant," by the vocal membrane. A number of the bee's notes have been interpreted. "Humm" is the cry of contentment, "wuh-nuh-nuh" glorifies the egg layings of the queen, "shu-u-u" is the note of the young bees at play, "s-s-s-s" means the muster of a swarm, "b-r-r-r" the slaughter or expulsion of the drones, and the "tu-tu-tu" of the newly hatched young queen is answered by the "qua-qua-qua" of the queens still imprisoned in their cells.



LOWE'S "UNLIMITED" TYPEWRITER.

A DESIGN FOR EASELS AND OTHER STANDS.

The illustration represents a horseshoe combined with a wishbone to constitute an easel, the design forming the subject of a patent which has been issued to Mr. Frederick J. X. Miller, of Olympia, Washington. Between the members of the wishbone at the open end of the horseshoe appears a scroll and an ornamental letter "I," while between transverse bars within the horseshoe is supported an ornamental letter "U," the bars themselves being adapted to receive a



"GOOD LUCK" DESIGN FOR EASELS ETC.

suitable inscription indicating the donor and receiver, or other words if preferred, and the whole device signifying "I wish you good luck." The two supports or legs are preferably in the form of horseshoe nails, but these supports may be entirely omitted, and the device suspended by a crescent or other symbol joining the two points of the wishbone. Paper, metal, celluloid, or a great variety of other material, may be used in the manufacture of this device.

The Art of Lengthening Life.

Dr. Ebstein, of Goettingen, delivered a long discourse on this subject, from which we take the following:

The question as to the natural duration of life is first to be answered. According to the latest discoveries, the average length of life, in the natural order of things, is from seventy to seventy-five years. Women live somewhat longer than men. The mortality among children, particularly less than a year old, is very great. From the age of puberty till the fiftieth year the death rate is small; from that time it becomes greater each year. Too great an old age is a questionable blessing, because a renewal of youth can be reached in no way whatever. It is evident, therefore, that the normal limit of the age of man is that which is attained without bitter breaking down and suffering. The first condition is a good foundation, a descent from parents physically and mentally healthy. Of further importance is suitable maternal care of the child. Then comes the school and military training for the increase of the powers of resistance. In advancing life, a proper activity must not be neglected. "An unused life is an early death." The correct means toward reaching a good old age were given by Moltke, when that question was going the rounds. These were "temperance and work." Not only temperance in regard to eating and drinking, but the same must be practiced in every direction. A great number of deaths in the prime of life occur through accidental wounds. (In business and industrial life and in war.) Another part on account of so-called constitutional illnesses, which are generally the result of some innate physical defect of the human body. These can always be combated. A third part result from contagious diseases. The danger of infection can generally be met by capable measures of defense. The art of lengthening human life has made little advance up to the present time. The age of man, in the average, has become no greater. Also the common principles of long life have been substantially the same in all times, only the relationships of culture and differing eras imply different occurrences and details. The speaker also insisted that the use of alcohol is entirely unnecessary, and that the danger of shortening human life is not to be found in the greatness of intellectual work, but in its unsuitable organization.—*Translated for Public Opinion from the Cincinnati Volksblatt.*

A GOOD fertilizer for the window garden is a tablespoonful of guano, dissolved in a quart of lukewarm water and applied around the roots, once a week. The amount given will be enough to fertilize half a dozen plants in pots of five or six inch size.

THE WORLD'S FAIR LUMBER AND FORESTRY BUILDING.

The general plan and character of this original piece of architecture have been fully decided upon, the contract for its construction having been let September 24. It is shown in the accompanying engraving. The estimated cost is $100,000, taking into consideration the fact that a large part of the material and some of the work will be contributed. The size will be 200 × 500 feet, and the central height 60 feet.

The following is stated officially, descriptive of the building: "It will be one of the unique features of the exposition architecture. Its interior appearance will be as natural as unhewed wood can make it. The pillars supporting the roof will constitute the principal feature of its architecture. They will consist of natural tree trunks from 16 to 20 inches in diameter and 25 feet long. Contributions of three trunks from each State and Territory will be used. The sides of the building, between the supporting trunks or pillars, will be filled in with slabs with the bark off. The window frames will be treated in the same rustic manner as the remainder of the building. The main entrance will be elaborately finished in different kinds of wood, the material and workmanship to be contributed by the woodworkers of the world."

The building has been provided for out of appropriations for the agricultural department, with which the department of lumber and forestry was merged, by authority vested in the management. When it was found that no direct appropriation had been made for the lumber and forestry exhibit, and that no special managerial head was to be provided, lumbermen all over the country were greatly disappointed; and finding himself placed in a peculiar and somewhat unfortunate position, without being himself responsible, Chief Buchanan set about to accomplish what he could for the lumber and forestry interests. He first engineered the lumber and forestry building through, and subsequently the sawmill building. The former will contain the entire government exhibit of lumber and forestry, with the exception of those things which may properly or necessarily be displayed in the open air. The exhibit will be general and international in its scope, the States and foreign countries all having space properly assigned for adequate representation.

Of course no complete or accurate idea of the exhibit can be had at this time, but the tentative plans of the world's fair management may be understood from the following official classification:

DEPARTMENT N—FOREST PRODUCTS—FORESTRY.

Class 1.—Logs and sections of trees—Samples of wood and timber of all kinds generally used in construction or manufactures, either in the rough or hewed, sawed or split, including square timber, joists, scantling, plank, and boards of all sizes and kinds commonly sold for building purposes. Also ship timber, as used in shipbuilding, or for masts and spars; piles, timber for fencing, for posts, or for timbering mines. Miscellaneous collections of wood.

Class 2.—Worked timber or lumber, in form of clapboards, shingles, sheathing or flooring, casings, moldings, stair rails, or parts of furniture.

Class 3.—Ornamental wood—Used in decorating and for furniture; veneers of hard and fancy woods; mahogany logs, crotches and veneers; rosewood, satinwood, ebony, bird's eye maple, madrona, black walnut; veneers, and other fancy woods suitable for and used for ornamental purposes.

Class 4.—Timber prepared in various ways to resist decay. (See also Class 118.)

Class 5.—Dyeing, tanning, and coloring—Dye woods, barks, and various vegetable substances in their raw state, used for dyeing and coloring, such as logwood, Brazil wood, peach wood, fustic, sumac. Bark of various kinds, Brazilian, acacia, oak, hemlock, murici, bicida, gordonia. Galls, excrescences, and abnormal woody products. Mosses used for dyeing and coloring.

Class 6.—Cellular substances—Corks and substitutes for corks of vegetable growth; porous woods, for special uses, pith, rice paper, etc.

Class 7.—Lichens, mosses, pulu, ferns, and vegetable substances used for bedding for upholstery, or for mechanical purposes, as teazles, Dutch rushes, scouring grass, etc. "Excelsior."

Class 8.—Gums, resins, vegetable wax, or tallow wax, including caoutchouc, gum senegal, tragacanth, arabic, mesquite gum, myrrh, copal, etc.

Class 9.—Seeds and fruits, for ornamental purposes; vegetable ivory, coquilla nuts, cocoanut shells, ganitrus beads, bottle gourds, etc.

Class 10.—Miscellaneous products.

Class 11.—Wood pulp, for making paper and other objects.

Class 12.—Woodenware generally, as pails, tubs, platters, broom corn, brooms, cooper's stock.

Class 13.—Basket industry—Willowware, etc.

Class 14.—Rattan, bamboo, and cane work in part. (For rattan furniture, see also Group 89.)

Class 15.—Forest botany—Distribution of forests, of genera, of species (maps). Wood sections and herbarium specimens of the economically important timber trees. Seed collections—not herbarium—etc. Illustrations of forest growth, typical trees, botanical features. Anatomy and structure of woods. (Veneer sections and photo-micrographs.) Peculiarities of forest growth—Cypress knees, burls. Diseases of forest trees and timber. Injurious insects.

Class 16.—Timber culture—Plant material—Conifers, seedlings, and transplants. Broad leaved trees—Seedlings, transplants of various sizes, cuttings. Seed collections and means for storing seed. Means employed in gathering and preparing seed and other plant material for market and seed testing.

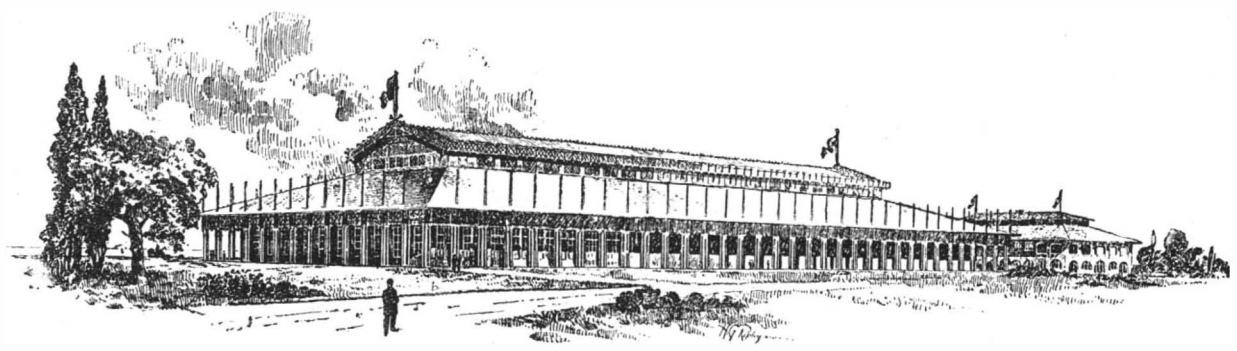
Class 17.—Timber culture and cultivation—Implements for the cultivation of the soil. Special adaptations. Sowing machines and tools. Implements and machines used for planting. Implements used in after-culture. Means of protection against insects, animals, climate. Seed beds and other graphic illustrations of nursery practice.

Class 18.—Forest management—Maps, plans, illustrations, calculations, illustrating forest management. Instruments for measuring standing timber. Growth of different ages and soils. Graphic or other illustrations showing influence of various managements on tree growth. Statistics of lumber trade and of forestry. Exhibits showing relation of forests to climate. Literature and educational means.

Class 19.—Lumbering and harvesting of forest products—The lumbering industry—Logging and transportation—Implements, machines, plans, drawings, and statistical material. Loggers' tools—Stump-pulling devices, marking devices, measuring tools. Loading devices—Sleds, flumes, slides, rope tramways, railroads, methods of water transportation, rafts, booms, etc. The tan bark industry. Other barks. The turpentine industry. The charcoal industry.

Class 20.—Preparation and manipulation of lumber—Dressing, shaping, and preparation of wood. Hewing of logs, spars, etc. Shaping of knees. Sawing and milling. Drying and seasoning of wood by use of antiseptics, etc.

The rustic colonnade, which will set off the building, was decided upon a few months ago, and solicitations for tree trunks were early sent out to the different States and Territories. It was stated that the building would occupy a commanding position on the lake shore, and that it would be designed to illustrate in its construction and arrangement the forest wealth of the world. The architecture should be of a rustic character to produce a beautiful and appropriate effect. A prominent feature would be a wide colonnade along the front of the building, facing the lake, and across either end. The supporting columns were to be trunks of trees with the bark on, representing the characteristic woods of the various States and Territories, thus adding to the unique beauty of the structure, creating general interest throughout the country and furnishing an opportunity for each State and Territory to exhibit specimens of its forest trees, and add character and attractiveness to the forestry exhibit. The trunks were to be from 16 to 20 in. in diameter at the base, tapering gradually, and 25 ft. long. Each column should have attached to it by the exposition a tablet on which should be engraved the name of the State or Territory furnishing it, the name of the tree, and an estimate, if furnished, of the approximate quantity of such timber in the State or Territory. Each State board of agriculture was asked to send on the three desired representative tree trunks.



THE WORLD'S FAIR LUMBER AND FORESTRY BUILDING.

Up to the present time a large number of the requests have received assurance of compliance, and while some of the State world's fair boards have not yet been organized, it is known that the rustic columns will be forthcoming in probably every instance.

The original plan has been somewhat changed, however. The trunks called for in the letter of solicitation referred to above will constitute the centers of each column, which will be completed by the addition of two smaller trunks, placed one on each side. The colonnade will also be extended along the fourth side of the building, in all probability. Thus the States will be called upon for more than an average of three trunks each.

The following list of trees has been suggested by Chief Fernow of the government forestry division, as leaders in a monographic display by different States:

Maine, white pine.	Kentucky, hickory.
New Hampshire, yellow birch.	Ohio, ash.
Vermont, sugar maple.	Indiana, black walnut.
Massachusetts, elm.	Illinois, white oak.
Rhode Island, sassafras.	Michigan, beech.
Connecticut, butternut.	Wisconsin, red pine.
New York, black spruce.	Minnesota, basswood.
Pennsylvania, hemlock.	Iowa, post oak.
New Jersey, pitch pine.	Missouri, sycamore.
Delaware, soft maple.	North Dakota, canoe birch.
Maryland, chestnut.	South Dakota, box elder.
West Virginia, black cherry.	Nebraska, black locust.
Virginia, loblolly pine.	Kansas, catalpa.
North Carolina, short leaf pine.	Montana, mountain white pine.
South Carolina, cypress.	Wyoming, lodge pole pine.
Georgia, long leaf pine.	Colorado, Engelman spruce.
Florida, red cedar.	New Mexico, cottonwood.
Alabama, chestnut oak.	Arizona, bull pine.
Mississippi, sweet gum.	Utah, Utah white pine.
Louisiana, Bull bay magnolia.	Nevada, mountain mahogany.
Texas, pecan.	Idaho, Douglas spruce.
Arkansas, red oak.	Washington, canoe cedar.
Indian Territory, bois d'arc.	Oregon, sugar pine.
Tennessee, whitewood.	California, redwood.

The selection of representative trees is a matter of considerable care. Mr. Fernow has evidently undertaken to avoid repetition as much as possible, and when a wood might be chosen by several States as a representative one he has sought to determine which State was pre-eminently entitled to be represented by it, as for example the allotting of white pine to Maine, the former white pine State.

Some of the closer details of the building have not been fully worked out, and it has been suggested that each of the several entrances might be finished artistically to represent the woods of a State or region, similarly to the plan decided upon as to the main entrance. Several lumber associations have made inquiry on this subject, and it is believed that each entrance could be very tastefully and appropriately made to represent different lumber sections or interests.

With regard to the colonnade fronting the lake, it is thought probable that it will be utilized for an elegant cafe, and made to form one of the most attractive resorts on the grounds.

The statement has been published that the roof of the building would consist of a thatch of straw. On the contrary it will be thatched with tanbark or other similarly appropriate articles.

Other rustic exterior details will be fittingly worked out.

The procession of flag staffs surmounting the outward portion of the roof suggests a tentative plan to have the woods of all countries indicated by the flags thereof. Each staff will probably fly a national streamer, accompanied by state emblems or foreign colors, the whole constituting a very pretty and suggestive display.

The frontage of the building, as shown in the engraving, is that facing the lake, the structure at the north end being the dairy building.—*N. W. Lumberman.*

A Steel Lake Tunnel.

At Cleveland, O., R. Powell has submitted to the Board of Control his plans for the construction of a steel tunnel for a waterworks intake, to extend 2½ miles out into the lake. According to the local papers he proposes to build it of ½ inch plates, in sections 1,000 feet in length and 8½ feet in diameter. Bulkheads would be put in at each joint. Each section would be filled with air and could be floated out to the place where it is necessary to sink it. All the sections would be joined together before they were sunk by men working on rafts. The entire length of 2½ miles would be sunk in a solid piece by opening the manholes and pulling out the bulkheads. The manholes would then be closed by a mechanical contrivance. The cost is put at about 50 per cent of that of a brick tunnel, and Mr. Powell claims that he could have pure water flowing through his tunnel to the city within four months. He estimates the duration of the work at fifty years.

The Destruction of Mosquitoes.

A correspondent of *Nature* says: I was told a few years ago by an English gentleman who has a most beautiful place on the Riviera that he had freed his property from this pest.

The property in question is a peninsula, and for that reason is exceptionally open to separate treatment. On the Riviera, as many of your readers will know, fresh water is a somewhat rare commodity, and all of it that the inhabitants can lay hold of is stored for future use in tanks or small receptacles.

The larva of the mosquito lives, as I understand, only in fresh water. Consequently, on the Riviera he is found in the tanks I have named.

The carp is, I am told, passionately fond of the larva of the mosquito, and the Englishman I refer to had extirpated the insect by putting a pair of the fish in every tank.

The plan is not one that could be adopted everywhere, but it is worth bringing under the notice of those whose circumstances are like those of the Riviera.

DR. ELKIN, the astronomer of Yale University, and formerly of the Cape of Good Hope, has, by a long series of observations on the parallax of the star Arcturus, arrived at the conclusion that it moves with the inconceivable velocity of 381 miles a second, that is to say, it would traverse the distance from London to Edinburgh between two ticks of a watch. This is twenty-one times faster than the speed of the earth in its orbit round the sun. Dr. Elkin also finds that Arcturus is so far away from us that his light, traveling 190,000 miles a second, takes 181 years to reach us.

Correspondence.

A Protective Coating for Metal Wanted.

To the Editor of the Scientific American:

I have a problem that I have been trying to solve for some time, but as yet have been unable to get any advice on the subject, and thought that you might help me through the columns of your valuable paper. The problem is in regard to a covering for frames upon which are placed articles to be electro-plated. It must be an insulator to electricity and be able to stand the action of boiling caustic soda at between 15° and 20° Baume hydrometer; also must resist the action of cyanide of potassium cold.

I have thought that possibly a covering of rubber might answer the purpose, but perhaps you can suggest something better. C. A. W.

Akron, O.

[A properly made stoneware would be very slowly attacked by the liquids you mention. It might be made in the form of tubes to slip over your frame, or if in half section, some simple interlocking or dovetailing of the pieces might be provided for. Perhaps some of our readers can suggest something better.—ED.]

Rainfall and Lightning.

To the Editor of the Scientific American:

There seems to be considerable discussion through your paper in regard to the fall of rain immediately after a lightning flash.

The unquestionable explanation of this phenomenon seems clear enough to warrant but little doubt in the matter.

The fact is that rain does not follow a flash of lightning, but the lightning follows a rainfall, as a shower of rain forms a connection between the electricity-laden clouds and the earth, through which the flash passes. In fact, if rain followed lightning, it would be some time (probably a half minute or more) till the rain would reach the earth from the clouds, which is much longer than the lapse of time usually between the flash and the following rainfall.

Now, suppose a shower of rain from a cloud has reached a distance of 200 feet from the earth when a flash of lightning passes through it, striking the earth some seconds before the rain, which, following almost immediately, is said to be precipitated by the lightning, while in reality the column of water has only served to establish a communication between the cloud and the earth.

For a practical corroboration of this theory may be taken the fact that sailors usually predict fair weather when thunder is heard during a rain, which seems to argue that lightning is caused by the precipitation of rain, rather than that rain is caused by lightning.

GEO. W. WEINGART, JR.

New Orleans, Nov. 3, 1891.

Sound and Rainfall.

To the Editor of the Scientific American:

In an article by Prof. Newcomb, published in the SCIENTIFIC AMERICAN of October 17, it is stated that "the popular notion that sound may produce rain is founded principally upon the supposed fact that great battles have been followed by heavy rains. This notion, I believe, is not confirmed by statistics." As a participant in many battles of the late war, please allow me to state a few facts, which may possibly serve to correct or amplify statistics in this matter, as what I state can be confirmed by numerous living witnesses. The battle of Pittsburg Landing was followed immediately by a heavy rain, succeeded by a clear day; the ravines of that field ran red with blood, while the fields were washed clean. The cannonade was heavy. At Iuka, Miss., the guns were light, and a fine shower followed the second day; the siege of Corinth was attended with rain, and the battles of Corinth and Hatchie River, October 5 to 6, 1862, were followed, October 7, by a night of very heavy cold general rain. The forty-seven days' siege of Vicksburg was attended with heavy cannonade evenings, followed each night with brisk showers of rain before morning. About the same was characteristic of the siege of Port Hudson, La. My memory serves me that the newspaper accounts of the battles of Bull Run, Antietam, Gettysburg, Chancellorsville, Atlanta, etc., were attended by heavy rainfall.

As I have been somewhat identified with the question of artificial rain, having written on the subject over thirty years ago for a New York paper, when it was thought very unpopular and impious to make the reference, I ask your indulgence of the suggestion that steps be taken to secure accurate statistics on the subject, with a view of verification of facts concerning cannonade and rainfall. There are plenty of living witnesses to give all the facts concerning rainfall connected with battles of the rebellion, and also some of the battles in Mexico; and they would undoubtedly do so if requested. My articles, published in 1857 to 1859, made reference to rainfall attending the battles in Europe during Napoleon's campaigns; and as the question only involves battles where cannonading occurs, history is not so remote as to make difficult the collection of facts.

There is also another source of gleaning statistics on this subject, that of Fourth of July celebrations, which have been notable of rainfall succeeding the midnight cannonading simultaneously at different towns in the older settled and closely populated States. One thing is certain, whatever theories may be followed in experiment, and whatever methods employed, the establishment of any practical system of artificial rainfall must depend upon the collection, classification, and verification of phenomena bearing upon the subject.

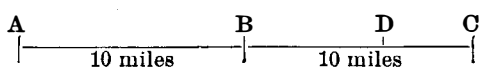
JOHN W. EVARTS.

Thurston, Ok. Ter., Oct. 29, 1891.

Solution of Query 3600.

To the Editor of the Scientific American:

In answer to the problem 3600, propounded in your issue of October 31, 1891, I beg to offer the following solution:



By the terms of the problem m is at A and n at B. They both travel ten hours, n straight from B to C, and m from A toward C until he catches up with n, when he returns to B. The point where m overtakes n must be somewhere between B and C—say at D. Evidently in the ten hours of his journey m travels his own 10 miles between A and B, and also twice the distance, B D, which n travels before the latter is overhauled.*

It is further evident that m, in returning from D to B, consumes the same amount of time as n does in going on from D to C (since they both finish at 5 o'clock P. M.).**

Let $x = m$'s speed per hour;

Let $y =$ B D, distance traveled by n before being overtaken.

Then we have the following equations:

$$* \; 10x = 10 + 2y;$$

$$x = \frac{y}{5} + 1; \ldots\ldots\ldots (1)$$

$$** \; \frac{y}{x} = 10 - y;$$

$$x = \frac{y}{10 - y}; \ldots\ldots\ldots (2)$$

Combining these two values of x, in equations (1) and (2), we have—

$$\frac{y}{5} + 1 = \frac{y}{10 - y};$$

$$y^2 = 50;$$

$$y = 7{\cdot}071068; \text{ and, therefore,}$$

$$x = 2{\cdot}414213.$$

Therefore n was 7·071068 miles from B when m caught him; and m traveled 17·071068 miles, at 2·414213 miles per hour, up to that moment; and 24·142136 miles in all.

REV. CLARENCE E. WOODMAN, Ph.D.

St. Paul's Church, New York, N. Y.

[We publish the above as a good example of the solution of the problem. A number of solutions, many of them wrong, have been received.—ED.]

Espadrilles.

To the Editor of the Scientific American:

R. S. asks, in your issue of October 24 (page 261), in regard to a cheap summer shoe that leaves the foot in its natural position, allows free ventilation, and does not hinder expansion of the foot in all directions.

I have found that espadrilles, worn in southwestern France and northeastern Spain, answer the above-mentioned conditions. Espadrilles are made of soles of braided hemp joined by a peculiar braided or crocheted stitch to uppers of cloth. They are occasionally worn in England and in the United States for bathing shoes, and I have seen a poor quality of them for sale in Boston.

My first use of espadrilles was while studying zoology in the Arago Laboratory at Banyuls-sur-Mer, in the eastern Pyrenees, as a protection to the feet when wading and hunting salt water animals. Liking them soon led me to wear them on land instead of shoes, as do many of the natives of that region.

The sole of braided hemp is very light, although about half an inch in thickness, and as it is of the same thickness throughout, it allows the foot to rest in a natural position. The uppers, which are not high, are made of a somewhat loosely woven strong cloth, are elastic, and allow ventilation. The hemp sole absorbs the perspiration, but the whole espadrille can be washed, after use for a month or two, if one cares to be economical and not buy a new pair. Espadrilles ara secured to the feet by a lacing of woolen tape, which crosses the upper part of the foot and ties, being elastic and quickly adjusted and fastened.

After using espadrilles in sea water they are rinsed in fresh water, to prevent retention of moisture by the salt, and dried.

The price of a pair of espadrilles in southern France varies from one franc and a half (about 30 cents) to twice that amount. They are usually made with white cloth uppers, ornamented with designs worked in brilliantly colored worsteds, while the thick soles retain the natural color of hemp. This conspicuous ornamentation and coloration constitutes the only strong objection to wearing espadrilles out of doors; but pairs can be bought made with plain black cloth uppers.

For foot races espadrilles would be very advantageous, because of their lightness, and the tender bottoms of the feet, which result from wearing impervious rubber soles, does not accompany their use. For indoor wear the more highly ornamental kinds of espadrilles are appropriate, and are preferable to leather-soled slippers. This use of espadrilles impressed me so favorably that upon my return from France I brought back with me a dozen pairs of them for wearing in this country. GEORGE DIMMOCK.

Canobie Lake, N. H., Nov. 3, 1891.

Thunder in its Relation to Rain Formation.

To the Editor of the Scientific American:

Being a constant reader of your valuable paper and its SUPPLEMENT, I have naturally become interested in the recent discussions concerning the artificial production of rain.

In your issue of October 3, Mr. A. J. James says that those who hold noise to be a potent factor in the production of condensation and rainfall "put stress also on the fact that during a storm the rainfall is greater immediately after the thunder claps." Mr. James admits the truth of this, but explains as follows:

"During the storm the small rain drops are buoyed up by ascending currents of air, and the thunder jars the atmosphere so that a number of these small drops are jostled together, and being collectively too heavy to be buoyed up, they fall to the earth."

Claps of thunder quickly followed by greater rainfall is a common and interesting phenomenon, and admits of an explanation quite the reverse, so far as cause and effect are concerned, of that given by Mr. James.

It often happens during a rain storm, when the clouds are not highly electrified and therefore not accompanied by thunder, that the rainfall suddenly increases. It is therefore evident that increase in rainfall during a storm is not necessarily due to the little drops being jostled together by thunder.

Now let us suppose the clouds heavily charged with electricity, as they often are, and see what we may expect in the way of thunder and lightning whenever there is rapid condensation and heavy rainfall, no matter what the cause of this may be.

For the sake of simplicity let us also suppose the little globules forming the cloud to be of the same size and charged with equal amounts of electricity. Now as these little globules unite to form the raindrop they carry their electric charges with them, all of which remains on the surface of the growing drop; and since the mass of a sphere varies as the cube and the surface as the square of the diameter, while its electric capacity varies directly as the surface, it is evident that increasing the diameter of the raindrops likewise increases their electric potential in exactly the same ratio, inasmuch as the potential varies directly as the quantity of charge and inversely as the capacity of the conductor.

It would thus appear, if the raindrops be rapidly formed, that the potential of each, and therefore of the whole cloud, must rise with the same rapidity and soon cause an electric discharge to the earth or a neighboring cloud.

Claps of thunder are thus seen to be the natural result of the formation of rain drops from electrified clouds. But it may yet be asked, if the thunder be the result of the increase of rainfall rather than the cause, why do we hear the thunder before we see the increase of rain?

Well, the flash of lightning is seen before the thunder is heard simply because light travels many times faster than sound, and so, too, the thunder is heard before the drops, whose formation caused the lightning flash, have reached us, simply because sound travels faster than the falling rain.

It might be well to add that often the thunder finally ceases because the rain quits forming; but the rain never quits because it fails to get the cheering claps of thunder. W. J. HUMPHREYS.

Miller Manual Labor School of Albemarle,
Crozet, Va., November, 1891.

A Curious Steamer.

A steamer which can be propelled on land by means of its own engine has just been constructed at the Ljunggren Engineering Works at Kristiansstad, in Sweden. It is intended for the traffic on two lakes close to Boras, which, however, are separated by a strip of land. Rails have been laid between the two lakes. The steamer, which has been christened very appropriately Svanen (the Swan), can run itself across from one lake to the other. At a trial trip, if one may call it so, at the works, the vessel fulfilled the tests very well. The engine is 10 horse power, and the Svanen can accommodate some 60 passengers.

THE SPONGE FISHERIES OF THE BAHAMAS.

(*Continued from first page.*)

fisheries, giving constant employment to the 6,000 men and boys engaged. These employes are all colored, mostly natives of the islands, and follow this industry all their lives; in most instances commencing as boys, growing up in it to manhood, and continuing at it as long as they are able to stand the fatigue and labor. A number of small open boats besides those attached to the vessels accompany the crafts. The owners of these give a share of the proceeds of the sponge they obtain to the owners of the vessels for towing them to the sponging grounds and allowing them ship room. The sponge they obtain is kept separate from the ship's cargo.

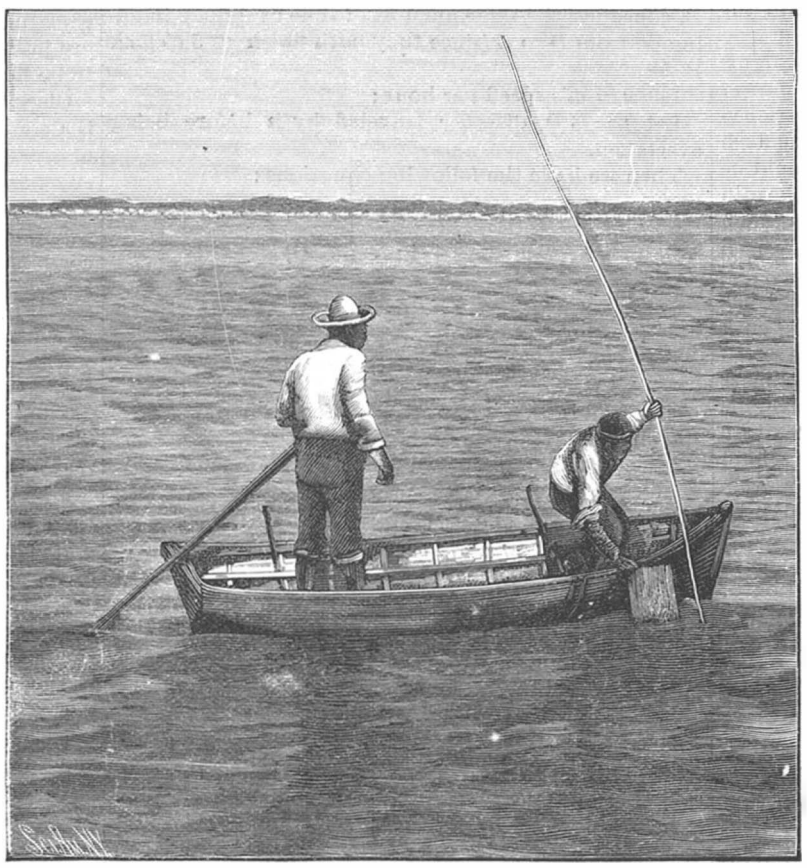
The method of obtaining the sponge from the sea bottom is by a staff and hook at the end, by which the sponge is torn from its place of attachment. (See illustration.) At greater depths than can be reached by the hook, the sponger will sometimes dive for them, but this is seldom resorted to. The water glass is an indispensable article in locating the sponge on the sea bottom. It is a wooden cone with a glass set in one end and open at the other. It is about eighteen inches long, and by placing the glass end just beneath the surface of the water and looking in the top, the operator has a clear view of the bottom of the sea, and with his staff in the hand not engaged in holding the water glass, he thrusts the staff down. When he sees and selects the sponge, he hooks it or tears it from its native bed.

The sponge, when taken from its resting place, has not the same appearance as when prepared for use. All its fine qualities are hidden. It is heavy, and contains a matrix of dark gelatinous matter with a dense external pellicle. This gelatinous substance is got rid of by maceration and washing, and the residuum is our well known companion of the bath. On placing any of these forms of sponge, before cleaning, in a tub of salt water, and with the aid of a lens observing the central portion of the body of the sponge, one will notice something like a fine woven cobweb projecting from the central part outward, from which refuse matter may be seen issuing. Looking more attentively, an immense number of very small pores will be seen, through which the food, infusoria and other organisms, is taken. The more powerful the lens, the more wonderful the internal structure is shown to be and the more surprising will the operations of nature in this particular case appear. With a powerful glass one can easily perceive the flagella or whips lashing the water, producing the inflowing and outflowing currents. Without the use of a magnifying power the sponge would appear as a dead, inert mass.

The propagation of sponges, the method by which they increase, is not only interesting, but is certainly very curious. At certain periods there will be formed projections from the surface, yellowish-looking buds, which grow until they detach themselves, when they are driven out by the outward flow caused by the flagella or whips lashing at the water. These yellowish-looking buds then appear as helpless atoms of jelly. But this is not the case. These tiny germs or atoms have a motion that we would not suspect. With a lens we see the whole of these minute objects covered with minute cilia, which vibrate and propel it through the water until, arriving at sufficient distance from the place of its birth, it settles down on the bottom, loses its cilia and grows—becomes a sponge.

After the taking of the sponge from its native bed they are all assorted and the different kinds and grades separated. They must be trimmed or clipped, as it is termed, baled, pressed, and incased in canvas to ship.

The sponging grounds of the Bahamas are well worth visiting. There is scarcely a more beautiful or interesting sight than a view in the clear limpid waters surrounding these sea-girt islands on a warm day. The marine flora, the various forms of coral scattered in rich profusion at the depth of a few fathoms, is something marvelous for its varied and extreme beauty, and is not surpassed in any part of the globe. In a tideway of medium flow it can be viewed to the best advantage. The graceful undulating sea fans, with a variety of sea anemones, with the colors of the rainbow, the branching coral, some fashioned, one would almost believe, with human skill and artistic taste, with the most beautiful colored fish sporting in these fairy grottoes, the water being so transparent that the bottom can be distinctly seen at a depth of over twenty fathoms, all combine to make a vision which for beauty, novelty, and variety is very fascinating, and once seen will not easily be forgotten.



TAKING SPONGES FROM THE BOTTOM WITH A POLE HOOK.

For information in reference to the growth, propagation, and habits of the sponge, also for statistics, etc., in this connection, I am under many obligations to the Hon. Judge Camplejohn, of Nassau, N. P., who has made a study of this subject for years. The local price of sponge ranges from 25 cents to $1.20 a pound, the fine wool sponge being the most expensive, while the yellow and glove sponges are the cheapest.

Heat from the Moon.

Mr. Frank H. Very's essay on the distribution of the moon's heat and its variation with the phase, which gained the prize of the Utrecht Society of Arts and Sciences in 1890, has recently been published. *Nature* says a bolometer in connection with a very sensitive galvanometer was used in the research, and the plan has been to project an image of the moon about 3 centimeters in diameter by a concave mirror, and to measure, not the heat from the whole of this, but only that in a limited part of it, from 1-25 to 1-30 of the area of the disk, the observations being repeated at different points and at different phases. Measures made six hours after full moon show that the east limb was hotter than the west limb in the proportion of 92·2 to 88·9. In one observation made a day after full moon, the excess of heat at the east limb was much larger. There is a regular decrement of heat in passing from higher to lower latitudes, and observations on this point appear to indicate that heat is accumulated after many days of continuous sunshine. The heat in the circumferential zone of the full moon differs from that of the center by about 20 per cent. In this respect, therefore, the thermal image is like the visual one. There seems to be some evidence that bright regions radiate a little more than dark during the middle of the lunar day, but this is not quite proved, and with a low altitude of the sun the effect is reversed. A comparison of the curve drawn by Zollner for the moon's light with that deduced from Mr. Very's observations brings out the point that visible rays form a much larger proportion of the total radiation at the full than at the partial phases, the maximum for light being much more pronounced than that for the heat. The diminution of the heat from the full to the third quarter is shown to be slower than its increase from the first quarter to the full. This result agrees with that obtained at Lord Rosse's observatory, and is direct evidence of the storage of heat by lunar rocks.

Compressed Air Power Transmission.

The town of Lucerne, Switzerland, after having had four years' experience of alternating current distribution of light by Ganz & Company, is about to supplement this by a distribution of power from the same water power; but this will be carried out, according to arrangements made with Messrs. Riedinger, of Augsburg, by means of compressed air. The town of Offenbach has also completed an installation of compressed air distribution, which seems to be causing great interest among German engineers. The total length of pipes laid amounted to 7760 yards, of which 1702 yards consisted of pipe 1 ft. in diameter, 1710 yards 8 in. in diameter, and 4347 yards 4 in. in diameter. The pipes were laid about 1½ ft. below the footpath. The connections of the pipes were made by means of India rubber, as in the similar installation in Paris. Valves are provided for shutting off the air from separate lengths of pipe. A trial of the system was made by the engineering authorities of the town and by the Boiler Inspection Association, which showed that there was a loss of 0 11 of an atmosphere in 7½ hours—that is, 0·39 of a cubic meter per hour kilometer. This loss amounts to 13 per cent on the daily output, the power transmitted being, on an average, 500 horse power.

Germs of Malaria.

The Washington *Star* thinks some day a method of inoculation for the prevention of malaria may be devised. Science has got hold of the germ recently, and identified it beyond question. It is not a bacillus or any kind of bacterium, as has been imagined, but an animal parasite. The name given to it is plasmodium malariæ. It belongs to the lowest grade of animal life, being a "protozoon."

This little parasite, which is of microscopic dimensions, appears to make its home ordinarily in the soil. It is plentiful in swamps, but wherever virgin ground is turned up for the first time, the plasmodium is apt to be very numerously present. It has been noticed in towns that when much digging and turning over of earth has been going on, malaria exhibits a tendency to prevail. There has been a good deal of digging in Washington lately.

Entering the human body through the lungs, the plasmodium seeks a roosting place in one of the red corpuscles of the blood. These corpuscles are in shape flat round disks, bearing a curious resemblance under the microscope to pieces of money. How essential their well-being is to health, everybody knows. The parasite having taken up its residence in one of the corpuscles, proceeds to multiply, forming a little colony. The colony feeds upon the material of the corpuscle, which thus becomes disorganized and is finally destroyed, so that the hostile germs are set afloat in the blood. At the beginning they were merely bits of protoplasmic jelly, without any particular shape, but now they become free swimmers and have developed long hair-like oars to paddle about with. Each one has three such oars radiating from its body. Thus they make their way through the veins and arteries, following the tide of the circulation.

Of course, it is not possible that this sort of thing should go on to any considerable extent without seriously affecting the health of the individual. The latter is attacked by chills, alternating with fever. Quinine and other remedies destructive to the parasites relieve these symptoms. However, if the patient continues to be exposed to the absorption of the germs in a malarious region, medicines will cease to have effect. The blood, invaded by hordes of plasmodia, becomes filled with disorganized red corpuscles, and nature gives up the fight, death ensuing.

Now that medical science knows precisely what it has to contend against in the treatment of this hitherto mysterious disease, it may be able to find more effective remedies. Already the discovery has enabled physicians to correctly diagnose many malarial cases which have a way of counterfeiting typhoid fever and other troubles. In such instances the presence of the plasmodia in the blood, readily ascertained by the microscope, settles the question. Besides, if one must suffer, it is a great comfort to know what is gobbling one up.

Another Rain Producer.

In the SCIENTIFIC AMERICAN for September 5, 1891, we published an extract from a U. S. patent granted for producing rain by explosive balloons. It now appears that a patent was granted in Austria on January 13, 1874, for what is termed an "apparatus for discharging electricity from hail clouds." After describing the theory of the formation of hail, the patentee says that if a balloon armed with metal points or covered with metal is sent up into a lower hail cloud charged with electricity, the latter passes to earth by the copper wire which holds the balloon captive, and the moisture in the cloud does not congeal but drops to earth in the form of rain. The drawing annexed to the patent shows a balloon with metallic points and a windlass on which is coiled the wire or cable for forming the ground connection and raising and lowering the balloon.

SLIPS for the broadside docking of vessels have been built at three of the principal ports of France. By this means vessels are to be hauled out of the water without straining, and the cost is less than by the ordinary means of placing in a dry dock.

LARGEST DRY DOCK ON THE GREAT LAKES.

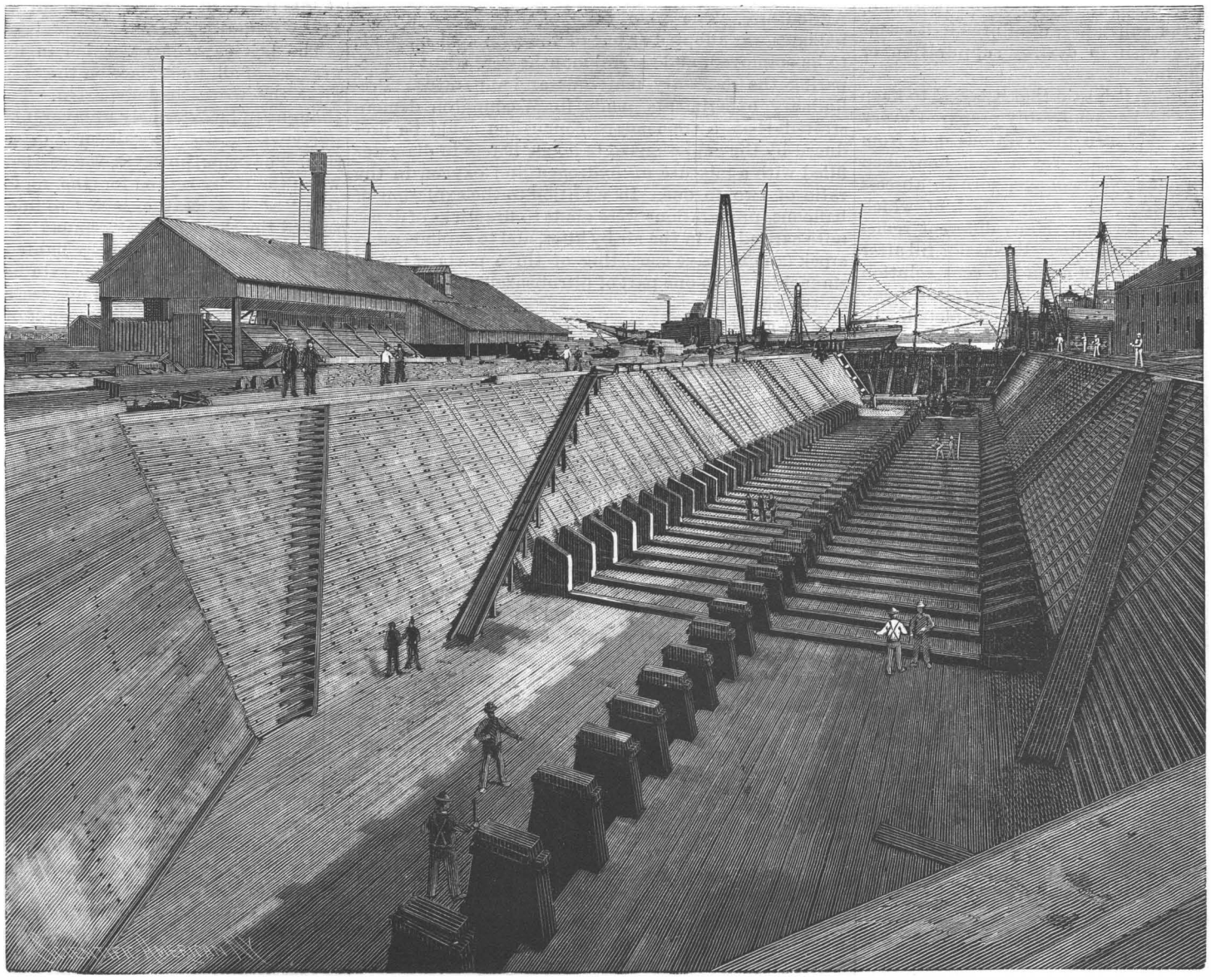
Almost a year has been required in the work of constructing the recently completed dock shown in our illustration, at the foot of Orleans Street, Detroit, Mich., where the saw mill, engine, boiler, and repair yards of the Detroit Dry Dock Company have been located for the past forty years. The soil where the dock is built is of fine blue clay, so that there was no interruption to the progress of the work from land slides or leakage. Two thousand piles were driven, making the structure very strong, it being designed to safely dock loaded ships carrying a cargo of 3,000 tons, while taking in vessels of the largest size.

The inside dimensions of the dock are: 378 ft. long; 91 ft. wide on top; 78 ft. opening at entrance; 56 ft. opening on miter sill; 55 ft. wide on floor; 16 ft. 6 in. of water over keel blocks; 16 ft. 6 in. of water over sill; 4 ft. 6 in. from top of keel blocks to floor of dock; 20 ft. 6 in. from water line to floor of dock.

The keel and bilge blocks are 5 feet from center to center, averaging 5 feet high, thus leaving plenty of room under a ship for the movements of workmen in making any necessary repairs to her bottom. There are two wells 12 feet deep situated at each end of the dock, with cranes above them for hoisting out and replacing wheels, etc. The caisson gate which, when closed, shuts off the ingress or egress of water, is of steel, constructed at the company's steel shipbuilding plant, at Wyandotte, Mich. It is 12 feet beam, 79 feet 5 inches long, with five 30 inch valves for flooding the dock, which it is estimated it will do in twenty minutes. Time required to pump the dock out is 1½ hours. The whole dock is surrounded with a puddling wall filled with blue clay 5 feet thick, and extending down below the old river bed, which completely shuts off all water from leaking through the sides.

The pumping plant consists of two centrifugal pumps, with 30 inch discharge each, driven by two 150 horse power independent compound Westinghouse engines. The pumps are in a well 22 by 11 feet inside and 35 feet deep, the water passing from the dock to the well through a brick tunnel, 5½ feet diameter and 55 feet long. The steam for the engines is supplied by a battery of three boilers, 5½ feet in diameter and 15 feet 6 inches long, built by the Dry Dock Engine Works. The fuel is oil, and the whole pumping plant is housed in a two-story brick building, 34 by 81 feet. A dynamo room is provided, where an electric light plant will be put in during the coming winter, which will supply the entire shipbuilding plant with light.

This dock is large enough to take in any boat now upon the great lakes, and has been designed especially for the wide railway car ferries and passenger boats with their overhanging guards and paddle-wheels. The cost of the dock was upward of $200,000. There has also been added to the Detroit Dry Dock Company's plant a pair of steel shear legs for hoisting boilers, engines, spars, etc., from and into boats. They are 100 feet high and have a lifting capacity of 100 tons.

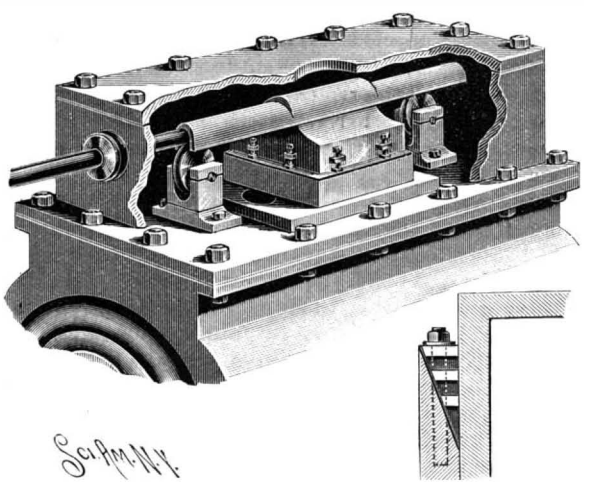


A GREAT DOCK RECENTLY BUILT BY THE DETROIT DRY DOCK COMPANY.

WHEN timbers or shingles are found in this country that have withstood the blasts of one hundred or one hundred and fifty winters it is regarded as quite remarkable, but in Norway there are wooden churches standing, with timbers in excellent state of preservation, that have withstood the fierce frosts of seven hundred almost Arctic winters. These timbers are not oak nor beech, but Norway pine, and their preservation is largely owing to the fact that they have been coated over and over again with tar.

A STEAM ENGINE SLIDE VALVE.

A valve of simple and durable construction, designed to reduce friction to a minimum, and be easily adjusted to its seat, is shown in the accompanying illustration, and has been patented by Mr. Roland E. Vandeventer, Mount Sterling, Ill. The valve is connected with a yoke made in the shape of an inverted box and fitting with its sides on the inner surface of the upwardly extending sides of the valve. Attached to the top of the yoke is a bar connected with the valve stem, passing through one end of the steam chest, and this bar has near each end longitudinal grooves on its under side, each groove engaged by a roller journaled in a suitable support, whereby the weight of the yoke, as the valve is moved, is wholly carried by the rollers. In order to secure a steam-tight joint between the sides of the yoke and the sides of the valve, beveled packing strips are fitted in beveled inner sides of the valve, as shown in the small view. To prevent the valve from being unseated by back pressure in the cylinder, set screws are arranged in lugs on the sides of the yoke, the lower ends of the screws being a very slight distance above the packing strips.



VANDEVENTER'S BALANCED SLIDE VALVE.

The bar supporting the yoke is prevented from being displaced on the rollers by suitable cross guards, not shown, and oil cups are arranged in the top of the steam chest to lubricate the rollers and bearings. The wear of the valve and of the bar traveling on the rollers is readily taken up, so that the relative positions of the several parts and their operations are not disturbed, and, with but slight changes in the steam chest, the device may be readily applied on engines now in use.

The Drawbaugh Telephone Claims Rejected.

The Drawbaugh telephone case, which has been dragging through the Patent Office for the last eleven years, was decided on October 28, by Commissioner Simonds' affirmation of the decision of the board of examiners in chief, denying the patentability of the subject matter of an application for patent for telephones, filed by Daniel Drawbaugh, on April 3, 1884, in continuance of his original application, filed July 26, 1880. The decision is on the ground that the invention was put to public use by Thomas A. Edison and others for more than two years prior to the date last mentioned, the evidence being presented that Edison had made the complete invention as early as July 30, 1877, as disclosed in the shape of his British patent of that date, etc.

How to Drink Milk.

Some complain, says a contemporary, that they cannot drink milk without being "distressed by it." The most common reason why milk is not well borne is due to the fact that people drink it too quickly. If a glass of it is swallowed hastily, it enters the stomach and then forms in one solid, curdled mass, difficult of digestion. If, on the other hand, the same quantity is sipped, and three minutes at least are occupied in drinking it, then on reaching the stomach it is so divided that when coagulated, as it must be by the gastric juice, while digestion is going on, instead of being in one hard, condensed mass upon the outside of which only the digestive fluids can act, it is more in the form of a sponge, and in and out of the entire bulk the gastric juice can play freely and perform its functions.

Half Century Jubilees.

The jubilee celebrations of two important inventions take place this year. One is the galvanic gilding and silvering method devised by the Swiss chemist, Mons. August de la Rive, in the year 1841, for which, in the course of the following twelve months, he received the Montyon prize of 3,000 francs from the Academie de Paris. Mons. Rive's process of imparting to common metal a firm gold or silver coating has entirely supplanted the old-fashioned pyritic method which, owing to the noxious mercurial vapors engendered, materially injured the health of the artisan. The second invention is that of steel-facing copperplates, the outcome of the ingenuity of a Frankfort professor, Herr A. Bottger. By this process engraved copperplates are coated with a very thin but firm and durable steel deposit. The shape and fineness of outline of the engraving are not thereby altered, and the copperplate is imbued with the metallic hardness of steel, by which means a considerably larger number of clear, sharp impressions may be taken than with the ordinary copperplate. A further advantage is that when the steel face begins to show signs of wear it may be dissolved by a chemical solution without in the least affecting the copperplate, which is then ready to receive another steel deposit.

THE longest railroad bridge span in the United States is the cantilever span in the Poughkeepsie bridge over the Hudson River—548 feet.

Pyoctanin.

In a paper read lately before the American Laryngological Association, and reported by the New York *Medical Journal*, Dr. R. P. Lincoln, of this city, gives an account of several cases successfully treated with by this remedy. "Pyoctanin is a chemical preparation of the class of aniline colors, there being two kinds, the blue and the yellow, the former, according to Pohl,* having the greater germicidal power. It is offered in the market in the form of powders, tablets, and sticks. It is odorless, almost tasteless, non-poisonous, slightly anodyne, and non-irritating. It does not coagulate albumen, has great penetrating and disseminating power, and hence does not form a protecting shield about disease germs. It destroys bacteria quickly, even a weak solution prevents the development of all micro-organisms. It is freely soluble in water and petroleum products. Its disadvantage is its staining quality, which is an offense to the sight, but which can be avoided on exposed parts by exercising reasonable care.

It may be used without unpleasant consequences in any degree of strength, from the pure substance to a weak solution. It can be applied to the part to be treated in the form of a spray, by means of a pledget of lint saturated with a solution, in the form of an ointment, as a powder or by crayon.

Its Method of Action.—W. Pohl,† of Berlin, reports in his inaugural thesis the results of the study of the effect of pyoctanin on different bacteria. Putrefactive‡ ones showed the greatest resistance. A solution of the strength of 1 in 2,000, however, stopped their evolution, while a solution of 1 in 1,000 killed them in half an hour. It is found by increasing the proportion of the chemical that this action is hastened. The rapidity of this action on all other micro-organisms is much greater. Janicke§ showed that a total stoppage of development took place in streptococcus with a solution of 1 to 333,000, whereas a solution of 1 to 5,000 killed it in half a minute.

Professor Stilling,‖ who appears to have been the first to have introduced and systematically experimented with pyoctanin, applied a strong solution to the eyes of his patients without much discomfort.

Bresgen,¶ who was the first to systematically use pyoctanin in the nose, noticed a distinctly anodyne faculty on its being applied to the mucous membrane.

Thus we learn that while its effect varies much in degree with the strength of the remedy, we need not be deterred, by fear of pain or too much irritation, from a free use of the substance, undiluted if it seems indicated, when we wish to destroy suppuration, or prevent it if impending.

When used in solution it is said that it is best to keep it in colored glass and have it freshly prepared every three or four days. My own observations date from July, 1890. One of my cases was a well nourished single woman, thirty-five years of age, with an abscess of the left frontal sinus, the early effect of which trouble had been most serious. Many different remedies had been applied for months. It was not till after I had made a few injections of a ten per cent solution of pyoctanin in water that a new impetus to the healing process began, which was speedily completed. In less than three weeks, the strength of the solution being gradually reduced, all discharge, either external or through the nostril, ceased, and the patient was relieved of a trouble that had caused physical and mental distress for nearly two years.

I had an opportunity to use the remedy in a case of suppuration of the antrum with equally gratifying results. Four cases of this disease where the suppuration has been pronounced have been relieved more promptly than ordinarily by other methods.** In cases of suppurative ethmoiditis, where I have been able to reach the parts in consequence of some fortuitous malformation especially, comparatively prompt relief has been secured, unless necrosis existed, in which case, after removal of detritus, the disease was readily corrected. Whenever ulceration of the mucous membrane and suppuration are present, I think the remedy most useful. I have seen several instances where there was erosion and unhealthy granulation on the septum nasi smoothed and healed in a short time. The granulations on the border of a perforated septum cicatrize more readily when coated with an ointment of 20 grains of pyoctanin with an ounce of vaseline. Like Bresgen,†† I have found it useful after cauterizations, but I am not prepared to say, with my present experience, that it has a great advantage over iodol, iodoform, and some other remedies we are familiar with, except for the fact that septic poisoning has been escaped by patients operated on when I have used it. It quickly heals all aphthous ulcerations in the mouth.

It is useful as a local remedy in all acute follicular inflammations, and especially in those chronic follicular diseases of the tonsils and soft palate where we find inspissated mucus often crowded with micro-organisms, as *Leptothrix buccalis*. The effect of a fifty per cent solution applied in instances of this last named affection is immediately evident to the observer.

I have applied the remedy in but two cases of unquestionable diphtheria. Both recovered without sequelæ. One case was very severe, and one only moderately so.

Three cases of diphtheria were treated in the early summer and encourage me to give the remedy further trial.* Its effect on a single instance of membranous rhinitis was, as should be expected, prompt and salutary, the plastic deposit being quickly destroyed and not reproduced after three or four applications. My experience with the remedy in laryngeal phthisis does not cover a period sufficient to justify me in expressing a conclusive opinion, but I note† that Dr. Capart, of Brussels, presented at the Annual Assembly of Belgian Laryngologists, May, 1891, a case of ulceration and perforation of the soft palate, occurring after an ulceration of the tonsil, in which Koch's bacilli were found, healed rapidly under pyoctanin. He also exhibited two patients with laryngeal tuberculosis in whom the ulcerations had improved under pyoctanin. I have used pyoctanin with most satisfactory effect in both syphilitic and non-syphilitic ozæna."

* W. Pohl, Darmstadt, 1891.

† *Op. cit.*

‡ Stilling. *Anilin. Farbstoffe als Antiseptica.* Strassburg, 1890.

§ *Fortschritte der Medicin*, 1890, No. 12, p. 460.

‖ *Loc. cit.*

¶ *Deutsche med. Woch.*, 1890, No. 24.

** In the *Journal of Laryngology and Rhinology* for September, 1891, I find, in the report of the May and June meetings of the Berlin Laryngological Society, that Cholewa recommends pyoctanin for diseases of the frontal sinus, and Meyer reports two cases of antrum disease improved. In the same report Scheinmann says it can only help when combined with other remedies, and Katzenstein and Herzfeld never saw any effect from it.

†† *Loc. cit.*

* Pohl reports nine cases of diphtheria, not selected, treated successfully.

† *Journal of Laryngology and Rhinology*, August, 1891, p. 343.

Rain Making in Texas.

In *Nature* of September 17 (p. 473), Mr. H. F. Blanford has discussed at considerable length the rain-making experiments in Texas, on the basis of such information as was attainable from newspaper reports. Inasmuch as these telegraphic reports have not only been inadequate, but also frequently inaccurate and misleading, the writer, who was the meteorologist of the expedition, is led to give the following brief summary of the experiments and their results.

The experiments, which have been quite independent of the direction or patronage of the Weather Bureau, have been carried on by the Hon. R. G. Dyrenforth, special agent appointed by the Department of Agriculture. The plan of exploding oxy-hydrogen balloons was adopted as one of the principal methods to be employed, and several months were spent in preparing the necessary materials and apparatus. Preliminary experiments made in Washington demonstrated that a tremendous concussion could be produced by the explosions of balloons 10 feet in diameter filled with a mixture of hydrogen and oxygen in the ratio of two to one. In addition to the explosion of balloons, preparations were made to fire sticks of dynamite carried up in the air by kites, and to explode rackarock (an explosive consisting of three parts of potassium chlorate to one part of nitrobenzol) and dynamite on the ground.

With materials for carrying out these three lines of experiment, the party went to an isolated ranch 23 miles northwest of Midland, Texas (lat. 32° 14′, long. 102° 12′). The inauguration of the experiments attracted great attention throughout the whole southwestern section of the country, and, locally, people went from all the surrounding counties to witness the operations. Actual trial in the field soon developed the fact that the preparations for the balloon experiments were entirely inadequate. Accidents occurred to the furnaces for generating the gas, which took much time to repair, windy weather prevented the filling the balloons, and a combination of other sources of delay rendered this line of experiment a practical failure. One or two balloons were exploded on several days, but these were too few in number and too infrequent to serve the purpose of an adequate experiment. Similarly it was found impossible with the small available force to operate the kites to advantage, and in windy weather they were quite unmanageable; so that, although, in all, quite a number of dynamite sticks were fired in the air in this way, yet as a line of effective experiment this also proved a failure. The only explosions that were made on a scale even approximately commensurate with the requirements were those of rackarock, and it may be stated that all the effective operations essential at Midland can be duplicated in every essential particular with 1,500 pounds of rackarock, together with 500 feet of wire and a small portable dynamo.

The first rain that occurred after the party reached Midland began shortly after noon on August 10, and continued at intervals until evening. The amount of rainfall was not measured, but it was stated in the language of the country to be a good "grass rain." The writer, who was *en route* to Midland, met similar sharp showers in the latter part of the afternoon near the Sweetwater, 100 miles to the eastward. On the preceding evening some preliminary explosions had been made, but only on a small scale, and no result was anticipated. In the telegraphic dispatch that was sent reporting the rainfall no causative action was claimed; in fact, such action was explicitly disclaimed in the telegraphic report, which stated, "We do not think the explosions actually produced the storm, as they were not on a large enough scale. The preliminary trial was made simply to test the efficiency of the special blasting powder." The firing, which was not over half a dozen blasts, was, then, simply a preliminary trial of material, and not in any sense an experiment to produce rain.

On August 16, 17, 18, and 20 cloudy weather very largely prevailed, and numerous thunderstorms were seen on the horizon that did not visit the ranch. On each of these days blasts of rackarock and of dynamite were fired while heavy cumulus or dense storm clouds were in the field. In several instances, when a dense, threatening cloud was overhead, a sharp detonating explosion of rackarock or of dynamite was followed at an interval of 30 to 40 seconds by a spatter of rain, or, if it was already sprinkling, the blast was followed by a very noticeable increase of the drops. This interesting result occurred a sufficient number of times to indicate that the phenomenon was a real effect of the explosions. On none of these days, however, was the amount of rainfall appreciable, except on the 18th, when it was two hundredths (0·02) of an inch. The 18th opened cloudy, and old settlers predicted rain for the afternoon, whether the experiments should be made or not. To what extent, therefore, the explosions that were made were influential in producing the 0·02 inch that fell is obviously very difficult to determine, and as an evidence of the efficacy of the explosion it is practically valueless.

The next explosions were on the evening of August 21, when 156 pounds of rackarock were fired in fourteen blasts. During the night a genuine norther came on, the wind blew from the north, the barograph curve rose rapidly, the temperature fell rapidly, and during the next forenoon a fine mist prevailed. This change of weather was quite extraordinary and unexpected, and with its accompanying mist was attributed to the heavy firing of the evening previous; but the norther had been on its way for several days, and the fine mist was evidently due to the uplifting by the cold north wind of the warm moist air of the plains. At numerous points in the State, where the air was more humid, a heavy rainfall occurred.

The last experiment, which in magnitude was the greatest of all, took place on the evening of August 25, after the writer had departed. The conditions were thought to be extremely unfavorable for rain, and the party was advised to wait for a more propitious occasion. The firing, however, was carried on until 11 P. M., when the party retired for the night. It is reported that "at 3 A. M. the heavy rolling of thunder disturbed the sleepers, heavy banks of clouds were seen advancing, almost constantly lighted by most brilliant lightning. An hour later the rain began to fall in torrents on the ranch, and did not cease till 8 A. M." Unfortunately, records of the *amount* of rainfall have not yet been received, but I am informed by a gentleman who was present that "it was nothing but a sprinkle." Further light is thrown on this rainfall by the weather map for 8 P. M., eastern time, of August 25. Rainfall is shown in New Mexico to the northwest of Midland, Texas, and the forecast officer made the following prediction: "For Eastern Texas, generally fair, except *local showers* on the extreme southeast coast *and the northwest.*" Here we have an official prediction made in Washington City of probable showers over the district in which the experimenters were operating, and for the very night in which the thunderstorm followed the last of the explosions to produce rain.

In view of these facts, it is scarcely necessary for me to state that these experiments have not afforded any scientific standing to the theory that rain storms can be produced by concussions. But, if the adherents of the theory maintain that "no experiment has been tried that is worthy of the name, and that no results ought to be looked for," it will be difficult to take opposite ground.

GEORGE E. CURTIS.

Smithsonian Institution, October 9.

The Lake Marine Exhibit.

Mrs. Annie C. Meyers, lady alternate of the World's Columbian Exposition, to whom has been intrusted the work of preparing an exhibit of the lake marine, is the widow of the late Capt. Victor E. Meyers. He was the first captain backed by a Chicago syndicate to successfully sail by the way of the Welland Canal and the St. Lawrence River to the West Indies and return. Prior to his death he commanded the freight steamer City of New York, of the Union Steamboat Company, plying between Buffalo and Chicago. Mrs. Meyers is thought to be in every way qualified for the work. She at one time held a position in the Patent Office and has for many years been prominently connected with foreign and home missionary movements.—*Marine Review.*

SOME SUGGESTIONS IN PHOTOGRAPHY.

BY GEO. M. HOPKINS.

The field of photography has been enormously enlarged by the perfection of the different methods of artificial illumination. An entirely different class of subjects is rendered available, and persons whose business monopolizes all of the daylight are furnished opportunities for the gratification of photographic tastes, provided their ambition does not lead them to a desire to "take all out of doors" at night.

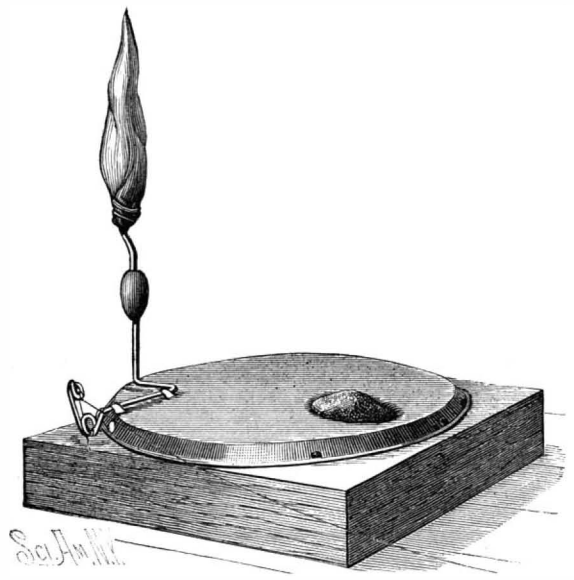


Fig. 1.—SIMPLE FLASH LIGHT.

In times past, some fault has been found with flash light pictures on account of the anxious expression of the subject caused by the expected explosion of the powder, or the closed eyes which are characteristic of pictures secured by flash lights that are not practically instantaneous.

It follows that a flash light must do its work "quicker than a wink," and that it must be ignited by some device other than a fuse or strip of paper, either of which gives warning and thus puts the subject on guard. Flash light lamps are undoubtedly good, but so far as the writer is aware, they are all limited in certain ways. In the first place it is necessary to compress a bulb to force air through a greater or less length of tube. This requires some effort on the part of the operator, and practically prohibits him from including himself among his subjects. If he does attempt to do this, the rubber tube leading from the bulb to the lamp must necessarily form an unsightly addition to the picture; and furthermore, the tube is limited as to its length, on account of the air friction, which so reduces the blast in a tube of considerable length as to entirely defeat the operation of the light.

After enumerating these objections to the ordinary flash light lamp, it is perhaps unnecessary to allude to the matter of expense. However, the lamps range in price from $1.50 upward.

In Figs. 1 and 2 is shown flash light apparatus the cost of which is practically nothing, as the needed materials may be purchased for a few cents, and the labor involved is a matter of only a few minutes. A description is hardly necessary; the engravings tell the whole story.

Two loops soldered to the bottom of a small tin pan

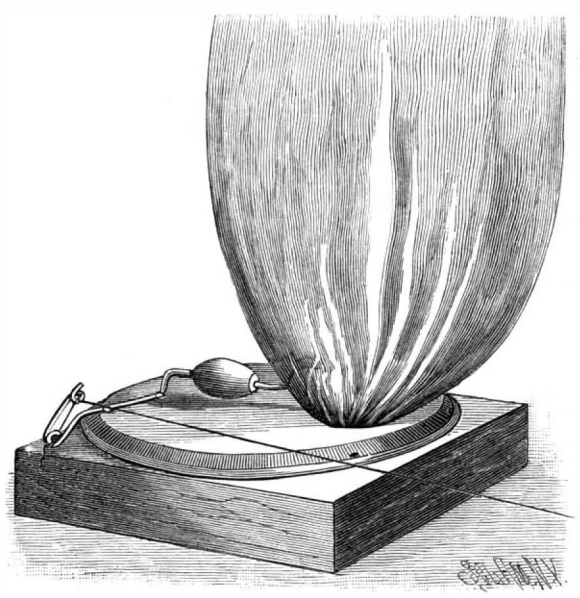


Fig. 2.—THE FLASH.

receive a wire which is bent at one end, forming a spiral, into which is inserted a little roll of asbestos. A fish line sinker is placed on the wire previous to bending, and near the pan the wire is bent to form a shoulder, which holds the wire in a stable position when raised, as shown in Fig. 1. The other extremity of the wire is bent at nearly a right angle and formed into a loop, then returned to form a practically T-shaped arm with an open eye at its extremity. A stout black thread of sufficient length to reach as far as may be required is tied in the loop.

At the point in the surface of the pan where the asbestos strikes when pulled over, a shallow cavity is formed by burnishing the tin with a rounded instrument like a tool handle, the tin being placed over a cup, a box cover, or something of that kind which will support the metal around the cavity during the operation of burnishing.

The pan is secured to a heavy wooden block or to any fixed support by means of two or three tacks driven through its rim. One or two boxes of Blitzpulver should be placed in the cavity in the tin; a few drops of alcohol are poured on the asbestos; the apparatus is placed on a step ladder or other high support, which is located at the side of the camera in such a position as to prevent the light of the flash from entering the camera tube. A large piece of white paper is suspended at the back of the apparatus and from 18 to 24 inches distant. If the operator is not included among the subjects, the black thread is simply connected with the lower loop, so that a rearward pull of the thread will tilt the wire arm forward. If the operator desires to include himself in the picture, the thread is slipped into the eye at the end of the wire, so that pulling the thread from the front will tilt the wire arm forward. Now, everything being ready, the alcohol is lit, the operator takes his position, pulls the thread, and the thing is done.

When the subjects are so posed with reference to the source of light as to produce undesirable dark shadows, this trouble may be avoided by arranging newspapers so as to reflect more or less light on the shaded side.

To secure good flash light pictures, two things in addition to a good instrument are required; one is an instantaneous light of sufficient intensity, the other is an instantaneous plate of the kind known as isochromatic or orthochromatic.

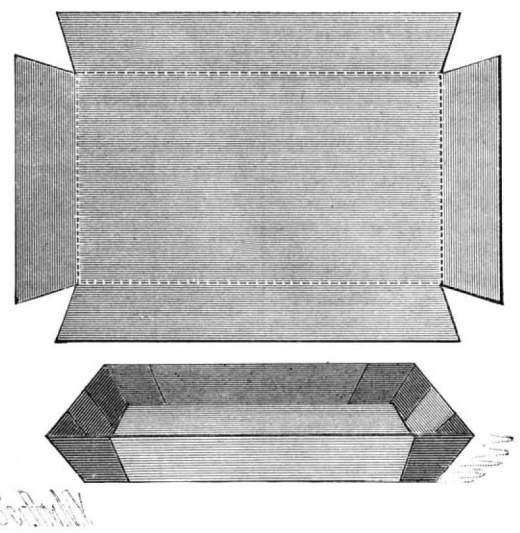


Fig. 3.—INEXPENSIVE TRAY.

Among the items of expense in the list of the amateur photographer's supplies will be found trays for developing, fixing, intensifying, toning, etc., and the temptation is often great to make one or two trays answer all purposes; but modern photography forbids the double use of trays, so that the operator must either purchase or make trays for himself. In Fig. 3 is seen, in the upper figure, a pasteboard blank, which, when creased as indicated by the dotted lines, bent up and fastened at the corners by pieces of cloth glued inside and outside as shown, forms a foundation for a serviceable tray. All that is required to complete the job is to fill the pores of the pasteboard and cloth with paraffine.

There are two ways of doing this. One is to dip the tray into paraffine melted in a pan of suitable size; the other way is to melt the paraffine by means of a hot iron and allow it to drop on the pasteboard, afterward spreading it with the hot iron. In either case a liberal supply of paraffine should be left in the corners. Paraffine candles will furnish the material for saturating the tray when paraffine in bulk is not available.

In Fig. 4 is represented a simple, easily made and efficient negative rack. It consists of thin wire frames pivoted to the base board and provided with corrugations for receiving the edges of the plates.

In Fig. 5 is shown a method of dark room illumination which permits of examining the negative thoroughly during the process of development without unduly exposing the plate. It consists of a two-candle power incandescent lamp attached to a handle and inclosed by a hemispherical reflector closed at the front with a disk of dark ruby glass. The lamp is held near the plate. All of the light is thrown downward, so that the eyes receive only the light reflected from the plate. Furthermore, only a small section of the plate is exposed to the light at any time. When the lamp is not in use in the manner described, it is either laid face down on the table or suspended so as to light the dark room

The Clouds.

Mr. John Aitken has been investigating clouds from the summit of the Rigi and Pilatus. He now finds, says *Science Gossip*, as in former observations, that fog is intimately dependent on the presence of dust particles in the air, each of the invisible granules forming the nucleus of a tiny head of water, these vesicles

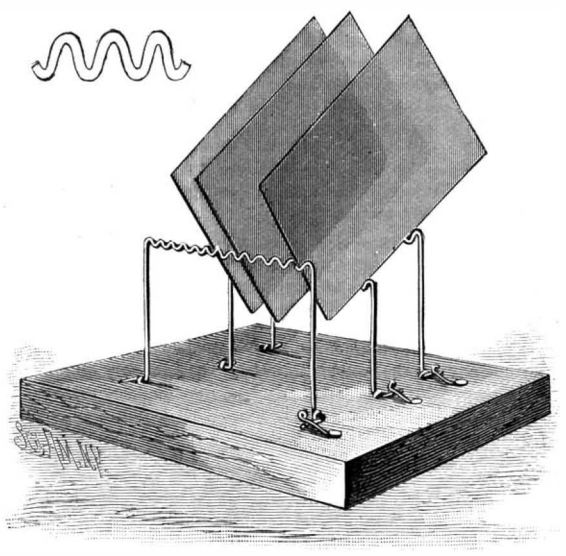


Fig. 4.—PLATE RACK.

constituting in the aggregate clouds, mists, and their kindred. At elevated situations the air is comparatively free from dust, while lower down it is full of it. But while clouds are passing over a peak the number of particles varies considerably. This, he discovers by a series of carefully compiled data, is due to the fact that the air entering into the clouds has forced itself up from the valley below. Hence the mountain air is pure or impure in exact accordance with the amount of this lower world current which has reached it. When the cloud vanishes, the ether resumes its old composition. Another curious fact just discovered by the same indefatigable observer is that the moment a cloud forms, it begins to discharge its contents in the shape of a steady shower of minute drops. These drops are not capable of being appreciated by the unassisted senses; but by the "fog-counter," an instrument of Mr. Aitken's invention, the exact number falling on a given space can be readily noted. What is still more curious is that though the air is in such circumstances saturated with damp, seats, stones, and other large objects near the earth are perfectly dry, the drops being evaporated by the radiant heat of the ground; but a pin's head or other small object, not offering the same area, is in these circumstances often covered with a minute globule of water. The fact of a cloud thus beginning to rain small drops whenever it is formed may account for the disappearance of these vaporous masses without any change in the wind or temperature. They gradually exhaust themselves.

W. A. HERRING, Mayor of Water Valley, Miss., informs us that the Illinois Central R.R. Co.'s shops at that place have ten 3 inch Cook brass strainer tube wells 30 to 60 feet in the ground, nearly all of which run water to near the surface, connected together to a 6 inch pipe which supplies 150,000 gallons per day for use of shops. Water falls two miles northeast on

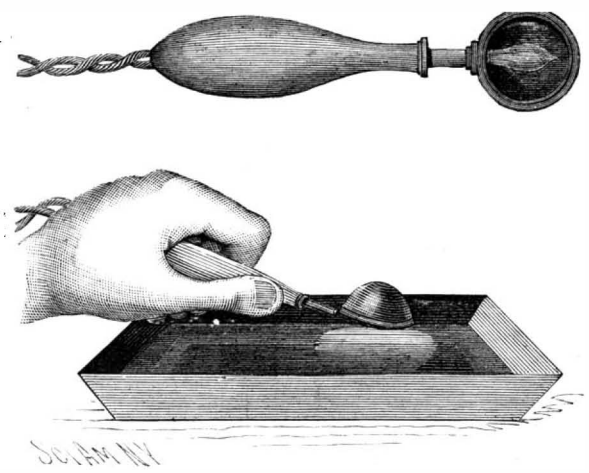


Fig. 5.—ELECTRIC TRAY ILLUMINATOR.

Black Jack Ridge, and percolates down through strata of pipe (good gig) clay and fine sand to the Creek Valley, where it breaks out in springs, and make an ever running brook 20 feet by 6 inches of water. The water used by railroad shops is as soft as rain water, clear and fine tasting; no appearance of mineral in it. It is rain water filtered through natural beds of sand.

RECENTLY PATENTED INVENTIONS.

Engineering.

FURNACE.—Emilio De Strens, Rome, Italy. Two fire or combustion chambers are provided in this furnace, one above the other, the design being to obtain a high temperature from solid fuel of any kind, especially that containing a large proportion of slag. The upper fire chamber has a front opening for the feed, and ordinarily left open to admit air, and has grate bars of refractory material, downwardly converging openings from which lead to the lower fire chamber. The latter has an ordinary grate extending rearward at a sharp incline, and in a space front of the bridge wall below the lower end of the grate is an opening leading to the ash pit, adapted for the flowing away of fused slag. The draught is downward through the upper fire chamber, and through the lower one to the mixing chamber front of the bridge wall, the ignited and partially burned fuel falling and its combustion being completed in the lower chamber.

BOILER CLEANER.—John L. and William E. Alexander, Hazlerigg, Ind. This invention consists of a pipe adapted to slide into and along the bottom of a boiler, entering through a blow-off valve, and disturbing in its course the impurities in the bottom of the boiler, which are drawn into and blown out of the pipe. From the outlet of the blow-off valve extends a short pipe carrying a stuffing box, through which slides the pipe of the cleaning device, having at its outer end a valve, and clipped to the short pipe is a frame carrying a drum rotated by a crank arm, a rope on the drum being connected with the sliding pipe for moving it in and out. The device is readily fixed in its place for the work designed, and removed after this is effected until it is again wanted.

Railway Appliances.

RAILWAY COACH. — Jesse P. Tillson, Union City, Ind. This coach has a series of doors in its sides, in pairs, hinged at their adjacent edges to open outward back to back, there being a latch for each door operative from within and without the car, with a series of vertically sliding bolts on the inner sides of the doors and a sliding bar having depending arms engaging the upper ends of the bolts, preventing the doors from swinging outward until the bar is retracted or the bolts pressed down. A door is to be located in the side of the car opposite each seat, means being provided for simultaneously locking or unlocking all the doors, and whereby also any door may be unlocked without disturbing the others. This construction provides ample exit in case of accident or fire, and such cars may be used for street railways as well as general railway service, each door preferably having a drop window.

CAR COUPLING. — Gabriel Rohrbach, Del Rio, Texas. This coupling is adapted for connection with one of the ordinary type with a link and pin, and is also designed to afford means to automatically connect cars and disconnect them from the roof or side of a car. The drawhead is spring-supported, and has its lower wall recessed to receive a pivoted jaw plate having depending flanges, so that its inner edge will be held raised by gravity, there being a device movable from the top or side of the car to rock the jaw. The draw bar is slotted and has a hook shoulder at each end, on its bottom surface and on each side, and is designed to interlock with the free inner edge of the pivoted jaw, or an ordinary coupling pin may be passed through the slot.

Mechanical Appliances.

CIRCULAR KNITTING MACHINE.—Max Gernsnym, Brooklyn, N. Y. This invention affords an improved construction whereby part of the tubular fabric is formed with a figured design according to a predetermined pattern, while the rest of the fabric is knitted in the usual manner in plain ribs with Cardigan or other stitch. According to the invention the cylinder or plate, or both, are formed in sections, one of which is shifted to change the relative position of part of the cylinder and plate needles, there being pattern wheels governing the movement of the movable section to reproduce on the fabric the pattern represented by the pattern wheel.

TRESTLE.—Thomas J. Peck, Ballston Spa, N. Y. This is an adjustable trestle or horse for the use of carpenters, masons, and others, to support work or scaffolds at any desired height between two and four feet without the use of blocking. Its main portion is formed of a bar of channel iron, to opposite ends of which are attached castings with sockets into which are screwed pipe legs and a central sleeve through which slides a standard projecting into a cross beam. The sleeves are cut away to receive friction grips, consisting of an eccentric on a pivoted lever, whereby the movable parts of the trestle are readily clamped in fixed position, or released for adjustment to any desired height.

Agricultural.

CULTIVATOR. — Bosil F. Coulomb, Clifton, Ill. This cultivator is capable of use either as a walking or riding implement. It has swinging frames in which are pivoted shanks adapted to receive various styles of cultivator blades, shovels or teeth, the frames being so constructed and hung, and the shanks so located, that the frames may be carried forward or outward in a horizontal line without lifting the blades or shovels from the ground, or pressing them farther in. Any desired degree of inclination may be given to the harrow or cultivator teeth, or to the shovels and cultivator blades, according to the character of the ground and the plants to be cultivated, the frames being carried toward or away from one another to cultivate wide or narrow rows.

PLANTER AND FERTILIZER DISTRIBUTER.—Andrew M. Hanna and Lewis J. Walker, Kosciusko, Miss. This is a combination implement of simple, strong, and inexpensive construction, adapted for attachment to an ordinary plow beam. It is provided with a slide valve capable of being positively and safely locked to permit more or less of the fertilizing material to be fed from the hopper, and its construction is such that one kind of seed may be planted and fertilizer distributed at the same time with the seed, or two kinds of seed may be planted, being dropped alternately, and fertilizer supplied at the same time.

Miscellaneous.

PROJECTILE. — Abraham Martin, Birmingham, England. This is an explosive projectile or shell, in the base of which is a screwed socket for the fuse of sufficient length to prevent the blowing out of the fuse and the consequent failure of the shell to burst under the force of the explosion. A ring or bush is first screwed into the base of the shell, the rear end of which is then closed or contracted behind the ring by means of dies, the closed-in base of the shell and the ring or bush together, or the bush alone, as the case may be, affording the necessary length of socket for the fuse.

PNEUMATIC GRAIN CONVEYER.—Frederic E. Duckham, Millwall Docks, London, England. This invention relates to the means whereby the admission of air in sufficient quantity to the mouth of the suction pipe is insured, so that the individual grains will be suspended or caused to float in the current and thus obviate choking of the suction pipe. For this purpose the nozzle is surrounded by a sleeve inclosing an air passage opening above the level of the grain in which the nozzle is inserted, the sleeve not extending entirely to the mouth of the nozzle, whereby air will be drawn through the sleeve to enter the nozzle with the grain.

FENCE WIRE REEL. — Mendal F. Reagan, Salisbury, Mo. A simple and durable construction is provided by this invention for conveniently and rapidly winding up or rereeling barbed or other wire that has been used on and taken from fences, posts, or other places. It consists of a light two-wheeled vehicle, from which one of the wheels may be readily removed to place and secure a spool on the axle, the spool when filled being as readily replaced by another spool. The vehicle is ordinarily pushed forward to wind the wire, the operator at the same time turning a crank arm near the end of the frame to operate a sprocket chain and sprocket wheel on the axle, or the vehicle may be at a standstill, and the wire wound by operating the crank arm.

HOOD FOR FIREPLACES. — John S. Wallace, Nelsonville, Ohio. This hood is pivoted above the fireplace, and consists of a semicircular or semirectangular cover to which is pivoted a series of flexible strips adapted to close one upon the other, the strips having recesses and stops to limit their movement. The improvement forms a simple adjustable device which may be attached to any kind of a fireplace and folded up so as to leave the fireplace entirely exposed or let down to partially inclose it, preventing ashes and dust from scattering about when the fire is shaken, and also increasing the draught.

BROMINE COMPOUND. — Frank H. Fischedick and Charles E. Koechling, New York City. This compound is designed as a medicine for the cure of nervous excitement, insomnia, headache and neuralgia, and for use in fevers. It is a new composition of matter derived from a combination of certain proportions of aniline, alcohol, and bromine, the solution and crystallization being effected after a specified manner, and the product being designated as bromanid. The crystals are of needle shape, small, white, brilliant, and nearly tasteless, while having a faint aromatic odor.

ALKALINE CARBONATE AND CHLORINE.—Farnham M. Lyte, 60 Finborough Road, London, England. This invention relates to a conjoint process of continuously producing alkaline carbonates and chlorine and their derivatives. The process consists in decomposing sodic or potassic nitrate by heating it with calcic carbonate, lixiviating out the sodic carbonate and converting the nitrous fumes evolved into aqueous nitric acid by the action of air or oxygen and water, dissolving plumbic oxide in the nitric acid, precipitating plumbic chloride by means of sodic or potassic chloride, fusing the plumbic chloride, and decomposing it electrolytically to form chlorine and metallic lead for use over again.

LAMP WICK RAISER.—Martin A. McBride, Woodville, Texas. The wick-operating wheel of this device consists of a cylinder formed with a series of coarsely pitched helically arranged ribs triangular in cross section, the ribs being so pitched that they extend from end to end of the cylinder without making a complete revolution. This wheel is secured on a shaft mounted to turn in bearings in the cap of the burner, the cap supporting in the usual manner the tube through which the wick passes. The device is designed to be of simple and durable construction, effectively facilitating the moving of the wick in the tube without cutting or tearing the wick.

INNER SOLE. — Augustine F. Littlefield, Lynn, Mass. This is a patent for an improved article of manufacture, in which a filling of leather, rubber, or other suitable material is glued, stitched, or otherwise fastened in the channel of the inner sole, a veneer being secured to its top surface and doubled over the edge to cover the channel. The object of the improvement is to produce an inner sole which will be light and flexible, but which will have sufficient strength, while it may be made of lighter stock than the inner soles in ordinary use.

GLOVE.—Isaac W. Lamb, Colon, Mich. This is a knitted glove composed of a main blank having finger pieces narrowed at the bases, the blank being narrowed at the point where the thumb is attached and having its upper portion of uniform width, while the thumb blank is secured to the main blank at the point of narrowing. The object of the invention is to produce a perfect fitting glove of good quality, which will look nicely when off the hand as well as when on.

CHECK BOOK. — Edward North, Newhall, Cal. In this book the stubs of each succeeding check vary in shape, dimensions, or position, so that as the checks are drawn and detached, the amounts of all the checks drawn will be plainly visible in column order, one below the other, thus affording great convenience for adding and footing them. A special stub is also provided for bringing forward check footings, and a leaf is inserted for entering deposits and showing balances.

BOX PULL. — William J. Evans and William H. Kunert, Minneapolis, Minn. This is a simple and inexpensive device adapted for ready attachment to any form of fragile box, especially paper boxes, as it has a large bearing surface on the box, whereby the strain will be so distributed that the box may be readily moved without injury. The pull is made with a back plate having ears adapted to project through the side of a box, while a front plate has end slots to receive the ears and diagonal slots for the insertion of a label, a removable handle being secured in the ears.

LABEL AND TWINE CABINET. — Thomas M. Haynes and William H. Gunning, Palestine, Texas. The cabinet provided by this invention is designed to facilitate the speedy and correct selection of any desired label, and is arranged for the storage of quantities of various styles of labels in a distinctive manner in a neat, compact, and ornamental device. The casing has a partly open front and a drawer below, while the casing is a rotating many-sided label-holding cylinder, glazed doors being hinged to bars on its periphery and springs holding the doors normally closed. There are finger springs for each door, holding the labels so they may be seen.

MUSICAL INSTRUMENT ATTACHMENT. —George W. Van Dusen, Norwood, N. Y. This invention provides a tremolo attachment for string instruments, consisting of a tremolo block adapted to press the free end of one of the levers of the set of levers connected with the unison strings, so that when the hammer strikes these strings, the one connected with the lever pressed on by the tremolo block produces a higher sound, which sound mingling with the rest produces a tremolo sound of the unison string. The device is designed to be very simple and effective, and completely under the control of the performer.

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

Business and Personal.

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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.

(3661) W. F. A. asks (1) for a receipt for electro-plating in bronze. A. For general electro-plating we refer you to our SUPPLEMENT, No. 310. We can also supply Watts "Electro-Deposition of Metals," $3.50 by mail. 2. What temperature is required to melt gold? A. 2016° Fah.

(3662) B. J. asks: 1. How can I glue or cement emery dust on wooden wheels? A. You can apply the emery directly to the wood, or you can first cover the wood with leather. Prepare a solution of white glue, to which add a very small percentage of common molasses, say 1 or 2 per cent. Spread the emery out on an iron plate heated to about 200° Fah. Coat the wheel smoothly with glue and immediately roll it in the emery. When the glue is dry, brush off

the surplus emery. 2. How shall I manipulate gutta percha to use it as a cement? A. For a flexible cement melt together equal parts of brown pitch and gutta percha. For a hard cement melt together gutta percha, pitch and sheliac, equal parts. 3. How to determine whether a battery is working? A. If it is a single cell, touch the ends of the wires to the tongue. If there are several cells, dip the wires in acidulated water. Gas will rise from the wires if the battery is active. A galvanometer, however, is preferable.

(3663) C. C. asks: Is there any way of deodorizing the common coal oil used in our lamps? What will do it? I have been using it for ten years as a hair dressing which keeps the hair soft and moist, but its disagreeable odor is a great objection to its use. A. Something can be done in the way of deodorizing coal oil by treatment with a mixture of bichromate of potash and concentrated sulphuric acid. If these are mixed and agitated with it, and the whole is then allowed to settle, the oil can be siphoned off, and after washing with water containing a little washing soda, will be found improved as regards odor. Conduct all operations without heat, and experiment on small quantities. The first named chemicals are very corrosive and poisonous. You might also try simple agitation with bone black. This is simpler, and might be measurably effective.

(3664) H. T. asks: 1. Does the generator in the Bell telephone connect with the main line and ground direct, or does the current pass through some of the other parts than the polarized bell? A. The magneto generator is connected through the bell magnet with the ground, either directly or through an annunciator. 2. Does the continued excessive sparking of a dynamo or flickering of the lamp indicate leakage? A. The sparking shows that the commutator is rough or otherwise out of order, or that the brushes are not correctly adjusted, or that the armature is not properly constructed. 3. What would an eight light dynamo like one described in SUPPLEMENT, No. 600, cost, ready made? A. About $100.

(3665) T. B. asks: 1. What is a magneto-electric machine? What is the difference between one and a dynamo? A. The magneto-electric machine is one in which the armature revolves between the poles of the permanent magnet. In a dynamo, the small residual magnetism of the iron core of the field magnet serves to slightly excite the armature, generating a small current, which traverses the winding of the field magnet and increases the original magnetism until the maximum is reached. The field magnet of the dynamo is an electro-magnet. 2. How is the electric system of timing races, as practiced a short time ago at the athletic meeting in St. Louis, managed? A. In the electric system of timing races an electric contact maker is arranged to be operated by a bullet from a pistol. The starter fires the pistol into the contact maker, thus giving the signal for the start, and at the same time causing an electrical impulse to be sent, which sets in operation the recording mechanism. The mechanism continues operative until the runners reach the end of the course, where is stretched a thread connected with the recorder, which is broken by the runner and causes an electrical record of the close of the race to be made. 3. What is carbolic acid? Is it poisonous? A. Carbolic acid is a product of coal tar. It is a light liquid which often crystallizes in long needles. It is very poisonous. 4. What is the poison brucine, and how is it made? A. Brucine is extracted from the bark of the *Bruce antidysenterica*. It has also been detected with strychnine in nux vomica. It is made by reducing the bark to a coarse powder, digesting it in ether to remove fatty matter, then with strong alcohol. The alcohol solutions are then distilled to drive off the alcohol. The matter remaining is dissolved in water and subacetate of lead is introduced to throw down the coloring matter. The excess of lead is removed by sulphureted hydrogen. The brucine is then precipitated by boiling it with magnesia. The liquid is evaporated, when a brown granular alkaline mass results. This is saturated with oxalic acid, and the oxalate is washed with absolute alcohol. The brucine is obtained by decomposing the oxalate by boiling it with magnesia and water. The brucine is then dissolved in boiling alcohol, which yields crystals of pure brucine when the solution cools.

(3666) A. S. H. asks how much wire, size, etc., and all that is needed to make a battery for shocking purposes, such as is used in the medical batteries. A. For an ordinary shocking coil make a bundle of soft iron wires, 3/8 of an inch in diameter and 3 inches long, of No. 24 wire. Wrap this with two or three thicknesses of stout paper, glue on a pair of heads to form a spool, and wind on the paper-covered core two layers of No. 20 magnet wire for the primary of the induction coil. Wrap this coil with two thicknesses of paper, and upon the paper wind twelve or fifteen layers of No. 36 silk-covered magnet wire. Bring out the terminals of this fine wire secondary coil, and connect them with binding posts for receiving the handles. Provide the primary wire with a circuit breaker, and connect the primary with a plunging bichromate battery. The strength of the current may be varied by sliding over the outside of the secondary wire a piece of brass tubing.

(3667) W. G. G. writes: To settle a doubt in regard to the winding of the armature of electric motor described in SUPPLEMENT, No. 759, will you kindly inform me if the armature is not wound in precisely the same manner as that of the dynamo in SUPPLEMENT, No. 600, with the exception that instead of twenty-four divisions of the periphery of the armature core in the dynamo, the armature of the motor is divided into but 12 divisions on the periphery of the core? A. The armatures are both wound according to the same system.

(3668) J. S. P. asks for the manner of polishing tortoise shell. Would like the successive steps of scraping or cutting down and final fine polishing. A. Tortoise shell is prepared for polishing by smoothing it with a single-cut file, then scraping it with a scraper like those used on wood. If this part of the work is carefully done, the polishing may readily and quickly be effected by holding the work on a thick leather buff charged with calcined Trent sand and oil, or fine pumice stone and oil. The finishing is done with rottenstone and oil, applied with similar wheel, the final touches being given by means of rotten stone applied dry with the hand.

(3669) L. H. & Co. write: We have a 5 inch steam pipe in dry kiln which has a bad leak at a coupling. Can we get or make a solder of some kind to close it without taking out the pipe? We also inclose specimen; please let us know what it is? A. If the coupling is wrought iron, you can calk the leak with a calking iron and hammer. If you are not able to stop the leak in this way, a clamp of wrought iron should be made to fit the place where the leak is, and bolted tightly over the leak with a thick piece of rubber between clamp and leaky place. The specimen is pyrites, composed of iron and sulphur.

(3670) L. M. W. asks: 1. What is the chemical difference between artificial and common camphor? A. Camphor is a terpene, a hydro-carbon ($C_{10}H_{16}$). Camphor contains oxygen. A typical formula is $C_{10}H_{18}O$. 2. How is bisulphide of carbon changed to the proto-sulphide? A. It is said by Sidot to be obtained by exposing the bisulphide to the sunlight in sealed glass tubes. Free sulphur and monosulphide are formed. The latter is dissolved out with bisulphide. 3. Is the protoform a crystal or liquid? A. It is a maroon-colored powder.

(3671) I. K. M. writes: I have a deposit of kaolin, which shows aluminum 40 per cent, silica 45 per cent, and iron about 2 per cent. I have also a deposit of marl, which shows by the analysis 65 per cent of carbonate of lime, and have been informed with these two articles combined, a first-class article of cement can be made. A. You can only tell by experiment what your materials will give. Mix ten per cent of the kaolin with ninety per cent of the marl, knead with water into lumps, and burn in a coal or charcoal fire. Grind and experiment by making briquettes with water, observing time of setting, etc.

(3672) A. W. N. asks for best receipt for dressing over rubber carriage tops. A. The varnish for this purpose is made by digesting orange shellac in ammonia until a solution is effected, which will require several days. Another varnish often used for this purpose consists of refined asphaltum cut in turpentine. It should be applied quite thin.

(3673) R. F. asks: Explain choke boring in a shot gun, the principle on which it depends, the manner in which it is done, and whether guns are choked throughout the entire length of the barrel or only a portion of the length? A. Many systems of choke boring have been tried, affecting different portions of the barrel. It is done by reaming or drilling. The general system is to choke or diminish the bore at the muzzle. This is supposed to deflect the outer pellets inward and to secure a more compact distribution of shot.

NEW BOOKS AND PUBLICATIONS.

ELECTRICITY SIMPLIFIED. The Practice and Theory of Electricity. By T. O'Conor Sloane, E.M., Ph.D. New York: Norman W. Henley & Co. 1891. Pp. 160. Price $1.

This book is designed to give a kind of information much needed by the student of electricity, but heretofore obtainable only by digesting a number of comparatively extensive works. It goes into the theory of electricity and furnishes many apt analogies of electrical action, giving examples of its practical application in every-day life. The analogies are new and well calculated to elucidate points which are generally regarded as obscure. As examples of its treatment of the subject, the sections devoted to the velocity of electric transmission, the relations of static and dynamic phenomena, the meanings of the units, volt, ohm, etc., may be cited The dangers of the current and conditions for the death-giving shock are also explained at some length.

PICTORIAL ASTRONOMY FOR GENERAL READERS. By George F. Chambers. London: Whittaker & Co. 1891. Pp. xvi, 268. Price $1.25.

This little manual is one of Whittaker's Library of Political Science. It is well illustrated and quite popular in its tone. As it is not written with a view to cramming for an English examination, its scope does not appear subject to the disagreeable limitations that so often mark contemporary English works. It is a review of the celestial world, rather from the old than from the new standpoint. For this reason it will be found to be of more popular cast than if the spectroscopic and photographic methods of the observatory had filled the greater part of the text.

PRINCIPLES AND PRACTICE OF PLUMBING. By S. Stevens Hellyer. London: George Bell & Sons. 1891. Pp. xv, 294. Price $2.

Mr. Hellyer is already well known on this side of the ocean by his other writings on this subject. In the present book the details of sanitary plumbing are treated with numerous illustrations of good and bad practice. The minutiæ of the subject, such as the making of wiped joints, the treatment of the solder, their proper length and size, etc., are given in practical form. An excellent index and a full table of contents, with the numerous illustrations, add greatly to the value of the book.

A Souvenir Edition of the Memphis *Evening Scimetar* presents a notably enterprising newspaper novelty. It is a large illuminated quarto containing reproductions from photographs of the principal churches, schools, public buildings, and private residences of the city of Memphis, with portraits of more than a hundred of its representative citizens. The pictures, as a whole, are remarkably excellent, and the enterprise of the publishers will doubtless receive a high degree of appreciation from Southern people, as they deserve to have. The beautiful buildings of Memphis, as portrayed in this illuminated *Scimetar* number, equal those of many of our larger northern cities, both in number and beauty of design.

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FINANCIAL.

NINTH NATIONAL BANK,
New York, November 2, 1891.

At a special meeting of the Board of Directors held this day, Mr. John K. Cilley was unanimously elected President of this Bank, in place of Mr. C. Henry Garden, resigned, and Mr C. Henry Garden was unanimously elected Vice-President.

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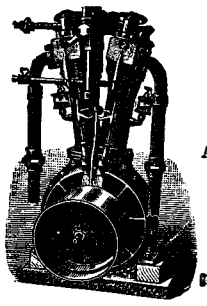

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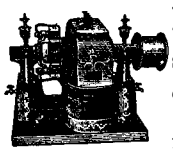

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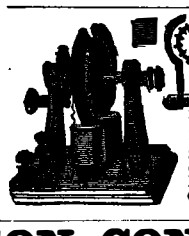

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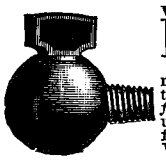

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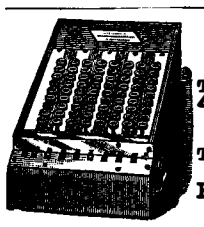

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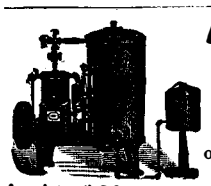

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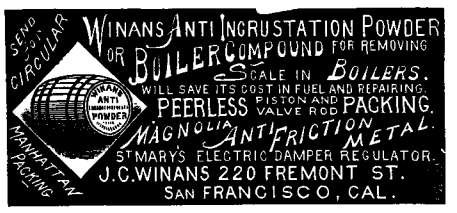

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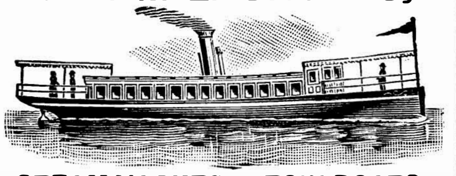

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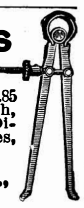

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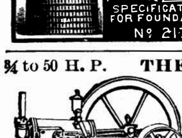

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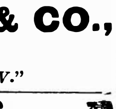

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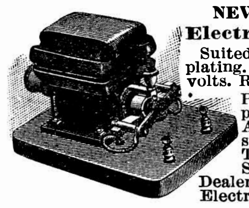

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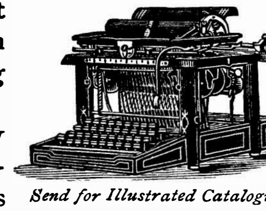

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