SCIENTIFIC AMERICAN

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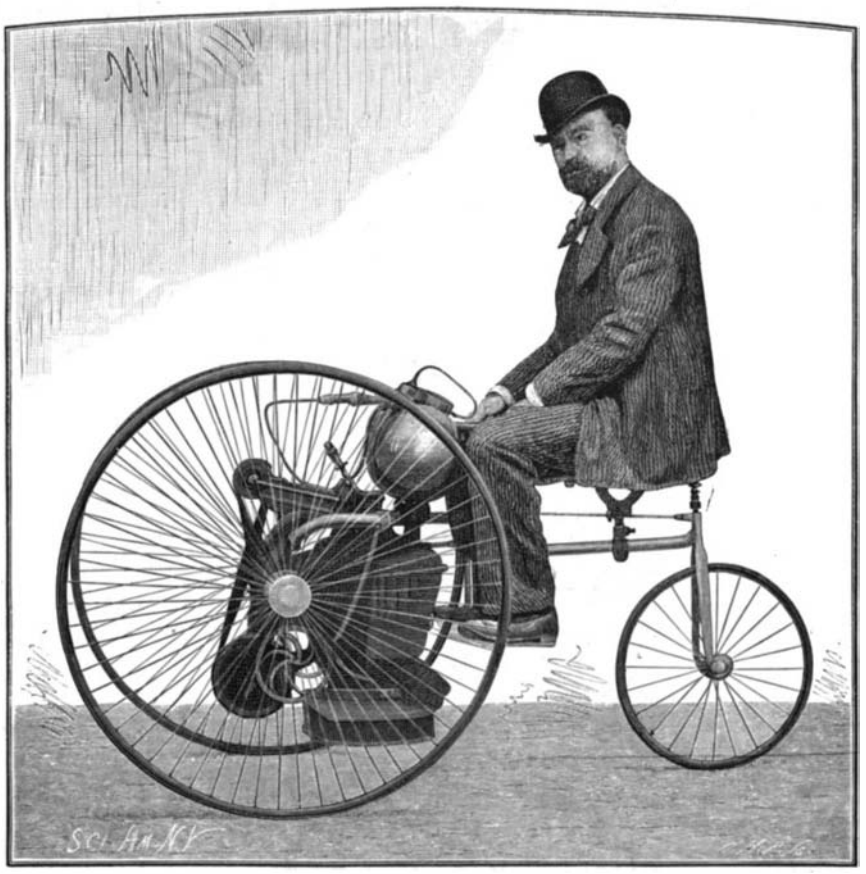
A NEW STEAM TRICYCLE.

We present an illustration of a French device, the steam tricycle, built by MM. Hildebrand and Wolfmuller, in which the mechanism is reduced to its simplest form. The motor consists of two cylinders which are arranged to impart motion to the large driving wheels of the tricycle by the medium of a twisted belt and gear wheels. The boiler is placed behind the engine, is spheroidal in shape and is made of steel. It is completely covered with asbestos or other non-inflammable material almost one-half inch thick. This asbestos is soaked with the inflammable material. When the machine is to be operated the combustible liquid is lighted, and at the end of fifteen minutes the pressure of the steam in the boiler is sufficent to actuate the motor. The pressure required is 60 pounds of steam, but the boiler is tested to 180 pounds, so the pressure can be increased when greater speed is desired.

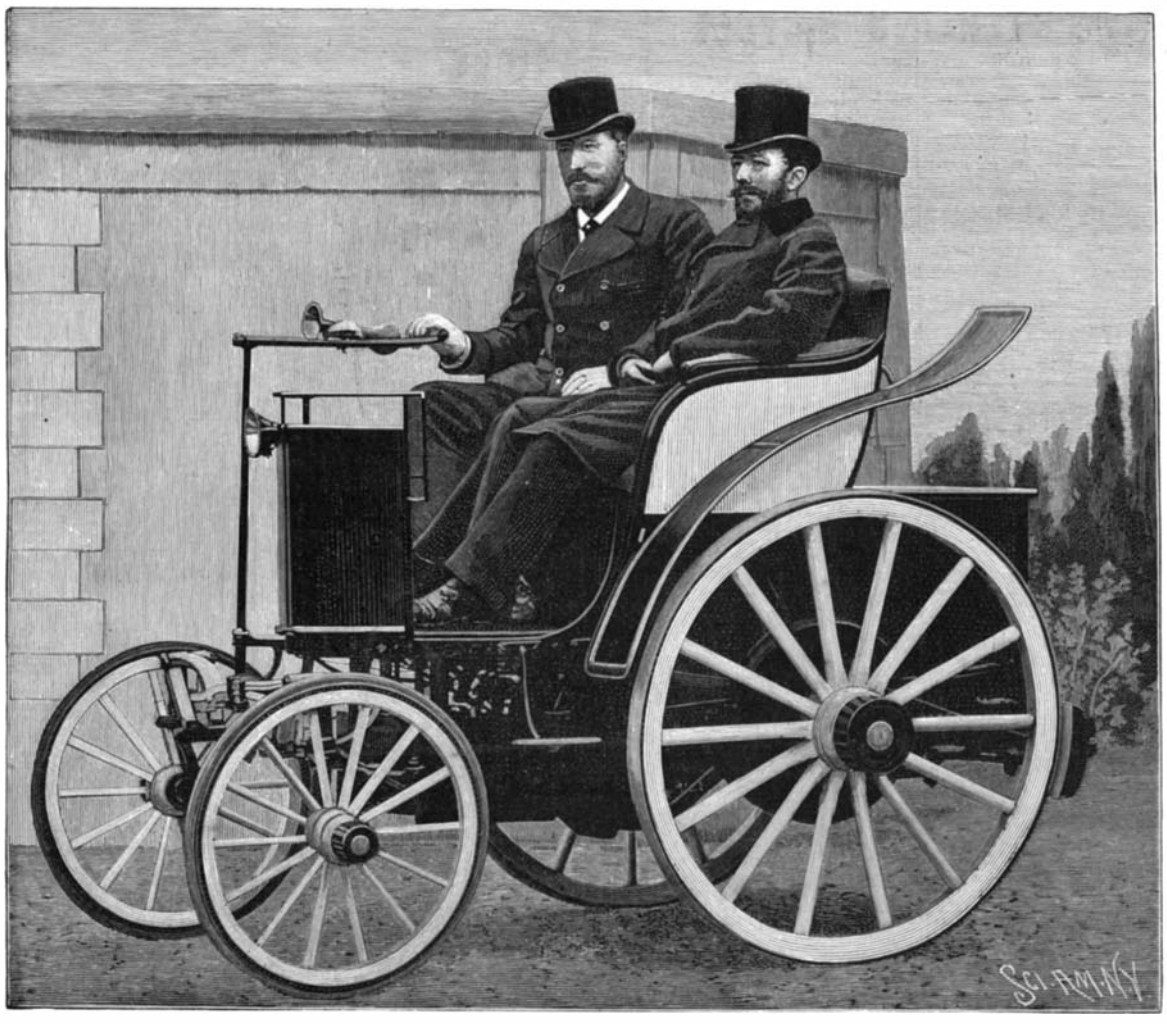


A STEAM TRICYCLE.

AN ELECTRIC CARRIAGE.

In SUPPLEMENT 979 we described the race of the automobile carriages which began July 19, 1894. In 1895 a similar race will be held over a course between Paris and Bordeaux, and promises some interesting developments in the line of steam, petroleum and electric carriages. M. Charles Jeantaud, the head of an important carriage establishment of Paris, commenced experimenting on an electric carriage in 1881, when the accumulators of Faure first appeared, but at this time the dead weight of the accumulators was so great that M. Jeantaud was forced to stop his experiments; but he was spurred into activity by the recent success of petroleum and steam motors for carriages, and the result of his labors is the electric carriage which we illustrate herewith. He found it necessary to obtain a source of electricity lighter and less cumbersome than those in use. He found it in the "Fulmen" accumulator. The plates are covered by a perforated celluloid envelope filled with the active material. In the center of this envelope are the lead plates which serve to collect the current. The celluloid is a perfect non-conductor and is not attacked by acids. The plates are carried in wooden receptacles, which are lined with celluloid. They are composed of two parts, the box proper and the cover, which is absolutely watertight and is transparent as well. The accumulator thus constructed presents a small bulk and light weight compared with its great capacity; it resists perfectly the shocks to which it is subjected. The batteries which propel the carriage of M. Jeantaud consist of 21 elements of the type just described, which give a current of 100 amperes of a pressure of 40 volts. In ascending slopes the current is increased.

The general appearance of the new carriage, as shown in our engraving, resembles that of a petroleum-propelled carriage. None of the actuating mechanism is in sight. The 21 elements are inclosed in seven small boxes, each containing three accumulators. These boxes are stowed away under the seat. The hands are free to steer the carriage and to control the speed; the switch, as well as the brake, is controlled by the foot. The foot is placed on the switch and the carriage starts with ease; on removing the foot the carriage stops and the momentum which it has acquired may be checked, if desired, by applying the foot to the brake. The brake is of the ordinary variety, a wooden shoe binding on the rear wheel; a circuit breaker is placed on the brake pedal, so that when the brake is applied the current is cut off at the same time. On a good level road a speed of 20 kilometers (12½ miles) per hour has been obtained, while in a hilly country the speed is reduced to 12 kilometers. The weight of the carriage is distributed as follows: Carriage, 490 kilogrammes; accumulators, 420 kilogrammes; motor, 110 kilogrammes; two passengers, 150 to 180 kilogrammes; total, 1,200 kilogrammes. As the kilogramme is equivalent to about 2·2 pounds, it will be seen that the carriage and contents weigh only about 2,645 pounds. The electric carriage has a future, and already in London there is a firm which displays a sign saying that they are prepared to charge accumulators of all sizes at any hour of the day or night. L'Energie Electrique, from which we have translated this description of the electric carriage, draws a glowing picture of France when the electric carriage shall have come into more general use, when travel in the vehicles which move without the aid of steam or animal power can be used for extensive trips, the accumulators being charged at any of the 10,000 establishments in France which have electrical plants.



THE ELECTRIC CARRIAGE OF M. JEANTAUD.

The Income Account of American Railways.

The "Preliminary Report of the Income Account of Railways in the United States," prepared by Mr. Henry C. Adams, statistician to the Interstate Commerce Commission, shows the great depression in our industries following the panic of 1893. On the basis of 149,559 miles of railway open for traffic, the passenger earnings for 1894 show a decrease of $53 per mile; the decrease in the freight traffic is still more marked, being $774 per mile. The total decrease per mile was $840 under the average earnings of the four preceding years. In 1894 the gross earnings of the 149,559 miles of railway were $949,639,075; the operating expenses in the same period were $643,428,331; this left $306,210,744 to be divided among the holders of the stocks and bonds. This may at first sight seem a large sum, but nearly one-quarter of the railways in the United States are in the hands of a receiver. The operating expenses for 1894 show a gratifying decrease of $574 per mile over the previous year. In 1893 the gross earnings per mile fell to $7,190, while the operating expenses increased from $4,809 to $4,876 per mile. In 1894 the gross earnings sank to $6,350 and the operating expenses were $4,302. This decrease of $574 per mile shows that a rigid economy must have prevailed, as many of the expenses of the railways are constant, without regard to whether business is good or bad.

A METHOD of detecting fire damp by sound has been invented by M. Hardy and approved by the French Academie des Sciences. It is based on the fact that the sound emitted by an organ pipe varies according to the density of the air supplied. M. Hardy's apparatus consists of two small pipes, the size of a penny whistle, one of which is connected with the air in the mine and the other with the ventilator shaft. The presence of fire damp produces a discord at once between the two sounds, which increases with the quantity of gas and can be measured. By this contrivance the presence of 1 part in 500 of fire damp can be detected.

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NEW YORK, SATURDAY, MARCH 23, 1895.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT No. 1003.

For the Week Ending March 23, 1895.

Price 10 cents. For sale by all newsdealers.

THE NIAGARA AERIAL TRAMWAY.

While the harnessing of Niagara may rank as one of the engineering triumphs of the age, it certainly cannot rank as one of its æsthetic triumphs; but now a new scheme for attacking poor Niagara has been evolved, this time not in the interests of commerce or of manufacturing industry, but simply as a money-making scheme based on the curiosity of the public.

The Aerial Tramway Company proposes to erect towers on each side of the Falls, one in the Canadian and the other in the American park, and to carry from tower to tower a double set of steel cables, which are to be traversed by cars suspended therefrom and operated by electricity from the American side of the Falls.

The cars, which are to be open, cage-like structures, will traverse the Falls about 30 feet above the edge, so as to give the sightseers a close inspection of the water where it takes the mighty plunge. The line will follow closely the brink of the American Falls to Goat Island, the prolongation of which direction will carry it as a chord to the Canadian or Horseshoe Falls.

The State of New York and the Canadian government have both established parks for the preservation of the natural beauty of the Falls, which were fast becoming impaired by vandalism. When the necessary powers were obtained for the establishment of these reservations, every lover of the beautiful in nature felt relieved to think that Niagara was saved, but it is questionable if in the worst of its days a greater act of vandalism was contemplated than the construction of the aerial tramway. The natural conformation of the ground about the Falls enables the visitor to approach close to the edge of the Falls and to see to an unusual advantage the great cataract. A nearer approach to its brink than that afforded by nature is not desirable, and the stretching of cables across the chasm in full view, to be traversed by cars, will be the greatest defacement to which the scenery has ever yet been subjected. Those who advocated the parks, and perhaps worked for their establishment, will regret to see them surrendered to such uses as the location for towers of the tramway.

ACETYLENE.

No recent chemical discovery has excited more interest than the direct production of acetylene. The calcium carbide process may properly be termed direct, for in it the carbon is first united to calcium and secondly to hydrogen, the calcium being supplied by lime and the hydrogen by water. We have given a number of papers on the subject, and the new process is now being presented in various exhibits, lectures and papers to the public. One private residence in this city has a small acetylene plant with which the house can be illuminated or which can be used to enrich the ordinary gas. If the calcium carbide can be produced commercially—and its promoters state most positively that it can be so produced—it will have a great effect upon the production of artificial light.

Political economists, who have devoted some thought to the influence of modern scientific progress upon the condition of the world, recognize in the modern development of artificial illumination one of the most powerful instruments for the civilization of mankind. In old times the dark streets of cities were dangerous, because they were haunted by robbers, who only lacked subjects because the people were afraid to go abroad after dark. When Argand invented his cylindrical lamp burner with central draught, he made one of the great steps forward in artificial lighting. The invention of plaited candle wicks, chemically treated, which, as the candle burned, would bend over and burn away, was considered a great discovery and achievement in its day, as doing away with snuffers. Then gas was introduced and proved to be the greatest civilizing agent for cities. When the streets were adequately lighted, crime at once diminished.

In recent years the electric arc light has proved the best street illuminant, but gas or the incandescent electric light remains the favorite indoor illuminant. In the co-development of gas and electricity some interesting cycles or transformations of energies have resulted or have been worked out. Gas is primarily made for the purpose of giving light. When burned in the explosion gas engine it gives, from the physicist's standpoint, a far more economical result than is attainable with the steam engine. In the commercial sense the economy, owing to the high cost of gas, disappears.

The gas engine burns some twenty feet of gas per horse power hour, which gas represents an illuminating power of sixty to one hundred or more candles. For the production of such gas four pounds of bituminous coal suffice, which give also as side products a material amount of coke and a quantity of coal tar. If a gas engine drives a dynamo, we may get from it in incandescent lights as much or more candle power than from the original gas burned as such, while if we use arc lamps the production would be vastly increased. In the new acetylene process, a similar but more complicated cycle exists. Power is expended in producing an electric current. The current is led to an electric furnace, where it heats to an almost immeasurably high temperature a mixture of lime and carbon. The lime is reduced and gives calcium carbide. This substance is treated with water, and every pound evolves five cubic feet of acetylene, enough to give 250 to 300 candle power of light for one hour.

Thus if we know how much horse power is expended per hour in producing a definite yield of the calcium carbide, we can compare the economy of the different cycles. As a matter of figures it is enough to say that they come out about the same. But the new product effects other results. It diminishes the minimum size of gas holder required for the usual exigencies of gas supply. A one-foot burner gives perhaps forty candle power, or as much as ten feet of ordinary gas would give. Hence a gas holder of one-tenth the ordinary size could be used. The new gas is made without heat, and without any dangerous agent such as gasoline. Finally, when the gas is made it is a permanent one. The utter simplicity of the apparatus and process is also striking.

One of the curiosities of the carbide is that it will not burn. It can be drawn out white hot from the electric furnace and cast in moulds. A piece can be held in a Bunsen burner without the least effect. But if a drop of water is put upon the stony substance it effervesces, and the gas can be lighted and will burn like a piece of wood for a few seconds until the water is exhausted. Then it goes out.

Merely as a matter of scientific interest it is to be hoped that the commercial production will soon be accomplished. The merciless judgment of the balance sheet has wrecked many a most ingenious scientific triumph. It is to be hoped that acetylene will fare better.

The Craig Colony for Epileptics.

The managers of the Craig Colony for Epileptics, at Sonyea, N. Y., have recently published an interesting report of the work so far accomplished in fitting out the home. During the year considerable progress has been made. In 1894, the Legislature of New York appropriated $140,000 for the establishment of the colony, and of this amount $12,000 has been expended in purchasing the farm which is to form the site of the colony, and in protecting and improving the property. A general design for the colony has been adopted to which all buildings and improvements will be obliged to conform, and architects and engineers, surveyors and others have been employed to carry out these plans. It is proposed to construct first an administration group of fine buildings. These are to be plain two-story structures, entirely disconnected and devoid of all "institutional" features, the whole resembling a cluster of private dwellings. The chief buildings of this group will contain the offices of the superintendent and members of his staff, and it will be here that the patients will be first received. Two of the buildings will be hospitals, one for each sex, and two will be used to accommodate patients before they are distributed in the colony. The idea is to provide the most homelike conditions. The minor offices and wants of the colony will be provided for by the patients themselves.

The designs of the respective buildings will vary from each other in detail and in outline. Everything will be done to prevent the colony from having the appearance of an institution. The home life will be further maintained by providing a dining room for each respective building. The patients from the several buildings will not, in any case, be massed together. There will also be separate buildings, to be known as sewing cottages, laundry cottages, etc. The farm at Sonyea comprises nearly 1,000 acres of excellent land, and much of this will be cultivated. The place will also be beautified by a tasteful arrangement of driveways, lawns, trees, and shrubbery.

Such an institution as is being here provided has for a long time been very badly needed. The State now makes provision in separate institutions for the insane, the blind, the deaf and dumb, and others suffering from chronic maladies. It is no less important that provision should also be made for epileptics. It is estimated that there are 12,000 epileptics in the State of New York. Of this number some 400 are confined in insane asylums and 600 in poor houses. The colony at Sonyea will doubtless correct this abuse. Its surroundings will, besides, be unusually healthful, and its atmosphere as far as possible homelike, and, therefore, restful and beneficial. The plan of providing an epileptic colony is already in successful operation in England, France, and Germany, where much good has been accomplished.

New Torpedo Catchers.

The Banshee, one of the three torpedo-boat destroyers built by Messrs. Laird Brothers, Birkenhead, recently made a successful trial, attaining a mean speed on six miles of 27·97 knots, and for the three hours' running 27·6 knots, being more than half a knot in excess of the contract speed. Exhaustive trials of steering, both ahead and astern, at full speed were also carried out with satisfactory results.

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Annual Report of the Factory Inspector.

The ninth annual report of the Factory Inspector of New York State, which has recently been submitted to the Legislature, contains much important information. The inspections of the past year have been very thorough, and much good work has been accomplished. During the year some 13,866 separate workshops have been visited, which employ in all 465,926 persons. Of these it was found that 150,662 were women and 12,536 were children under sixteen years of age. The inspection has led to the correction of many abuses of the laws governing the ages of children employed and the proper protection of the lives and morals of employes. In all, 10,425 notifications requiring changes and improvements were issued, many of which were of great importance.

It was found that the number of children in the factories, under sixteen years of age, was less than in previous years. About 2·6 per cent, or less than 27 children in each 1,000 of factory workers, were under age, and it is claimed that this is a better record than that of any manufacturing State or country in the world. Many improvements have also been brought about relating to the guarding of machinery and the proper protection of operatives. The inspector has, as far as possible, exercised supervision over the sweating or tenement house system of manufacturing. In this work eight deputy inspectors were at work for ten months on the east side of New York City alone. As a result of these inspections a great many notifications were served and enforced to better the conditions of these places. Notifications were also served relating to the guarding of elevators and hoistways, the erection of fire escapes, the renovation of factories, the provision of proper toilet rooms, to better ventilation, and similar improvements. The report states that in most cases the notifications were promptly and cheerfully obeyed.

Electric Road Between Niagara Falls and Buffalo.

Everybody in Niagara Falls is rejoicing, says the Buffalo Express, over the letting of the contract for the building of the electric road between the Falls and Buffalo. The contract, as W. Caryl Ely announced, was formally signed recently in Buffalo, and it was mainly through Mr. Ely's tireless efforts that this road was secured. According to plans, the road is to be built of 94 pound steel girder rails, with side trolley poles. It is to be double-tracked except for a distance of 2½ miles, where the highway commissioners of the town of Wheatfield refused to grant more than a single-track line franchise. The best feature of all is that is will give Buffalo and Niagara Falls cheap fares, the rate to be but 50 cents for the round trip at all times. Quick time is to be made, and in order to do this the road is to be made so that heavy cars can be used. The running of late cars will keep hundreds of Buffalo people in Niagara Falls until late in the evening, who now are obliged to go home before the really enjoyable part of the day about the Falls comes. The power for operating the road will be furnished by the Niagara Falls Power Company, and according to the contract, the cars will be running by July 1 of this year.

In Niagara Falls the road will be run on the tracks of the local street railway company from Echota, and this line, which is now a single track, will be double-tracked this spring and rebuilt entirely.

All the capital for the building of this road has been secured and the moment the weather permits, work on its construction will begin. The first section between Buffalo and Tonawanda will, it is said, cost about $500,000, complete.

The "Experimental Farms" of Canada.

For several years the provinces and the federal government of Canada have been taking an active interest in the improvement of agricultural methods throughout the provinces, and at present the equipments of their so-called "experimental farms" are very complete and efficient. The central experimental farm, situated near Ottawa, comprises some 500 acres of land and a complete outfit of buildings and the necessary machinery. The buildings are especially fitted up for cattle, horses, pigs and poultry, and all of these are well stocked. There is also a dairy equipped with the modern appliances for carrying on experimental work. The farm also includes a seed testing and propagating house and a conservatory. Besides this central station, there are eleven experimental farms situated in other parts of Canada, and these carry on experiments in agriculture, horticulture and arboriculture with much profit. The several farms are situated so as to render them as helpful as possible to the most thickly populated districts, and in their equipments and general methods they resemble closely the central station. The staff of workers at the central experimental farm includes a director, an agriculturist, a horticulturist, a botanist, an entomologist and a chemist. There is also a poultry manager, a "foreman of forestry" and several assistants to assist the members of the staff. The work is varied in nature and has to do with practically everything which relates to farming in Canada. The adaptability and merits of various varieties of wheat are, for example, the subject of careful inquiry.

Experiments are also carried on to determine the vitality and purity of various agricultural seeds, and to investigate the nature of the diseases of plants and trees, and the cure for the ravages of insects. Various varieties of fertilizers are tested to determine their comparative value with different soils and crops. The study of the care of animals is also a very important interest, and the value of different breeds of stock and their adaptability to various climates and other conditions are carefully investigated.

These stations also examine the scientific and economic sides of butter and cheese making. Experiments are also carried on to determine the best methods of planting and pruning trees for fruit raising or for shelter or timber. The information gained in all this work is carefully recorded and published for general distribution.

First Aid to the Electrically Shocked.

The French Minister of Public Works, under expert advice, has prepared the following rules in case of shock: The victim is to be, first of all, taken into an airy place; three or four persons should be taken there to assist and no one else allowed to enter. The clothing is to be loosened and efforts made to re-establish respiration and circulation as soon as possible. To re-establish respiration, recourse can be had to the following two methods, viz., drawing of the tongue and artificial respiration. In the former case, the mouth of the victim is opened with the fingers, or, if there be resistance, with a piece of wood, the handle of a knife, spoon or fork, or end of a walking stick. The front part of the tongue should then be taken between the thumb and index finger of the right hand, bare or covered with, say, a pocket handkerchief to prevent slipping. The tongue is then strongly pulled, and allowed to relax, in rhythmical imitation of respiration, at least twenty times a minute. These movements must be continued without a break for half an hour or more. For artificial respiration the subject should be laid upon his back, the shoulders slightly raised, the mouth open and the tongue free. The arms are taken at the height of the elbows, supporting them strongly on the walls of the chest, next bringing them above the head, describing the arc of a circle. These movements are to be continued at least twenty times a minute until the re-establishment of natural respiration. It is suitable to commence with the movement of the tongue as described, simultaneously, if possible, with the adopting of artificial respiration. At the same time, it is desirable to try and restore circulation by rubbing the surface of the body, by beating the body with the hands or with wet towels, throwing cold water on the subject from time to time, and applying ammonia or vinegar to the nose.—Boston Transcript.

Iced Bar Base Apparatus.

The United States Coast and Geodetic Survey employ an interesting and ingenious apparatus for determining the exact measurement of base lines. Considerable difficulty is experienced usually in this work from the variation of the measuring bars due to changes of temperature. A measuring bar will even be so affected by the heat of the hand holding it as to become more or less inaccurate. The length of a rod of brass or copper a foot long will vary from the heat of the hand from 0·007 inch to 0·01 inch. In order to secure perfect accuracy this expansion must be considered. In outdoor work such as surveying it is of course impossible to keep the measuring rod at a constant temperature.

The apparatus used by the survey for avoiding this danger is known as the "Iced Bar Base Apparatus." By this device a single rigid bar is used as the element of length. The bar is carried in a Y-shaped trough and when in use it is surrounded by melting ice, which, it will be seen, serves to preserve a uniform temperature for the rod. The trough is very rigidly constructed and especially adapted to resist vertical strains. The trough is completely filled with pulverized ice, and the slanting sides of the trough serve to keep the ice constantly in contact with the bar. The particles of crushed ice used for this purpose vary in size from the smallest flakes up to the size of a cubic centimeter. This is found to suit the purpose better than snow or pulverized ice, since it does not pack.

The bar is rectangular in shape and is formed of rolled tire steel. The upper part of the bar is cut away at either end to receive the graduation plugs, which are of platinum-iridium. The trough carrying the iced bar, as described, is attached to two cars, which may be moved along a horizontal track. The measuring may be moved in this way to the positions required in measuring the base lines. Micrometer microscopes are used to mark its successive positions. The trough is covered with a close fitting jacket or blanket of heavy white cotton felt, which serves to protect the ice in a measure from the heat. In actual practice the apparatus is found to work very successfully.

Ordnance Notes.

Lieutenant E. F. Qualtrough, U. S. N., has contributed some interesting notes on the progress of ordnance in the thirteenth number of the General Information Series issued by the Office of Navy Intelligence of the Navy Department. The leading authorities seem now agreed that the naval artillery of the future will be of more moderate dimensions. There are several objections to guns of large size. The endurance of a gun diminishes as the caliber increases. The machinery required for the manipulation of heavy guns is easily disabled by a projectile from a comparatively small gun, and large guns can only be fired at intervals of several minutes, so that often much smaller rapid-fire guns will do more execution. The employment of guns of moderate size paves the way for improvements in reduction of displacement and increase in the coal endurance. For a given outlay the reduction of caliber means an increase of ships and guns, and where a large battery of guns of moderate dimensions are provided, there is less danger of the vessel being crippled by the dismounting of a gun or two. The projectile fired by the latest 12 inch gun is capable of perforating any armor afloat at fighting ranges, so that if the penetrating power is sufficient to successfully attack the defensive armor which is liable to be encountered, it is advisable to increase the number of guns and not their size. The manufacturers of rapid-firing guns have been increasing the caliber of their weapons and have recently made important improvements in mounts and ammunition.

An efficient gun mount has such important duties to perform that the new devices in the way of disappearing carriages and means of absorbing the energy of the recoiling gun that the progress made in the last few years is fully as great as that made in the gun itself. By arranging for the recoil to take place in the line of fire the "jump" is much reduced, and sudden blows to the deck are obviated, although a severe strain is necessarily brought upon it. Springs have been generally introduced for returning guns to the firing position. They were first used with the mounts for rapid-firing guns, and the experience thus obtained has led to their more extended employment. Gun shields have increased in thickness, and nickel steel is being introduced for use in constructing them. Sights are now usually fitted on the mount, so that the pointing of the gun is in no way interfered with by the loading or firing.

Food Fish of Alaskan Waters.

A careful study of the many varieties of food fish of Alaska has recently been made by one of the government ichthyologists in the interests of the Smithsonian Institution, and the observations made are very valuable and interesting. In Alaska every native is a fisherman, and the fish of these waters are so abundant and of such variety that the entire native population is able to support itself by this means. The report, it is to be hoped, will lead to some arrangement by which these quantities of food fish may be brought to the markets of the United States.

The great wealth of Alaskan waters lies in their abundance of salmon. The natives catch the salmon by the aid of spears, nets and traps, and dry them at present for their own use exclusively. The large variety known as king salmon often weigh from sixty to ninety pounds apiece, and these are very abundant. The waters also swarm with codfish equal, it is reported, to those of New England. In the northern rivers several varieties of whitefish take the place of salmon. They grow to a weight of about thirty pounds and have a delicious flavor. The rapid streams are well supplied with grayling; and Dolly Varden trout are very plentiful, and frequently exceed fifteen pounds in weight. Quantities of pike, dogfish and redfish also abound. Probably the most abundant of all fish, however, are the common herring. These are very fat and of an excellent flavor. It is said that vessels often sail for hours at a time through shoals of these herring.

Weather and the Mind.

The psychology of the weather is considered by Dr. T. D. Crothers as a promising subject for study. He says, in Science:

"Very few persons recognize the sources of error that come directly from atmospheric conditions on experimenters and observers and others. In my own case, I have been amazed at the faulty deductions and misconceptions which were made in damp, foggy weather, or on days in which the air was charged with electricity and thunderstorms were impending. What seemed clear to me at these times appeared later to be filled with error. An actuary in a large insurance company is obliged to stop work at such times, finding that he makes so many mistakes which he is only conscious of later that his work is useless. In a large factory from 10 to 20 per cent less work is brought out on damp days and days of threatening storm. The superintendent, in receiving orders to be delivered at a certain time, takes this factor into calculation."

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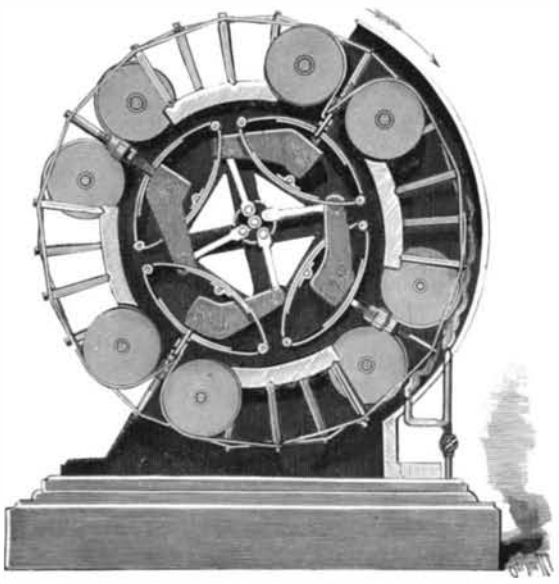
A MOTOR OPERATED BY THE EXPANSION AND CONTRACTION OF METAL.

In the motor shown in the accompanying illustration, two bands are alternately expanded by the direct application of heat, and the bands are so connected with springs that when one band is expanded it releases its hold on the springs while the other band is receiving the full pressure of the springs. "Pyromo" is the name given this motor by its inventor, Dr. W. W. French, of Fort Branch, Ind. The engraving represents a sectional side elevation of the motor, a loosely rotating wheel having an exterior expanding



FRENCH'S MOTOR.

and contracting rim preferably made by sets of metallic bands arranged one alongside the other. The bands are subjected to the heat from gas burners which open into a hood on one side of the wheel, and the ends of each band pass over pulleys journaled in suitable bearings in the sides or spiders of the wheel, the two sets of bands passing over corresponding sets of alternately arranged pulleys. The ends of the bands, after passing over the pulleys, connect with links in the middle of the outer leaves of elliptical springs, the springs being attached, at the middle of their inner leaves, to rods secured in the sides of the wheel. The several bands are supported intermediate of their pulleys on posts, and the bands are connected at their middle by inwardly extending links, with levers fulcrumed in the sides of the wheel. Each link has a turn buckle, whereby the length of the link may be increased or diminished, and the levers are connected by other links with a disk on a crank arm on the shaft. The bands of each set connect at their ends with the same springs, and they connect by independent links with separate levers opposite each other and connected with opposite sides of the disk on the shaft. As a band is heated from the burners, its expansion releases a set of springs, whose closing power is exerted on the ends of another band, and through the two links and lever a pull is exerted on the disk to cause the wheel to rotate in the direction of the arrow. A similar operation takes place with the other bands. The motor is designed to be self-governing, the springs establishing a yielding connection between the bands and levers, to prevent the bands from breaking and take up slack until the running temperature is reached.

A New Cure for Stiff Joints.

At St. Bartholomew's Hospital, London, an ingenious hot air bath is now in use for the treatment of sprains, inflamed joints due to gout or rheumatism, and similar affections. It consists of a copper cylinder about three feet long and eighteen inches in diameter, which will hold an arm up to the shoulder or a leg up to the middle of the thigh; it stands on an iron frame and is heated by gas burners placed underneath, so that the temperature can be raised to 300° or 400° Fah. The patient is placed in an arm chair at one end of the cylinder, the limb is introduced, and the joint made air-tight by a rubber band. No discomfort is felt up to 250° until perspiration sets in, when the moisture has a scalding effect, which is relieved by opening the further end of the cylinder and letting the moisture evaporate. A sitting usually lasts forty minutes. The immediate effect is a greatly increased circulation in the part treated, profuse local perspiration, and relief from pain.

BRISTOL'S RECORDING AMPERE METER.

The accompanying engravings illustrate a new recording ampere meter, which is being placed upon the market by the Bristol Company, of Waterbury, Conn. This instrument, in connection with their recording volt and watt meters, which are already well known, makes it possible to keep a continuous record, day and night, of the output of an electric lighting or power plant.

The general design of this instrument is clearly shown in Fig. 2, an interior view, from which it will be seen to consist of a stationary solenoid, an armature, B, carried by a non-magnetic shaft through the center of the solenoid, the shaft being supported at its opposite ends on steel knife edge spring supports, C and D, the same as in Bristol's recording volt meter.

The recording pen arm, E, is secured directly to the steel spring support, D, and partakes of its angular motion as the armature is attracted to the coil or solenoid by a current passing through the solenoid. Although the actual distance that the armature itself moves is small, it will be observed that it transmits an angular motion to the pen arm, resulting in a wide range on the chart without employment of multiplying devices between the spring and the pen.

A novel feature of this instrument is the form of armature which is used to procure a chart with the divisions nearly uniform throughout its range. It consists of two parts, a flat and very thin disk of iron and a small sleeve or core of iron on the non-magnetic shaft. The sleeve is completely concealed from view within the solenoid. The disk is stiffened by a plate of non-magnetic metal.

If the armature consisted simply of the flat disk portion, the magnetic attractive force would increase very rapidly as it approached the solenoid, giving a chart with divisions as in the Bristol's recording volt meter: contracted at lower portion on the scale but very open at upper portion; while if the armature consisted only of the core portion, the attractive force upon it would decrease as it approached the central or neutral position of the solenoid, and the divisions for the lower portion would be quite open, becoming contracted at upper portion of the scale.

After considerable experimenting, a combination disk and core armature has been found which produces the nearly uniformly divided scale as shown in the specimen section of a chart, Fig. 3, for a range of fifteen amperes.

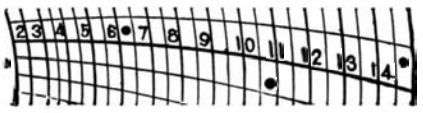
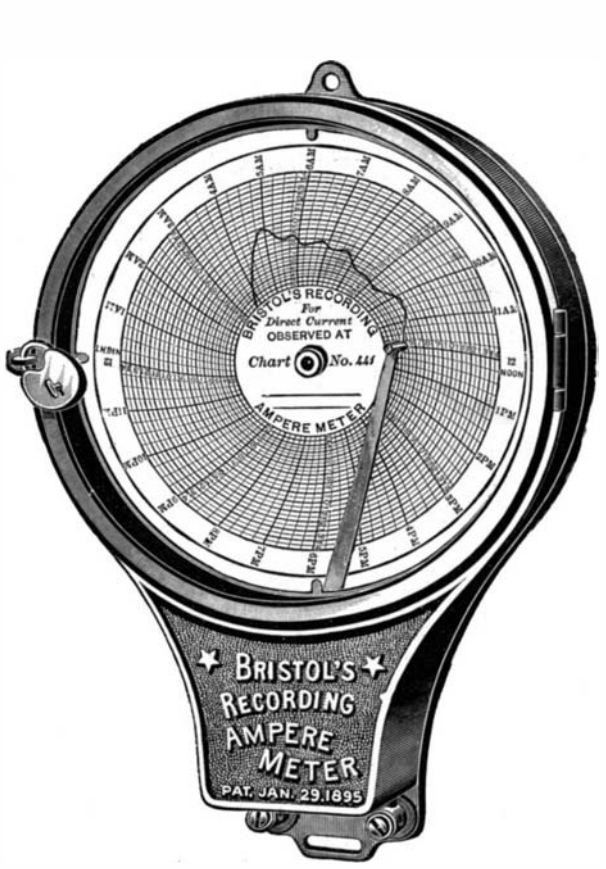


Fig. 3.



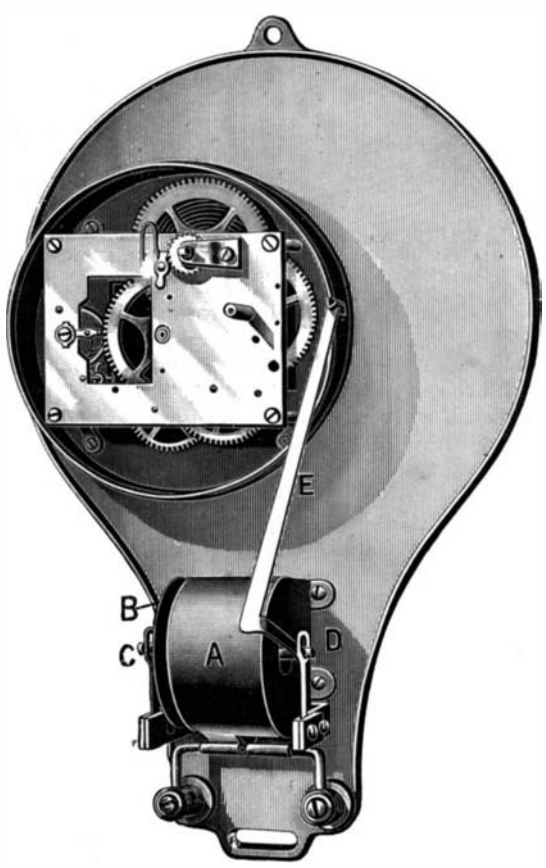


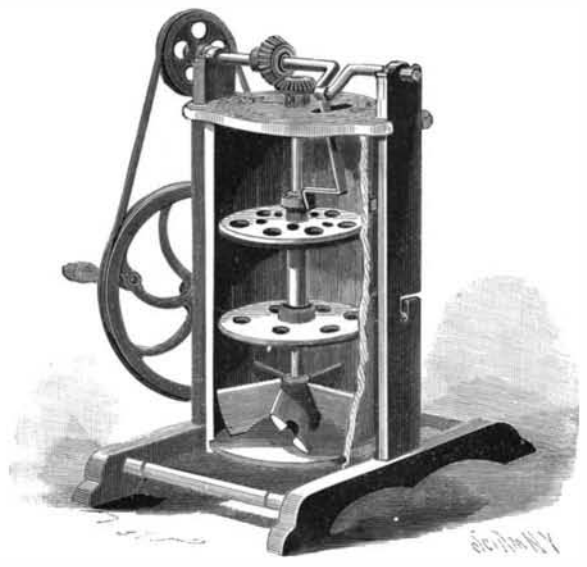
Fig. 1. BRISTOL'S RECORDING AMPERE METER. Fig. 2.

The armature and moving parts are reduced to a minimum in size and weight to avoid magnetic lag and the effect of the inertia when current is thrown off and on. To provide for cases where there are extremely rapid and large fluctuations in the current to be recorded, as for example on an electric railroad, a damping device will be provided, which consists of a vane of aluminum, secured to the left knife edge spring and immersed in a vessel of glycerine.

For low ranges the solenoids are designed to carry the entire current, but for high ranges shunts will be provided.

A CHURN WITH VERTICAL AND ROTARY DASHERS.

The two dashers with which this churn is provided, one having a vertical and the other a rotary movement, may be operated together or either dasher may be



KELLY AND HAGQUIST'S CHURN.

used independent of the other. It has been patented by Messrs. M. F. Kelly and N. A. Hagquist. The body of the churn has exterior pins on opposite sides, each pin adapted to enter an angular slot in one of the side standards, and the cover is made in two sections, flanged to fit over the upper edge of the body. In the upper ends of the standards is journaled a shaft adapted to be rotated by a belt from a hand wheel, the shaft having a crank arm, and a beveled gear being adjustably secured on it, the latter meshing with a similar gear on the upper end of a vertical shaft on whose lower end is secured the hub of a rotary dasher. Plates of somewhat diamond shape extend diagonally from the hub, the plates being adapted to agitate the milk at the bottom of the churn body. Sliding upon the vertical shaft is a sleeve upon which are located two apertured disks, constituting the vertical dasher, to which movement is communicated by means of a link connecting the upper end of the sleeve with the crank portion of the driving shaft at the top. By simply disconnecting the upper end of the link from the crank, the movement of the vertical dasher ceases, and a slight lateral movement of the driving shaft disconnects the bevel gears through which the rotary shaft is operated, both movements being thus readily controlled by the operator for the use of both dashers together or either one separately, as may be desired. Communications relative to this improvement may be addressed to Mr. M. F. Kelly, Blossburg, Pa.

A Giraffe Ten Feet High.

The Zoological Society, London, has just purchased a fine female giraffe, which has recently arrived from South Africa. This is believed to be the first example of the large dark-blotched race ever seen alive in Europe, the giraffes previously exhibited having belonged to the smaller and paler form found in northern tropical Africa. As the animal stands more than ten feet high, there may be some delay, owing to the difficulty of passing it under the railway bridges, but it will probably be on view in a few days. The society has also purchased a pair of sable antelopes (Hippotragus niger) and a pair of brindled gnus (Connochœtes taurina) all in excellent condition.

IT is said that dew will not form on some colors. While a yellow board will be covered with dew, a red or black one beside it will be perfectly dry.

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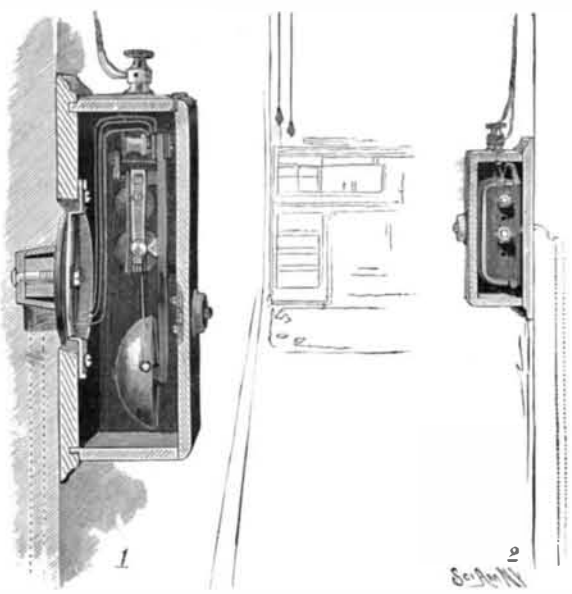
A COMPACT ELECTRIC SIGNALING DEVICE.

The illustration represents a signaling outfit contained in a small box or case, for convenient installation in residences, hotels, or other buildings, either during or after the erection of the buildings, without injury to the walls or woodwork. The improvement has been patented by Mr. James N. Connolly, of No. 452 Madison Avenue, New York City. The case is dust proof, and has an opening in the rear to permit it to be placed over the socket of a bell-pulling outfit, a support over the opening being adapted to receive the center post of the outfit, and a nut screwing upon the center post clamping the box firmly to the wall. The box has a hinged cover, readily thrown open to facilitate making any adjustment which the bell requires, or any desired change in the circuit connections, and the bell is preferably mounted on the cover of the box, which thus serves as a sounding board and intensifies the sound. The circuit wires, also connecting with a suitable battery, are carried in the tubes which extend to the several rooms or a house, after the manner of equipping many large buildings not strictly modern in construction, and a push button or other circuit closer is mounted on the outside of the box. The two binding posts on top are for use when it is desired to ring by means of a flexible cord from different parts of a room, as from a bed, a desk, etc., the cord terminating in a pear-shaped button. By using a buzzer instead of a bell, the case may be made materially smaller, or a buzzer may be placed in circuit and mounted in another part of the room, when either one of the devices may be used, as desired.



CONNOLLY'S ELECTRIC SIGNALING DEVICE.

Peroxide of Hydrogen.

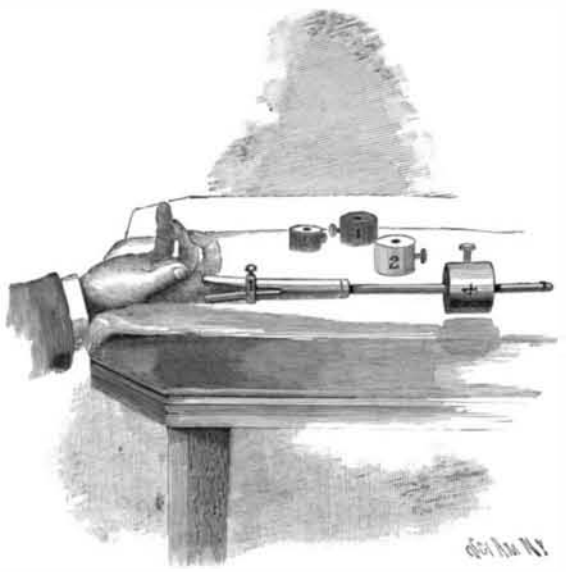
By a process patented in England Dr. Richard Wolffenstein, of Berlin, prepares a more stable and chemically pure peroxide of hydrogen of high percentage. The dilute peroxide solution, which contains perhaps 3 per cent peroxide, is heated at a constant temperature of between 100 deg. and 110 deg. C., with or without the aid of rarefied vessels, until the fluid has a proportion of about 60 per cent peroxide. Then in a vacuum at a moderate temperature the peroxide is distilled over. With gradual rising of the boiling point a watery vapor first passes over until, at 84 deg. C. and a pressure of 24 millimeters, a 99 per cent solution of superoxide distills over. A chemically pure peroxide can be got from this by pouring it into a solvent which does not combine with water, i. e., ether, and dissolving again the pure peroxide out of the ether solution. It is claimed that the product is stable in concentrated solution, and does not decompose even on long keeping. The dilute solution, to begin with, must be entirely free from foreign substances, even from mechanical impurities such as sand.

History of the Barometer.

In the Meteorologische Zeitschrift for December last, Prof. G. Hellmann gives a very interesting account of the invention of the barometer, which has now been in use 250 years. Torricelli, who died at the early age of thirty-nine years, was too busily engaged in mathematical studies to publish an account of his discovery, but on June 11, 1644, he wrote a description of it to his friend Ricci. This letter, and Ricci's objections to the experiment, were published in 1663 by C. Dati, a friend of Torricelli's, and as this work is now exceedingly scarce, Prof. Hellmann has reprinted the correspondence, in the original Italian, in the above-mentioned journal. Some of the paragraphs, says Nature, are noteworthy, especially those in which Torricelli states that it was not merely a question of producing a vacuum, but of making an instrument which would indicate the changes of the atmosphere. The first continuous barometrical observations appear to have been made in France. In England they were first taken by Robert Boyle, about the year 1659, to whom we owe the invention of the word "barometer."

A FINGER EXERCISING DEVICE.

An extremely simple device to facilitate the development of muscular strength in the fingers is represented in the accompanying illustration. It is designed to be of especial benefit to violin players, piano players, etc., or may be used by a surgeon to develop a contracted cord or muscle of the fingers, hand, or arm, being also of utility to penmen, telegraph operators, typewriters, and all who require finger dexterity. It has been patented by Mr. Frank E. Osterhout, Oneida Castle, N. Y. It consists of a tube or sleeve with longitudinal side slits at one end to permit the convenient insertion of the finger, while from the other end extends a rod on which a weight is adjustably held at the desired distance by means of a set screw. The sleeve at its split end is fastened on the finger by a clamp consisting of an elongated slotted ring passing around the sleeve, and a clamping plate slidable vertically in the ring, and engaged by a set screw at the top. The exercise is made more or less severe, not only by moving the weight out or in on the rod, but weights of different sizes are employed, as may be deemed most advantageous.

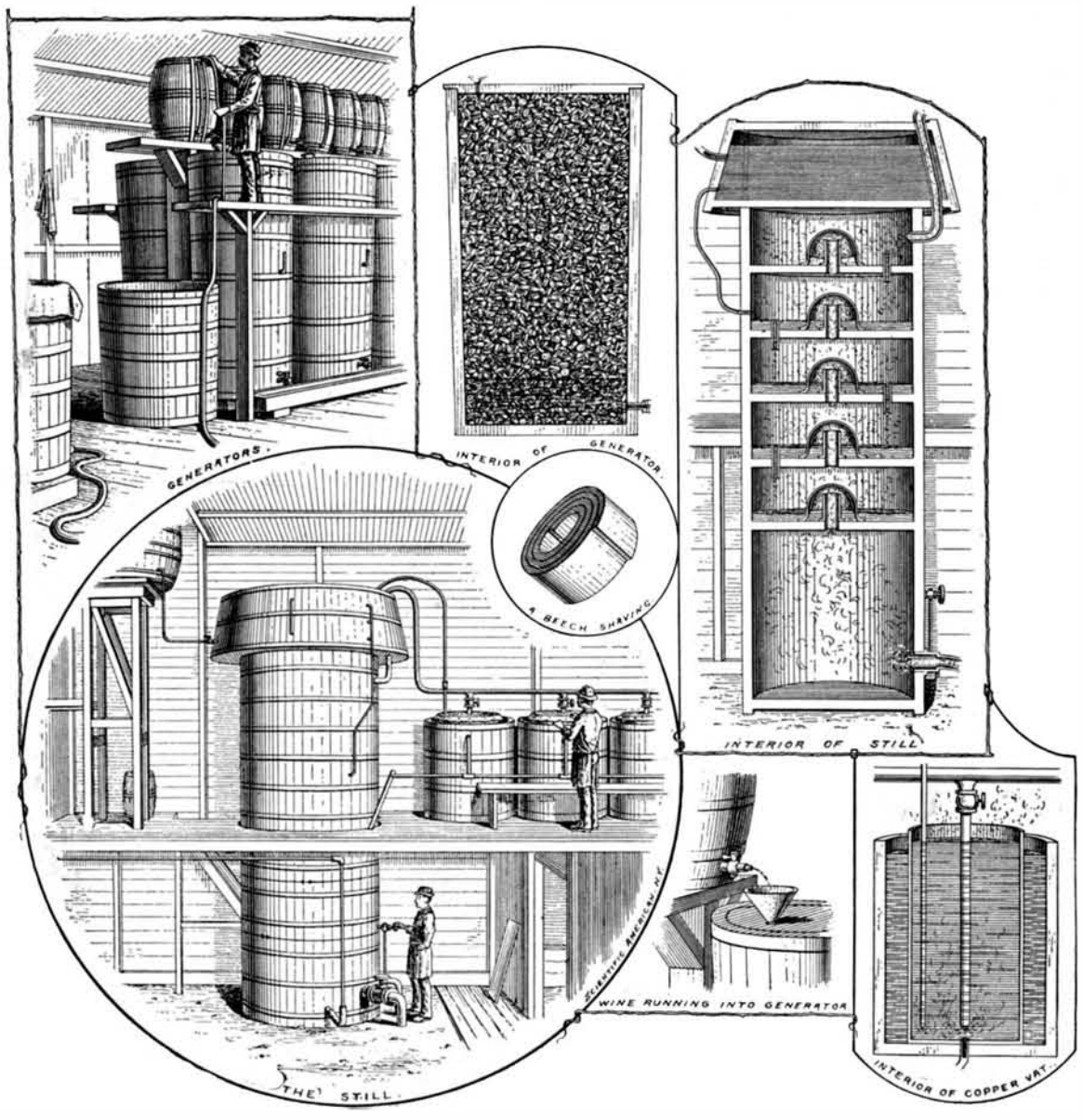


OSTERHOUT'S FINGER EXERCISING DEVICE.

MANUFACTURE OF WHITE VINEGAR.

White vinegar can be manufactured from molasses, corn, etc., or from almost any substance that will ferment. The material is first passed through a fermenting and distilling process which turns the liquid into what is called a low wine. This wine is then allowed to trickle slowly into generators filled with beechwood shavings, where it works and becomes sour. The material used principally by the manufacturers is molasses. The casks or hogsheads of molasses are first emptied into an underground reservoir and thinned down with water. It is then pumped up through a rubber hose into a 1,000 gallon fermenting tank, where it is allowed to stand for about two days and ferment. After fermenting it is forced up into another reservoir, from which by means of pipes the liquid passes down into a wooden mash tub connected to the top of the still. This mash tub is about 3 feet in height and about 7 feet in diameter, and holds about 600 gallons. The still is circular in shape and is about 20 feet in height, about 6 feet in diameter and made of ash. The interior is divided off into five compartments. The partitions or headings are made of wood about 6 inches in thickness and about 2 feet apart. Running through the center of each heading is a copper pipe or tube about 14 inches in height and about 8 inches in diameter. Directly over the top of each pipe is a circular copper head 18 inches in height, the bottom of which connects to the flooring of the headings by means of a number of arms. Through each heading midway between the copper heads and sides of still is a 3 inch drop pipe which projects above and below the partition about 6 inches. Attached to the side of mash tub is a small 1¼ inch copper pipe which connects with the second compartment in the still. The liquid passes down this pipe on to the floor of this heading. As soon as it reaches to the depth of 6 inches it begins to run down the drop pipe to the next heading. When the liquid again reaches to the top of the pipe it drops down again in the same manner to the next heading below. The steam is turned on from the bottom of the still and passes up through the center and drop pipes and underneath the copper head of the first heading.

From the first heading it passes upward through the different compartments in the same manner, heating and steaming up the liquid, which passes off at the top of the still in the form of vapor through a 4 inch pipe to a number of copper vats below. The vats are about 5 feet in height and about 3½ feet in diameter. Running into each vat within 2 inches of the bottom is a pipe which connects with the still pipe. About 120 gallons of water is placed in each vat through which the vapor passes, mixing itself with the water. Each vat rests in a wood tub containing about 300 gallons of cold water. After about 120 gallons of the vapor has been thoroughly mixed with the 120 gallons of water, it is then allowed to cool. After cooling, which takes about 24 hours, the material is drawn off from the bottom and run into a receiving tank. From the receiving tank it is pumped into casks and left to stand for about 12 hours. To make the low wine work quickly in the generators, a quantity of strong vinegar is mixed with it, the proportions being about ½ gallon



MANUFACTURE OF WHITE VINEGAR.

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of vinegar to 1 gallon of low wine. After mixing, the liquid is pumped into small 30 gallon casks, where it passes out through a small glass tube. The stream of wine, which is about the size of a thread, runs down through a funnel in the top of the generators.

The generators are made of ash and are about 8 feet in height and about 4 feet in diameter and filled with beechwood shavings, each generator holding about 25 bushels. These shavings are circular in shape and are about ⅛ of an inch in thickness, about 1 inch in width and about 2 inches in diameter. When stretched out they measure from 13 to 15 inches in length. They cost about from 25 to 30 cents per bushel and will last from 30 to 35 years. As the fine stream of low wine trickles down slowly through these shavings the air inside acts on the liquid, causing it to work and turn into vinegar. The thread-like stream runs continuously into the generators. Vinegar to the depth of a foot collects at the bottom of the generators, which are drawn off morning and evening. From the generators the vinegar passes into large tanks and then runs off into small casks holding from 10 to 50 gallons, for the market. The loss of low wine by evaporation amounts to about 1 gallon to the barrel. The molasses used costs about from 8 to 10 cents per gallon. The vinegar is sold by the cask from 8 to 10 cents per gallon. It is used principally by grocers pickle houses, etc.

The sketches were taken from the plant of Edward Reinecke's Sons, Hoboken, N. J., who turn out about 1,000 gallons per day.

Armored Trains for Coast Defense.

A few months ago an interesting test of an armored train took place at Newhaven, England. The idea of an armored train is not new, such trains having been used in our civil war, in the Franco-Prussian war and in the Egyptian campaign of 1882; but the arrangement of these trains was such that the guns could shoot only in the direction along the rails, unless the car were propped up to prevent it from being derailed by the recoil. The car was designed by Colonel Boxhall, of the First Regiment of Volunteer Artillery of Sussex, and was constructed at the shops of the South Coast Railway Company. The car is made of steel, with a vertical armored wall all around it to protect the artillerymen. Inside the car is a 40 pounder cannon mounted on a platform so that it can be turned in any direction. It is moved by geared wheels and cranks. Underneath the car are arranged extensible beams which may be pushed out on one or both sides of the car, and are arranged to abut against the ground by means of vertical screws at their extremities, so that in case of a fire at right angles to the track they transfer the shock of the recoil beyond the rails. Beneath the car are also clamps which grip the rails and prevent the car from being derailed. In the old style of armored train the guns could shoot only in the direction of the rails, unless the car were propped up as already stated. In the new style of train the cars can be anchored in a moment and can shoot in any direction.

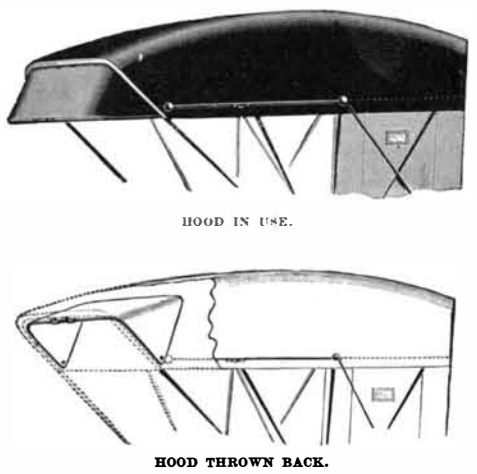
The trial of the armored train took place in the presence of a number of military men. Twelve shots with service charges were fired in a direction at right angles to the track at a target moored out at sea. Neither the car nor the rails showed any effects of the recoil, which was absorbed by the turning platform and the beams. Some shots were fired without clamping it to the rails. Of course the target offered to the enemy by the sides of the cars is of considerable size, and Lord Beresford thinks that the car should be concealed as much as possible and that thin iron plates would be a sufficient protection for the cannoneers from the light projectiles of the enemy. Lord Beresford considers it preferable to arm the car with a few small rapid-fire guns. The value of such trains for sea coast defense is very great.

Bicycles in State Militia Drill.

The New York Seventh Regiment has organized a bicycle corps, which had its first drill in the regimental armory March 13, superintended by a U. S. Army officer expert in the newly adopted bicycle tactics. The men were arranged in fours, six feet between wheels and eighteen feet between sets of four. Stress was laid on preserving the intervals between the bicycles and on the riders assuming a military position on their wheels. The commands, "Stand to cycle!" "Cycles front!" "Cycles rear!" Prepare to mount!" and "Mount!" were explained, and the men went through several infantry movements on foot, pushing their bicycles. Afterward they mounted and went through the evolutions on their bicycles. Around the armory the riders wheeled, fours right and fours left in column of fours, by twos, in company front, making wide turns and narrow ones, and going through all the movements as would a company of infantry, while the military spectators looked on approvingly. The members of the corps were in uniform and presented an attractive appearance as they wheeled around with soldierly precision.

AN ADJUSTABLE STORM AND SUN HOOD FOR CARRIAGES.

The illustration represents the application of a simple form of hood readily fitted to any vehicle top, and let down, as shown in one of the figures, as a protection during a rain storm or when driving in the face of the sun. When thrown back, as shown in the skeleton cut, it is completely out of the way and out of sight, or it may be without any trouble taken out entirely and left at home or placed under the seat. It is thrown into or out of position for use instantly with one hand. It is manufactured by the Wilbur H. Murray Mfg. Co., of Cincinnati, Ohio. The frame is made of spring steel and it is covered with greenback rubber drill, unlined. Parties ordering this hood for old vehicles should state distance between front bow sockets at bottom of quarters.



HOOD IN USE.

HOOD THROWN BACK.

MURRAY ADJUSTABLE STORM AND SUN HOOD.

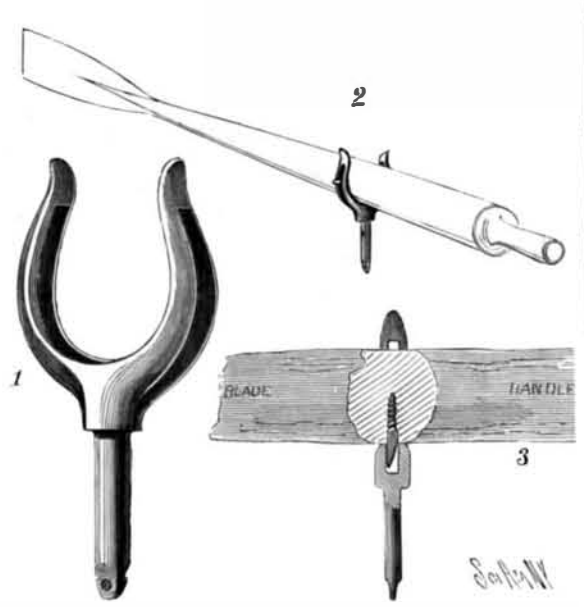
Reflection of Light.

The following table, showing the amount of light reflected from various substances as compared with that which falls upon their surfaces, is given by Dr. Sumpner, and will be found of interest:

White blotting paper	82 per cent.
White cartridge paper	80 "
White tracing cloth	35 "
White tracing paper	22 "
Ordinary foolscap	70 "
Newspapers	50 to 70 "
Yellow wall paper	40 "
Blue paper	25 "
Dark brown paper	13 "
Dark chocolate paper	4 "
Planed deal, clean	40 to 50 "
Planed deal, dirty	20 "
Yellow painted wall, dirty	20 "

AN IMPROVED OARLOCK.

The extremely simple device represented in the illustration is intended as an improvement on the swivel oarlocks of boats employed for fishing and hunting purposes on lakes and rivers, and is especially adapted for steering and sculling boats and for use in shells. It has been patented by Mr. L. K. Scudder, No. 181 Broadway, New York City. Fig. 1 represents the oarholder, formed integral with the pintle, and with vertical slots extending through its opposite curved arms, there being also a channel of equal depth transversely through the shoulder at the top of the pintle. Fig. 2 shows the holder locked on an oar by means of a screw having one side of its shank beveled, as shown in Fig. 3, the beveled side being turned toward the inboard end of the oar. By this means the oar may be moved and turned freely as desired, and is yet securely locked in position. The feathering of the oar is in no way interfered with. The device is designed ordinarily to remain attached to the oar when the latter is removed from the boat, but may readily be detached therefrom by unscrewing the pin.



SCUDDER'S OARLOCK.

Correspondence.

The Mechanical Color Test.

To the Editor of the SCIENTIFIC AMERICAN:

I regret extremely that anything in my recent article under the above caption should have seemed to have done injustice to editor-in-chief of the Standard Dictionary. Certainly that was not my intention or desire. The statment, "Early in 1894, the question of the possibility of analyzing various colors and shades in terms of certain standards having been referred to the present writer," does not conflict with the statements of the Funk & Wagnalls Company. At the time mentioned, i. e., 1894, all previous attempts to obtain a satisfactory scheme having failed, the matter was referred to me, and the plan then developed by me and adopted was based on the very able and lucid exposition of the subject entitled "On a Color System," by Professor Ogden N. Rood, that was read before the National Academy of Sciences on November 12, 1891. That the ideas expressed in this paper in any way infringed on the original conception of the plan by Dr. Isaac K. Funk is news to me, and was certainly never expressed by him to me in the many conversations that we had on the subject. Moreover, the Milton Bradley Company, of Springfield, Mass., have had a similar plan in active operation for many years, ordering colored papers from their factory by methods similar to those described by me. A popular exposition of these ideas can in no sense violate the copyright of a dictionary, which from its very nature is a compilation of the ideas of others.

In conclusion, if I have written aught that deprives Dr. Funk of one iota of credit for the plan for a standard for colors conceived in 1891 by him, then it was done unwittingly. MARCUS BENJAMIN.

A New Armor Test.

Tests of armor plates now occur with great frequency, but the interest of the general public in these tests remains undiminished. The test of a nickel-steel Harveyized plate eighteen inches thick occurred at the Indian Head proving ground, near Washington, on March 11. This test was the first of a series which will take place between now and June, by which time nearly all the armor contracted for under the Whitney agreement, amounting in all to about $11,000,000, will have been manufactured and delivered to the government. This includes armor for ships now nearing completion and those on the ways. The success of the trial amply demonstrates the wisdom of the Russian government in having armor plates made in the United States. The ballistic trials of our government are very severe, as the gun is pointed at right angles to the plate, while in actual battle the elevation of the gun necessarily for accurate aim and allowance for "drop" of the projectile, taken with the angle of the ship's sides, especially when rolling, will prevent a normal impact, so that the government trials are unfair to the plate, as every advantage is given to gun and projectile.

The plate weighed thirty-eight tons and cost $20,000. It measured 17 by 7½ feet. A 12 inch rifle was used, which was placed 290 feet from the target.

The first shot fired was a Carpenter projectile, propelled by 295 pounds of powder. The shell entered about 4 inches, where the point was welded to the plate, so as to almost close the aperture. The body of the projectile was shattered, but an examination of the plate failed to show any radial fracture. In the second shot the charge was increased to 395 pounds, giving an initial velocity of 1,956 feet per second. The projectile penetrated 7 inches, and the top was welded as before, while the base of the projectile was completely shattered. A long vertical crack was produced; it extended from the top to the bottom, but there was no longitudinal crack. The crack was so narrow that it was difficult to see how far it extended. Capt. Sampson, head of the Ordnance Bureau, considered the test entirely successful.

The test showed that nothing short of a 13 inch rifle would pierce this armor at a fighting distance of 2,000 yards, which naval experts consider the probable range of the fleet action when in battle. In the battle of the Yalu River the distance between the opposing fleets was greater and the armor was thinner.

Orizaba in Eruption.

The peak of Orizaba is in a state of eruption. The signs of disturbance began to manifest themselves on the 10th inst., and have increased in force constantly since that time. It is vomiting poisonous gases and thick volumes of smoke are emitted from 100 apertures. The earth for 100 miles around is shaken periodically with subterranean vibrations.

The Governor of the State of Vera Cruz will shortly name a commission of scientific men to make an investigation into the eruption, and to make recommendations looking to the protection of the inhabitants of the neighboring villages. The present eruption is in the heart of the best improved coffee districts in Mexico, where many Americans live.

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Abstract from Interesting Decision by the United States Circuit Court of Appeals—Fourth Circuit.

HULSE AND WRIGHT v. BONSACK MACHINE COMPANY. BONSACK MACHINE COMPANY v. HULSE AND WRIGHT.

"A contract between an employer and employe, wherein the employe obtains service with the employer on condition that any improvement he may make on the machines of the employer shall be for the exclusive use of his employer, held valid."

The Bonsack Machine Company is a corporation whose business it is to construct, operate on royalties, lease, and sell machines for the manufacture of cigarettes in this and many other countries. Its principal machine is known as the "Bonsack" machine. By perfecting it and procuring and purchasing patents connected with it the company has acquired and is doing a large business. In the course of its business the company engages many persons to operate its machines. In several instances persons so employed discovered improvements in working them, and, without disclosing the discovery, took out patents, which they used or sold in competition with the company. To avoid this in the future, the company adopted a rule by which it required all persons entering its employment to agree to give the company the benefit of any improvement made while in the employment of the company or at any time afterward.

Hulse had been working at his trade as a mechanic, realizing between four and five hundred dollars a year. On or about July 19, 1886, he applied for employment in the Bonsack Company. In his interview with the president of the Bonsack Company, at which his application was granted, he entered into a written contract, the provisions of which were explained to him, especially that relating to any improvements which he might make in cigarette machines. Of that provision he expressed his approval. He served the company at an increasing salary, beginning at $50 per month; then $60; again $75, and afterward $85 per month.

The contract between the Bonsack Machine Company and Hulse is in these words and figures:

"That the said company has this day employed the said Hulse to set up and operate its cigarette machines at a salary of $50 for the first month and $65 per month thereafter, with such advance of salary up to not exceeding $75 per month as the services of the said Hulse may justify. It is agreed that the said Hulse will serve the company whenever desired, the company to pay his railroad fares whenever traveling at the request of the company.

"No abatement will be made for loss of time because machines are not kept running, nor any extra payment for extra hours.

"The said Hulse agrees to do all in his power to promote the interests of the said company, and in case he can make any improvement in cigarette machines, whether the same be made while in the employment of the said company or at any time thereafter, the same shall be for the exclusive use of the said company.

"And it is agreed that in case the said Hulse be not able to serve the said company efficiently, or shall in any way neglect his duty, the company may stop his services at any time, paying up to such time; but, in case the said Hulse desires to quit the said company, he shall give sixty days' notice thereof."

In July, 1889, while employed by the company in Montreal, his health failed and he ceased to work with it.

Thereafter, on a salary of $125 per month, he entered into employment and partnership of another party named Wright, whose business was to introduce and sell the Bonsack machines in foreign countries. While in this employment Hulse made known to the company that he had devised improvements in their machines. Thereupon he was furnished by the company with a suitable room, power, and materials to continue his experiments and to perfect his idea. While so employed, however, he did not draw any salary from the company. The experiments continued some three or four months.

Hulse then wants the company to pay him one hundred thousand dollars for the invention, which was declined, and the company brought suit to compel the delivery of the invention and patent to the company, and obtained an injunction prohibiting Hulse from assigning the patent or invention to others. The referee gave judgment awarding the patent and invention to the company, but requiring a payment to Hulse and partner of $8,126.

The parties on both sides were not satisfied with this award and an appeal was taken to the United States Circuit Court of Appeals. Judge Simonton delivered the opinion of the court Feb. 5, 1895.

The questions made in the assignments of error are these:

First. What was the contract between the company and Hulse? Is it divisible, consisting of independent covenants; and is it, or any part of it, without consideration?

Second. Is it an unconscionable or unreasonable contract?

Third. Is it void as against public policy?

Fourth. Is the amount reported by the masters a just and reasonable compensation?

1. The Contract.—It is a contract of employment made after an explanation of its terms by one party and the approval of them by the other. No question is made here impugning the bona fides of the contract. The consideration moving from the company is the employment of the services of Hulse at a progressive salary, with no abatement for loss of time and no extra payment for extra hours, all railroad fares of Hulse, when traveling for the company, to be paid.

In consideration of these stipulations, Hulse is to serve the company whenever desired, agrees to do all in his power to promote the interests of the company, and in case he can make any improvements in cigarette machines, either while in the employ of the company or at any time thereafter, such improvements are to be for the exclusive use of the company. This last provision was stated to him as a condition precedent to his employment, was approved and consented to by him. Here we have a contract of hiring at stipulated prices and a contract of service with one detail of the service inserted to prevent any misunderstanding. It would seem to be an indivisible contract. The stipulation claimed to be an independent covenant, directed to any improvements made by him in cigarette machines, was the very stipulation which secured the contract on the part of the company to engage and pay Hulse. The consideration on the part of the company moves to all the parts of the contract. The contract was one of employment. The company was to do certain things. In return Hulse was to do certain things—set up and operate the cigarette machines and promote the interests of the company, and, to do this, give them the benefit of improvements in cigarette machines in case he made any. Can it be said that if he set up and operated the machines he had exhausted the consideration of his contract and that he could antagonize the interests of the company whenever he pleased, his agreement to promote its interests being nudum pactum? For similar reasons it cannot be said that this agreement, or any part of it, is without consideration. In the absence of fraud, mistake, illegality, or oppression, and where no relations of trust and confidence exist between the parties, courts cannot inquire into the inadequacy of the consideration of a contract or set up their own opinions respecting that which parties in good faith on both sides have agreed upon.

"If there is one thing more than another that public policy requires, it is that men of full age and competent understanding shall have the utmost liberty of contracting, and that contracts, when entered into fully and voluntarily, shall be held good and shall be enforced in a court of justice. (Jessel, M. R., Printing, etc., Co. v. Sampson, L. R., 19 Eq., 465.)"

Some consideration is requisite to support a contract; but the sufficiency of the consideration cannot be inquired into. (1 Sedg. on Dam., 455.)

Is this contract unreasonable or unconscionable?

The Bonsack Machine Company owned valuable patented machines employed in the manufacture of cigarettes. Comparatively, the invention was in its infancy, and the machinery was known to be difficult of operation and open to improvement. Any one entering into the employment of the company had full opportunity of learning the merits of the machines, and by constant and daily use could see where the machine was defective and where improvement was needed. If any improvement suggested itself to his mind, he could, by using the machine and the time and material of the company, experiment upon it and ascertain its value. The improvement would be his own idea; but it owed its suggestion and origin, its progressive development and perfection, to the business, the practical working, the opportunity afforded by the company. When, therefore, the company, taught by costly experience, determined to protect itself from the discovery of improvements by its own servants, it did a natural and reasonable thing, and when it protected itself by a covenant in advance of any employment with those seeking its service it did a fair thing. Nor was that part of the contract which put in the same category improvements made while in the employment of the company and those made at any time thereafter unconscionable or unreasonable. Without this safeguard the contract on this point could be easily evaded and be made valueless.

Is the contract void as against public policy? Does it injure the public?

Here we have the case of an ingenious man, without opportunity of developing his talent, and struggling under difficulties, enabled by this contract to secure employment in a large and prosperous corporation, where he could give his inventive faculties full play. He in this way was afforded every opportunity of discovering and removing defects in cigarette machines. He secured this employment by signing this contract. He could not have obtained it if it had been understood that this contract had no validity. Then, in all human probability, the public would have lost the benefit of his discovery. In this point of view a contract of this character cannot be said to be against public policy. Sir George Jessel, in discussing the subject, holds that not only is there no rule of public policy against such a contract as this before us, but that public policy is with it. (Printing and Numerical Co. v. Sampson, L. R., 19 Eq., 466.)

We concur in the conclusion reached by the circuit judge in his opinion in this record:

"The public, in so far as questions relating to public policy are concerned, has no interest in this matter. Should the claim of the Bonsack Machine Company fail, the public would have no right to use the improvement. The device would then belong to Hulse, would be his secret, protected by patent and guarded from the public use by provisions of law. The restraint provided for in the contract does not interfere with any interest of the public, and it only gives a fair protection to the party in whose favor it is given, for which proper compensation was stipulated for the party making it."

The last assignment of error is the amount found by the master and allowed by the court.

The question was what compensation should, under the circumstances, be allowed. The Bonsack Company had declared that the compensation would be liberal. The deserving party was Hulse and the compensation was really his. Wright deserved nothing. He was only a speculator seeking a share of Hulse's reward. Hulse voluntarily, or for considerations which he considered adequate, agreed to divide with him. When, therefore, the master awarded the gross sum of $8,126.36, this was his finding of what would be a liberal compensation for Hulse's service in and about the improvement. We see no error in this of which either party can rightly complain.

It is ordered that the decree of the Circuit Court be affirmed in all respects, each party paying its own costs in this court.

Snow as an Atmospheric Purifier.

BY JOHN B. COPPOCK, F.C.S., SCIENCE MASTER, CAMBERWELL INSTITUTE.

When a flocculent solid body falls through a fluid, it drags down in its falling suspended matters contained in the fluid.

We should therefore expect that snow falling through the atmosphere will cleanse it by taking out most of the suspended matters. The present year has afforded many opportunities of getting a quantitative value for the purifying action of snow.

The first analysis gives figures yielded by snow collected in the suburbs of London, where the district is fairly open. This snow fell on January 13, having a depth of 4 inches approximately. One characteristic of this snow was its great porosity, the crystals were also regular; both indicating that the snow was formed in a calm atmosphere.

The snow was melted and then analyzed as water, the impurities being stated in grains per gallon.

Total solid matter	10·65
Mineral matter	5·75
Carbonaceous matter	4·90
Free ammonia	3·20
Albuminoid ammonia	4·62
Oxygen to oxidize	0·721

A further analysis was made of snow from the same district after the fall of January 30. The result was almost identical with the above figures; but this fact came out that the first few strata of snow contained the largest amount of impurities. Fifty per cent of the snow's thickness yielded 75 per cent of the impurities.

An analysis of the snow of January 30 was also made upon snow collected in the quadrangle of Somerset House. The following shows the difference in the impurities. The physical condition of this fall was favorable to its picking up in its meshes much suspended matter.

Total solid matter	17·32
Mineral matter	6·25
Carbonaceous matter	11·07
Free ammonia	4·65
Albuminoid ammonia	6·50
Oxygen to oxidize	1·16

The carbonaceous matter in each sample was ordinary soot particles.

These figures point out the value of a fall of snow from a manurial point of view, and also its value from a hygienic point of view. In a city where the air is often saturated with carbon particles, a fall of snow may be regarded as a mechanical contrivance of no mean value.—Chem. News.

Bleaching Straw Braid.

Take 7¼ pounds pure oxalic acid and dissolve in 45 gallons of water, using the latter as soft and as cold as possible; then stir in, in small quantities at a time, 4½ pounds peroxide of sodium, waiting between each addition until all action has ceased. When fully dissolved test with litmus paper and make the bath feebly alkaline by adding more peroxide, or ammonia, or silicate of soda. Enter the straw braid, which has been previously cleaned, and leave in the bath until it is bleached, or has a faint straw tint, then lift, rinse, and pass into a bath of tartaric acid. By using less water, the bath may be made stronger and quicker in working.

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A New Use for Mica.

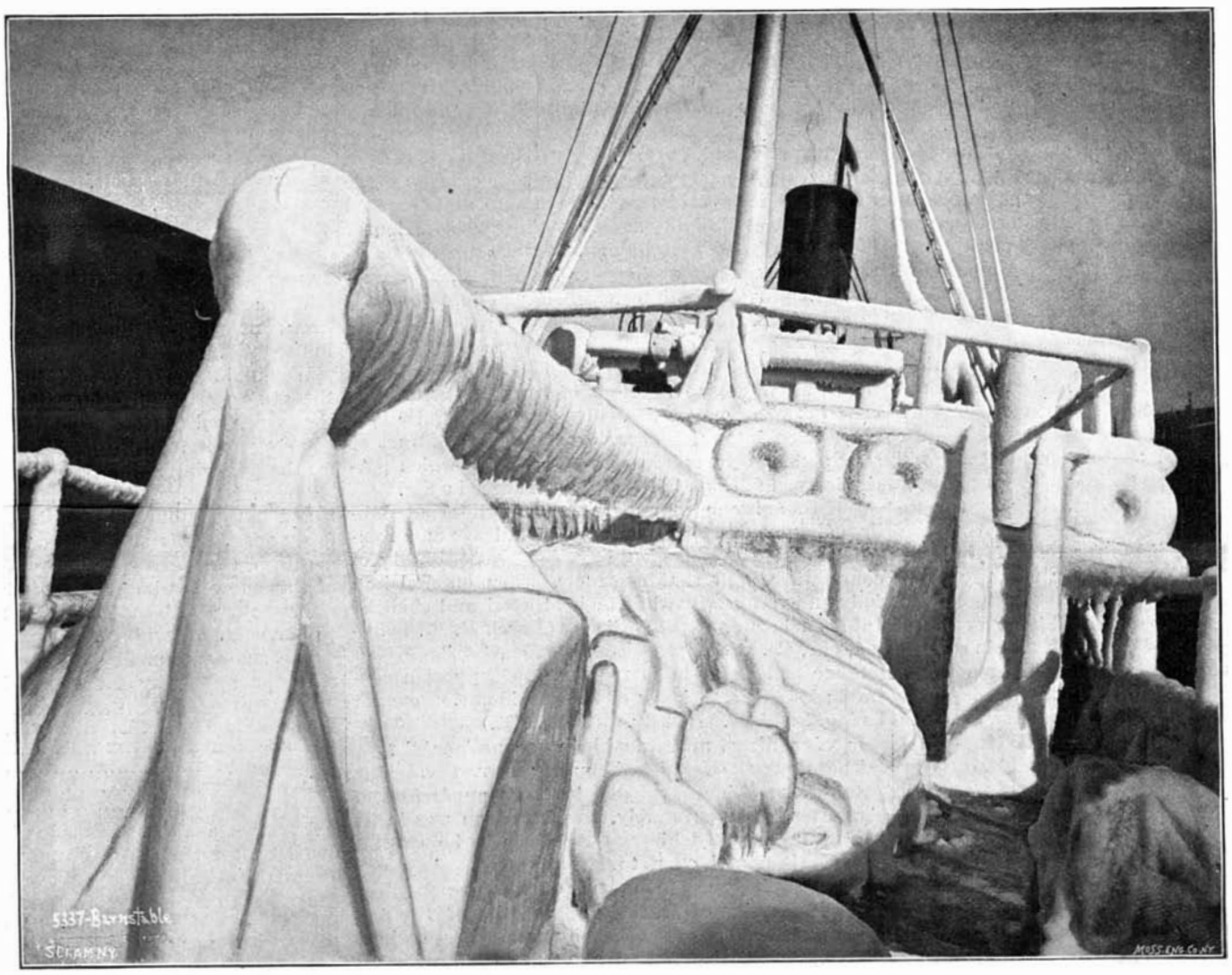
A recent device of the tailors is the figure of a man done on mica. This figure is about a foot high, and is set in a square of cardboard. Sometimes it is in the shape of a man wearing a sack suit, while in others he wears a cutaway outfit, and in others again a frock suit. The man himself is transparent as to body, but his face is painted on, and he wears a collar and necktie of the latest style, in paint. He serves as an illustration, and he is designed to do away with one of the banes of a tailor's life, the man who comes in to look at goods and says:

"Ah, yes; it looks very nice in the piece, but I'm not sure it would suit me so well made up. I'll wait until you cut a coat for some one else, and then I'll come around and see how I like it."

Now when a customer springs this ancient remark the tailor produces one of his mica manikins, lays him over the piece of cloth in question, and lo! he stands forth fully clothed in a wrinkleless suit of that pattern. With a cloth of uniform color or small pattern this device works very well.

THE ICY COASTS OF NORTH AMERICA.

Among the severest trials of mariners who navigate the northerly coasts of America during the winter season is the formation of ice upon the decks and rigging of their vessels. The past winter has been an especially trying one in this respect. Many vessels have been damaged and nearly lost by the accumulation of ice, due to the rapid congelation of the spray which beats upon the bows and other exposed parts. An example of these ice difficulties is seen in our engraving, which is from a photograph of the forward deck of steamer Barnstable as it appeared on the arrival of the ship at Boston, Mass., in February last, after a voyage from the tropical regions of Jamaica.



STEAMSHIP BARNSTABLE—ICE FORMATIONS UPON FORWARD DECK AND BRIDGE.

The Value of Torpedo Boats in War.

A Blue Book recently published deals with partial mobilization of the British fleet and the maneuvers of 1894, which began on July 18 and came to an end on August 7. The conclusion of the book may be quoted: "No ship was put out of action by a torpedo boat. The lightness of the nights seems to have had a twofold effect. No. 80 (Red side) in evading a 'catcher' at first missed the Blue Fleet, but managed to keep up with it and got within range of the rear ship, which was not attacked because she was supposed to belong to Group 3, a class exempted from torpedo attack by the rules. The light apparently was not sufficient to permit the real character of the ship to be ascertained. On the other hand, it is reported that the nights were never really dark enough to afford concealment to the torpedo boats. The torpedo lieutenant in command of No. 80 makes the interesting observation that, owing to the speed of the 'hostile' fleet, the boats were unable to regain their position for attack when once it had been lost. From this it seems permissible to infer that high speed will be of itself no unimportant protection to ships traversing at night narrow waters infested by torpedo boats. The torpedo boat operations were upon a too restricted scale to supply much valuable instruction; but, as far as they went, they tend to confirm the view that the most effective employment of the torpedo boat in war will be limited to sending her to attack an enemy's ship in a known position within the boat's range of action, and that the whereabouts of the enemy must be first ascertained and be communicated to the commander of the boat. The necessity of combining with torpedo boats vessels of other and larger classes to scout and discover the enemy—where exact information as to his position cannot be obtained by other means—seems to be established, and, if so, it carries with it the obligation to consider a mere flotilla of torpedo boats by themselves as a belligerent factor of distinctly imperfect efficiency."

The Electrical Aspects of Calcium Carbide.

In a critical notice of Professor Lewes' Society of Arts paper upon carbide of calcium (See SCIENTIFIC AMERICAN SUPPLEMENT, No. 998), the Electrical Review discusses the electrical aspects of the proposal to manufacture the compound on the commercial scale, and the prospects of acetylene as an illuminant. It is considered that the commercial success of the calcium carbide industry depends upon cheap water power; because of all the heat produced by the coal in a boiler furnace working a steam electric plant, only about 5 per cent is recoverable by an electric furnace. Our contemporary is inclined to regard acetylene as a genuine improvement in gas as an illuminant, and one likely to aid gas in competition with the electric light. Apart altogether from its illuminating properties, it is admitted that acetylene has a much more important commercial aspect, because from it a great many hydrocarbon compounds can be made, such as benzine, hydrocyanic acid, ethylene, alcohol and many other bodies. It is not thought that, at Professor Lewes' estimate of their comparative duties in light given for power consumed, steam-generated carbide of calcium and acetylene can compete with incandescent electric light.

Professor Lewes put the comparison thus: Acetylene, 44; electric, 28. But it is held that the difference is not quite so great; for with incandescent lamps at 4 watts per candle it comes out as 40: 50 very nearly. With electric lights working at 3·25 watts per candle, power for power, the two light sources are equal. With arc lamps the superiority is reversed; the figures coming out at 80 for the electric arc, as against 50 for the acetylene light. It is admitted that the question is not altogether one of power, although this consideration is of interest as settling whether carbide of calcium can be profitably made with existing steam power plants. If water power can be obtained at the American estimate of cost, which is 50 cents per hour for 180 horse power, the acetylene will cost as little as its advocates claim, or 6s. 4½d. per 1,000 cubic feet. Although this is about double the average price of ordinary coal gas in England, acetylene gives 15 times the light or 7½ times the candle power for the same money. Now, to compare its cost, light for light, with incandescent electric light, 6s. 4½d. will buy 13 units of electricity, which, at 4 watts per candle power, works out to 3,250 candles gross; while 1,000 cubic feet of acetylene give 28,000 candle power for the same money. Meanwhile, the inquiry is made as to what is the cost of large water power.

A "Letter" Officially Defined.

A ruling was recently made by Postmaster Coveney, at Boston, Mass., upon the question as to what constitutes a letter "in its usual and ordinary form," and it has just been confirmed, according to the Boston Transcript, by a communication from Washington. The ruling and its confirmation were the outcome of a complaint recently made to the postmaster by a gentleman who desired to send through the mails a sealed roll properly stamped and directed to the Commissioner of Patents at Ottawa.

He said that the roll contained plans and drawings relative to a patent. He had offered this roll to the clerk at the foreign window, and following out the rules of the office, the clerk refused to receive it. When asked for reasons, he was referred to the postmaster. Col. Coveney gave a decision to the effect that the term letter is to be construed to mean and embrace sealed packages consisting of an envelope of any size, but flat, as is the usual letter. The objector did not think that this ruling and definition of a letter was correct, and gave his opinion that a letter "was a package containing personal matter of no salable value."

In the communication from Washington, N. I. Brooks, the Superintendent of Foreign Mails, says that "the Canada office and this department concur in the opinion that the term letter in its usual and ordinary form is to be construed to embrace sealed packages consisting of an envelope of any size, but of the usual letter shape and its contents; but that rolls or a package not inclosed in an 'envelope,' as the word envelope is generally used, cannot be considered to be 'a letter in its usual and ordinary form.' A sealed package in the form of a roll is therefore not entitled to transmission in the mails exchanged between the United States and Canada, and your office was correct in declining to receive the sealed roll mentioned."

Complaints of the kind made by the gentleman who wished to forward the sealed roll have been numerous, but this is the first time in the history of the department that it has been called upon to decide what constituted a letter. By this decision no sealed packages nor rolls will be taken at the Boston Post Office for transportation to Canada, as the regulations of the Postal Convention say that "sealed packages other than letters in the usual and ordinary form are not allowed to be dispatched to Canada, even if postage has been prepaid in full at letter rates." This is no new law or regulation, as it was enacted about ten years ago, and has always been enforced more or less.

Wood Stains.

A solution of 50 parts of commercial alizarin in 1,000 parts of water, to which a solution of ammonia has been added drop by drop until a perceptible ammonia odor is developed, will give to fir and oak a yellow-brown color and to maple a red-brown. If the wood is then treated with a 1 per cent aqueous barium chloride solution, the first named become brown and the latter a dark brown. If calcium chloride be used instead of barium chloride, the fir becomes brown, the oak red-brown, and the maple a dark brown. If a 2 per cent aqueous solution of magnesium sulphate be used, the fir and oak become dark brown and the maple a dark violet-brown. Alum and aluminum sulphate produce on the fir a high red and on oak and maple a blood red. Chrome alum colors maple and fir reddish brown, and oak Havana brown. Finally, manganese sulphate renders fir and maple a beautiful dark violet-brown and oak a dark walnut-brown.

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INVENTOR TESLA'S LOSS.

By a fire which occurred at 33 and 35 South Fifth Avenue, New York City, on the morning of March 13, Nikola Tesla, the inventor and scientist, sustained a severe loss in the total destruction of his laboratory, in which were several nearly completed inventions which, it is said, were intended to revolutionize electric lighting. The loss cannot unfortunately be reckoned in dollars, and it is feared may seriously affect Mr. Tesla's health, as for some time he has been in a state of nervousness bordering on exhaustion, on account of overwork occasioned by the approach to completion of some of his great inventions.

Dr. Tesla was for a time associated with Edison. The attention of the scientific world first centered upon Tesla in 1887 through his invention of the rotating magnetic field for the economic transmission of power. It is believed that Mr. Tesla's experiments were made with a view to saving at least one-third of the energy now wasted in electric lighting. He has been working in his laboratory with a number of assistants, and the results which he has actually obtained have been kept a profound secret. Mr. Tesla has lectured before scientific bodies, both in Europe and America, and he has recently received honorary degrees from Yale and Columbia Colleges. He is at present controlling electrical engineer of the Niagara Falls Power Company. Some of Mr. Tesla's remarkable experiments have been reproduced lately in Berlin. The Illustrirte Zeitung of recent date gives an engraving, which we copy, together with the following account:

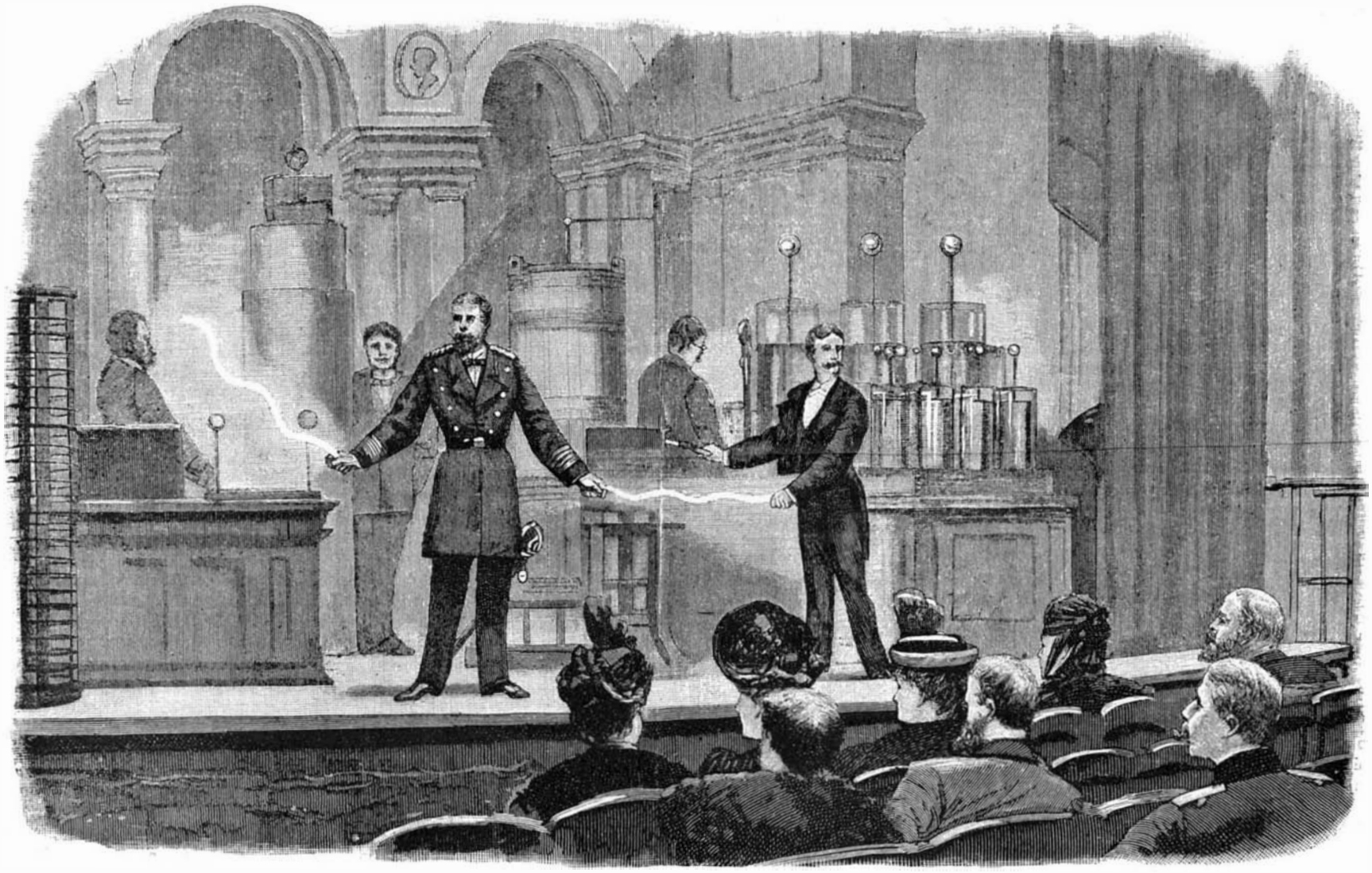
"About twenty years have passed since Edison produced the incandescent lamps under the proud name of the 'light of the future,' and which lamps slightly modified are now the 'light of to-day.'

"A new 'light of the future,' is again promised from the United States, and should it materialize in practical form will have the great advantage over the incandescent and arc lamps that for its production no conducting wires are required, and which for this reason alone would be sufficient to produce a complete revolution in the electrical world.

"Nikola Tesla, the inventor of the new light, obtained by his experiments surprising results. In following up certain discoveries of Prof. Herz, of Bonn, relative to electrical waves, he succeeded in lighting a freely suspended incandescent lamp by the use of high tension and rapidly alternating currents.

"The experiments further demonstrated the remarkable fact that alternating currents of a tension ten times that which is used in electro-execution do not affect or injure the human body when passed through the same; and in fact are hardly perceptible in case the currents alternate 100,000 times in a second, that is, change their direction at this almost incomprehensible velocity.

"Several of the experiments were made at the last annual meeting of scientists in Vienna, but through Prof. Spies, one of the members of the Berlin 'Urania,' the experiments were made publicly, and were attended by the German Emperor's brother, Prince Henry, who, as the cut shows, served as a conductor for the high voltage currents. By reference to the illustration, it will be seen that the connection between two persons is made by Geissler tubes, which show the light produced by the currents. In another experiment a number of connected wires were arranged in the auditorium and connected with the electric current, whereby an electrical wave was produced in the room, and noticed by some of the audience through the lighting of Geissler tubes held in their hands, and without these persons being in direct connection with the wires."



RECENT TESLA EXPERIMENTS IN BERLIN.

The Loss of the Elbe.

At the recent inquest upon the bodies landed at Lowestoft of the victims of the Elbe disaster, Robert William Greenham, pilot, stated what took place on board the Elbe after the collision. He said he had crossed the North Sea about 400 times, and had been on board the Elbe about one-tenth of the trips. At 12 o'clock midnight on January 29 the atmosphere was clear, but the sky was cloudy. The Elbe was lighted by electricity, which was kept burning all night. The masthead light and the side lights, however, were oil. He went to his cabin at midnight, undressed and went to sleep. At 5 o'clock he looked at his watch, which showed English time, and about 20 minutes afterward he heard a crash as if a cylinder had burst, and thought the engines had broken down. He got out of his bunk, put on some clothes and went to the bridge, where the captain and the chief officer were standing. He asked the captain what had occurred and he replied, "A collision has taken place." One of the officers remarked that they had been run into by a steamer on the port side. He observed the ship make a slight list to port, and the captain then ordered that rockets should be fired and blue lights burnt, and that the steam siren should be blown. One of the officers then came up and reported all the watertight doors closed. The ship made a further list to port, and the captain ordered the engines half speed ahead, with the helm put hard to starboard, the engines having been stopped at the time when the witness went on the bridge, and the wind being strong from the east-southeast. By this maneuver it was sometimes possible to give the vessel a list to starboard and bring the damaged portion high out of the water. The engines went for about four minutes and then stopped. The captain then gave the order to get all the boats ready and swing them out, but not to lower them. There were ten boats on board, five on each side. The witness left the bridge in company with the chief officer in order to assist in getting the boats ready. He proceeded to No. 3 boat, and as soon as the covers were sufficiently removed for the crew to get at the boats they used axes to free them, as everything was frozen stiff. The order was then given to every man on deck, "Let all the crew remain at their stations." The women and children were ordered to the starboard side, which was the lee side, in order that they might be got into the boats first. There was no confusion on board, and every order was obeyed punctually. Everything was in total darkness at this time, as the electric light had gone out. The lights had been turned on to the promenade deck to give light to launch the boats. The third officer informed him that as all the watertight compartments were closed it was impossible for the ship to sink. Both No. 3 and No. 5 boat, which were the next to be got out, were pretty well filled with people. It was too dark to see whether they were passengers or sailors. The ship settled down very quickly, and the witness went up to the bridge and warned the captain that the water was already breaking over the quarterdeck. He returned shortly to No. 3 boat and heard the order given to lower the boats. No. 5 boat was lowered and swamped as soon as she touched the water. He jumped into No. 3 boat and the third officer followed. The boat was immediately lowered. He saw a green light about three points abaft the port beam, some three miles away, while he was standing on deck. He also saw a white stern light apparently on the same vessel. At daybreak, which was in about three-quarters of an hour, he observed the hull of the vessel with the two lights aboard her. He could not see her masthead lights. The vessel steamed ahead, burnt two lights, which he took to be blue lights, put her helm hard a-starboard, and, proceeding in a southerly direction, shortly afterward disappeared. He took some paper from his pocket just before the steamer turned her head and burnt it in order to attract her attention. He made the observation that he believed it was the steamer which had run into them. There was also a smack in the vicinity. The steamer was about two points on their starboard bow to windward, and the smack was on the starboard beam. The steamer was from half to three-quarters of a mile away and the smack about one mile. He saw several smacks' lights in the vicinity, but none close by. He saw the lights quite distinctly, as they could see a light that night directly it came out of the water.

The lights of the Elbe were burning when he got on deck. He was positive that the steam siren was continually sounded and that a quantity of rockets were discharged, in addition to the burning of 20 blue lights in pairs.

The witness gave his opinion that the ship probably sank because two watertight compartments were knocked into one. He could not say whether the Elbe ever had boat drills on board. He had never seen such drills when on the North Sea.

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Clay Eating.

Among the extraordinary passions for eating uncommon things must be reckoned that which some peoples exhibit for eating earth or clay. Of this practice, which would appear to have once prevailed all over the world, numerous examples were cited by Captain J. G. Bourke, U. S. A., in the Ninth Annual Report of the Bureau of Ethnology. In some places, the custom has degenerated into a ceremonial, while in others the eating of this strange food still prevails as a kind of necessity to the lives of those who are addicted to it.

The Mexican devotees picked up a piece of clay in the temple of Tezcatlipoca and ate it with the greatest reverence, and also ate a piece of earth in swearing by the sun and earth. But the use of clay by the Mexicans was not merely a matter of ceremony, for the substance seems to have been an esculent in common use. Edible earth was sold openly in the markets of Mexico, and appears in the list of foods given by Gomara.

Cabeza de Vaca says that the Indians of Florida ate clay, and that the natives offered him many mesquite beans, which they ate mixed with earth. Venegas asserts that the Indians of California ate earth. The traditions of the Indians of San Juan Capistrano and vicinity show that they had fed upon a kind of clay, which they often used upon their heads by way of ornament. The Tatu Indians of California, according to Powers, mix red earth into their acorn bread to make the latter sweet and cause it to go further. Sir John Franklin relates that the banks of the Mackenzie River contain layers of a kind of unctuous mud, which the Tinneh Indians use as food during the seasons of famine, and even at other times chew as an amusement. It has a milky taste and the flavor is not disagreeable. The Apache and Navajo branches of the Athabascan family of North American Indians are not unacquainted with the use of clay as a comestible, although among the former it is now rarely used, and among the latter is employed only as a condiment to relieve the bitterness of the taste of the wild potato. In the same manner it is known to both the Zuni and the Tusayan.

In South America, likewise, the eating of clay prevails among the Indians on the banks of the Orinoco, throughout Brazil, and on the mountains of Bolivia and Peru.

In Western Africa, the negroes of Guinea have long been known to eat a yellowish earth called by them "caouac," and the flavor and taste of which is very agreeable to them and said to cause them no inconvenience. Some addict themselves so excessively to the use of it that it becomes to them a real necessity, and no punishment is sufficient to restrain them from the practice of consuming it.

When the Guinea negroes were in former times carried as slaves to the West India islands, they were observed to continue the custom of eating clay. But the "caouac" of the American islands, or the substance which the poor negroes attempted to substitute in their new homes for the African earth, was found to injure the health of the slaves who ate it, and so the practice was long ago forbidden and has possibly now died out in the West India colonies. In Martinique, a species of red earth or yellowish tufa was formerly secretly sold in the markets, but the use of it has probably ceased in the French colonies also.

In Eastern Asia a similar practice prevails in various places. In the island of Java, between Sourabaya and Samarang, Labillardiere saw small square reddish cakes of earth sold in the villages for the purpose of being eaten. These were found by Ehrenberg to consist for the most part of the remains of microscopic animals and plants which had lived and been deposited in fresh water. Some of the Japanese, too, are addicted to the practice of eating earth. Dr. Love, some time ago, published an analysis of a clay which is eaten to a considerable extent by the Ainos; it occurs in a bed several feet thick in the valley of Tsietonai (eat-earth valley) on the north coast of Yesso. It is light gray in color and of fine structure. The people mix with the clay fragments of the leaf of some plant for the aromatic principle it contains. They eat the earth because they think it contains some beneficial substance, not because it is a necessity with them. They have meat and abundance of vegetable food. The clay is eaten in the form of a soup. Several pounds are boiled with lily roots in a small quantity of water, and afterward strained. The Ainos pronounce the soup very palatable.

In Runjut Valley, in the Sikkim Himalayas, a red clay occurs, which the natives chew, especially as a cure for the goitre.

In Smyth's Aborigines of Victoria, it is stated that a kind of earth, pounded and mixed with the root of the "mene" (a species of Hæmadorum), is eaten by the natives of West Australia.

In Northern Europe, especially in the remote northern parts of Sweden, a kind of earth known by the name of "bread meal" is yearly consumed by hundreds of cart loads, it is said. A similar earth is commonly mixed with bread in Finland. In both these cases, the earth employed consists for the most part of the empty shells of minute infusoria in which there cannot exist any ordinary nourishment.

Some of the Siberian tribes when they travel carry a small bag of their native earth, the taste of which they suppose will preserve them from all the evils of a foreign sky. We are told that the Tunguses of Siberia eat a clay called "rock marrow," which they use mixed with marrow. Near the Ural Mountains, powdered gypsum, commonly called "rock meal," is sometimes mixed with bread. The Jukabiri of Northeastern Siberia have an earth of a sweetish and rather astringent taste, to which they ascribe a variety of sanatory properties when eaten.

In North Germany, on various occasions where famine or necessity has urged it (as in long protracted sieges of fortified places) a substance called "mountain meal," similar to that used in Sweden and Finland, has been employed as a means of staying hunger.

According to Pliny, the Romans had a dish called "alica" or "frumenta," made of the grain zea mixed with chalk from the hills of Puleoli, near Naples.

According to the myths of the Cingalese, their Brahmins once fed upon earth for the space of 60,000 years.

Chemical Powers of Minute Sea Creatures.

All known chemical substances are present in solution in sea water. In spite of the precision and delicacy of their analyses, chemists can never determine absolutely the exact proportions in which these elements are present; they can merely indicate their presence as "traces," especially in the case of the very rare elementary substances. Except for the chlorates and sulphates, which are easily obtained by evaporation, spectrum analysis alone shows us the existence of these elements in sea water.

It has been shown that the sheets of copper on ships often become covered with a layer of silver from the water of the sea, deposited there by electro-chemical action; and nevertheless all our minutest methods of analysis have not yet been able to detect this metal in the waters of the ocean. Iodine, found in such abundance in the ashes of marine plants, reveals itself to analysis only in traces. These organisms, then, must have the power to extract and concentrate it from the mass of water in which it exists in such dilute form. Many chemical elements exist in the water in very minute quantities; that at the bottom of the sea, for example, contains carbonate of lime only in the proportion of one to ten thousand. This does not prevent plants and living organisms, such as the Foraminifera, the corals, echinoderms, mollusks, etc., from finding in this small proportion what is necessary to their constitution and to their existence. At the death of these organisms, the mineral matter accumulates and ends by forming great rocky masses. In all parts of the ocean there live, multiply and die myriads of calcareous organisms that fall continually in showers to the bed of the sea. The calcareous rocks, that on the earth attain often great thickness and cover thousands of square miles, have this origin.

Of all the deposits that form in the depths of the ocean, the most singular and the most curious are the irregular nodules varying from the size of a small pea to that of an orange, and composed of hydrated oxides of manganese and iron. They contain 25 per cent of binoxide of manganese, 15 of peroxide of iron, 30 of water, besides divers silicates, and 30 per cent of various substances, among which careful analysis has shown the existence of thallium, molybdenum, tellurium, vanadium, nickel, lithium, cobalt, barium, strontium, tin, copper and lead. The origin of these associations of diverse and rare substances has not yet found any plausible explanation. How have such minute quantities of manganese as those that have been shown in the composition of rocks, and that do not exceed the twentieth part of those of iron, come to form concretions in which this substance predominates? The soundings made by Murray and Buchanan on the west coast of Scotland have shown that these nodules are found especially in the marine slimes where pyrite and other compounds of iron exist. These slimes accumulate slowly after having passed through the bodies of worms or other organisms an infinity of times. At each passage a little manganese and iron is added, and in the course of ages these oxides, becoming more and more concentrated, form these bizarre and remarkable nodules.

The eminent German botanist Cohn has shown that the agents really effective in freeing the carbonic acid that keeps in solution the mineral matter are minute plants, around which are deposited those substances that the water, deprived of carbonic acid, can no longer dissolve. Wethered has proved that the limestone of various epochs is composed in great part of organisms consisting of twisted tubes, simple or branched, which have been given the names of girvanella, micheldeania, etc.; these organisms are plants secreting calcareous matter in their cellules; they thus form at their death calcareous agglomerations that make up rocks. But while certain plants participate by their constant action in the formation of these rocks, others, on the contrary, have a diametrically opposed action. They dissolve and destroy the calcareous elements. By his researches, Duncan showed to scientists this curious fact, that fossil corals are often found perforated by minute tubes. He concluded from this that they had vegetable parasites. All the observations made during recent years on the deposits that cover the bottom of the ocean lead to this conclusion: Wherever substances are found in solution in sea water, they can be extracted thence only by the wonderful action of living organisms.

What Shall We Eat?

W. O. Atwater, Ph.D., professor of chemistry in Wesleyan University, in a pamphlet issued under the auspices of the United States Department of Agriculture, says:

"A quart of milk, three-quarters of a pound of moderately fat beef, sirloin steak, for instance, and five ounces of wheat flour, all contain about the same amount of nutritive material; but we pay different prices for them and they have different values for nutriment. The milk comes nearest to being a perfect food. It contains all of the different kinds of nutritive materials that the body needs. Bread made from the wheat flour will support life. It contains all of the necessary ingredients for nourishment, but not in the proportions best adapted for ordinary use. A man might live on beef alone, but it would be a very one-sided and imperfect diet. But meat and bread together make the essentials of a healthful diet. Such are the facts of experience. The advancing science of later years explains them. This explanation takes into account, not simply quantities of meat and bread and milk and other materials which we eat, but also the nutritive ingredients or 'nutrients' which they contain."

The chief uses of food are two: To form the material of the body and repair its wastes; to yield heat to keep the body warm and to provide muscular and other power for the work it has to do. Dr. Atwater has prepared two tables showing, first, the composition of food materials, the most important of which are the nutritive ingredients and their fuel value; second, the pecuniary economy of food, in which the amount of nutrients is stated in pounds. In the first table we find that butter has the greatest fuel value, fat pork coming second, and the balance of the foods mentioned being valued as fuel in the following order: Cheese, oatmeal, sugar, rice, beans, cornmeal, wheat flour, wheat bread, leg of mutton and beef sirloin, round of beef, mackerel, salmon. Codfish, oysters, cow's milk, and potatoes stand very low as fuel foods.

From the second table we learn that the greatest nutritive value in any kind of food of a specified value (Dr. Atwater takes 25 cents' worth of every kind of food considered) is found in cornmeal. In 10 pounds of cornmeal there are a trifle more than 8 pounds of actual nutriment. In 8⅓ pounds of wheat flour there are over 6¾ pounds of nutriment; in 5 pounds of white sugar there are 4½ pounds of nutriment; in 5 pounds of beans there are 4 pounds of nutriment; in 20 pounds of potatoes there are 3¾ pounds of nutriment; in 25 cents' worth of fat salt pork there are 3½ pounds of nutriment; in the same value of wheat bread there are 2¼ pounds; in the neck of beef, 1¾ pounds; in skim milk cheese, 1¾ pounds; in whole milk cheese, a trifle more than 1½ pounds; in butter, 1½ pounds; and in smoked ham and leg of mutton about the same; in milk, a trifle over 1 pound; in mackerel, about 1 pound; in round of beef, ¾ of a pound; in salt codfish and beef sirloin, about ½ a pound; in eggs at 25 cents a dozen, about 7 ounces; in fresh codfish, about 6 ounces; and in oysters at 35 cents a quart, about 3 ounces.—Troy Press.

Man's Debt to Spiders.

It cannot be reasonably doubted that one of the most interesting features connected with the natural history of spiders is their habit of gaining a livelihood by spreading nets for the capture of prey. It may be that the large share of the attention of naturalists that this habit has attracted is to be attributed to the fact that it appears to be confined in the animal world to spiders and men. This circumstance is of itself sufficiently remarkable to call for special comment; but its interest is not a little enhanced by the reflection that since spiders made their appearance in the history of animal life vast ages before man came upon the scene, none of us can justly claim that any member of our own kind was the first in the field in the invention of the art of netting. Possibly, indeed, the oft-repeated and unavoidable observation of the efficacy of a spider's web for the purpose of catching otherwise unobtainable prey may have roused in the brain of some intelligent hunter among our ancestors the idea of the practical utility of a similar instrument for the capture of fish or other eatable forms of life. But if this be so, civilized man has long forgotten the debt of gratitude he owes to spiders. For, to the average individual among us, a spider is a thing to be looked upon and spoken of with fear and dislike amounting to loathing, and to be ruthlessly destroyed when a safe chance of destruction is afforded. R. I. Pocock

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VERTICAL DOUBLE SPINDLE HOLLOW CHISEL MORTISING MACHINE.

The illustration shows an entirely new and novel machine, designed particularly for door mortising and other work where there are a number of pieces in duplication. It is especially useful for the best class of hard wood doors, such as are used in railroad and street cars. The machine will do its work rapidly, two door stiles at the same time, they being exact duplicates right and left, so as to frame up absolutely square.

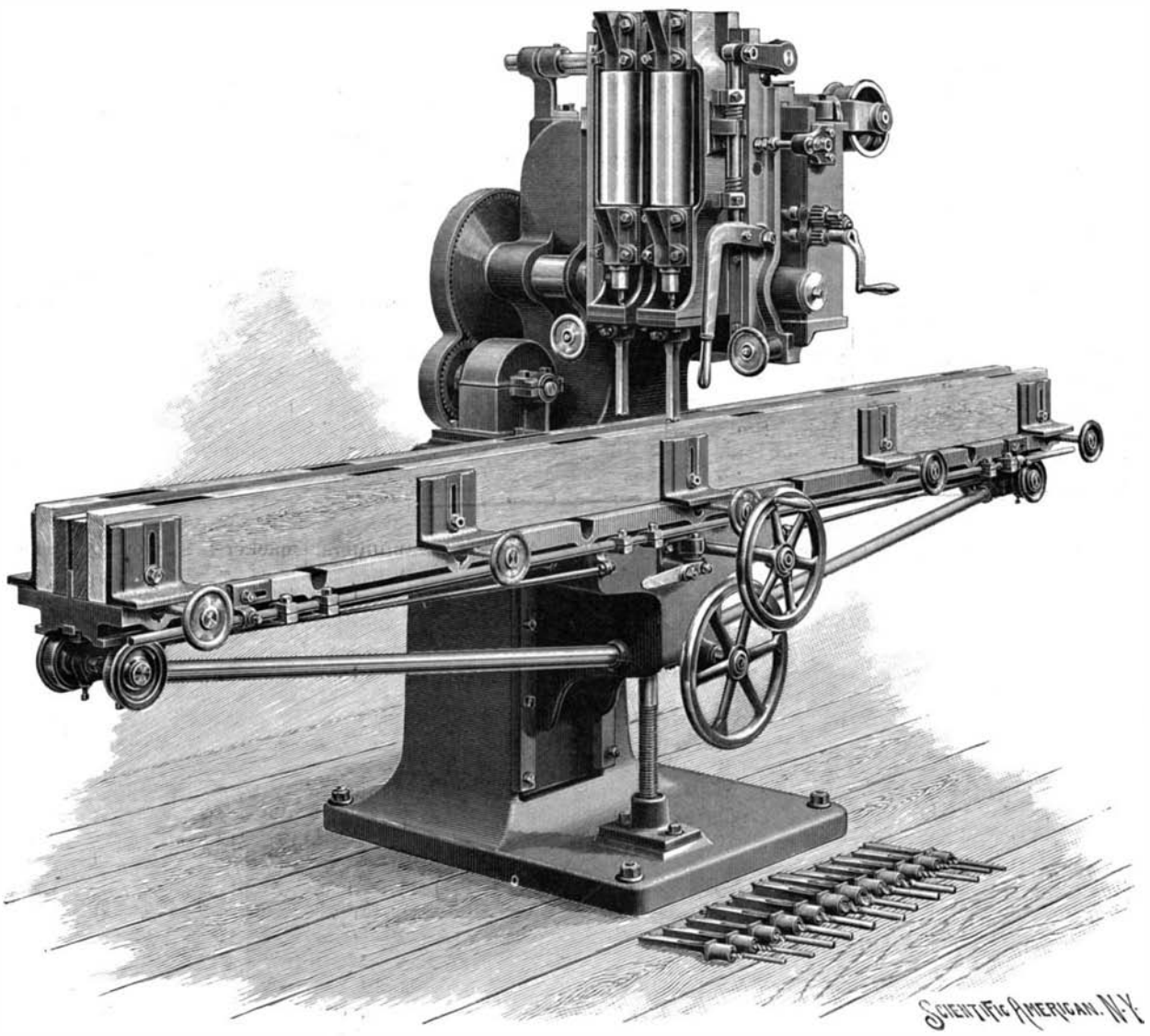
There are two hollow chisels instead of one, being in perfect alignment with each other. The stroke of the chisel bars can be regulated for depth of mortise and can be increased or decreased at will or stopped at any point of the stroke, the greatest stroke being 6½ inches. They operate automatically. They can also be adjusted to cut to the same depth in case of one chisel being shorter or longer than its mate. The chisels have quick return, and will make thirty-five strokes per minute, increasing in number as the strokes are shortened.

Each spindle carriage is provided with a strong clamp, so that when set it can be securely held in position. They are also counterweighted. The chisel has a range across the material of 2 inches for each. All gear wheels are machine cut, those of small diameter being made from steel forgings.

The table is of iron, 10 feet long, and planed true. It has a vertical adjustment of 14 inches and a horizontal movement of 10 feet. It is provided with a suitable number of quick-acting clamps, which clamp both pieces at the same time, also an ample number of stops, so that when set up no laying out of the work will be necessary.

The range of the mortising is from ¼ inch to 1¼ inch. In mortises from ½ inch up it will make a blind mortise in a pair of 12 inch stiles, 6½ inches deep, or will mortise through a pair of stiles 6 inches wide.

The machine is provided with two chisels and augers, each ¼ inch, ⅜ inch, ½ inch, ⅝ inch, ¾ inch, 1 inch, and 1¼ inch. Also countershaft, which is placed overhead, and suitable steel forged wrenches. The tight and loose pulleys are 12 inches diameter, 5 inches face, and should make 800 revolutions per minute. Weight, 3,600 pounds. This machine is manufactured by Messrs. Berry & Orton, Arch and 22d Streets, Philadelphia, Pa.



VERTICAL DOUBLE SPINDLE HOLLOW CHISEL MORTISING MACHINE.

The War Bicycle.

An interesting paper on the importance of the bicycle for military purposes has been prepared recently by Col. A. R. Saville, the professor of military tactics at Royal Military College at Sandhurst. The author's prominent position lends unusual importance to these opinions. Col. Saville says:

"The speed and staying power of cyclists qualify them for employment in all the duties pertaining to messengers, orderlies, or dispatch bearers, both in peace and war. The establishment of relay posts of cyclists on any long line on which messages have to be sent would insure very rapid transmission. The speed and noiseless progress of bicycles fit them as a means of communication between the fractions of an outpost force, both by night and day, and between outposts and the main body.

"The same qualifications, and the inconspicuous character of the riders, make them eligible as scouts or reconnoiterers in any inclosed and cultivated country where the operations are mainly confined to roads. Cyclists, being infantry, can dismount and go wherever infantry can go, and thus a small body of wheelmen has nothing to fear from an equal body of horsemen similarly engaged in scouting.

"Cyclists are well qualified to act as escorts for convoys. The men would not be tempted to mount the wagons, and the convoy could move faster than if the escort were composed of infantry, and the cyclists could reconnoiter widely to the front or flanks. As an escort for guns they would prove efficient, for all such infantry duties can be more quickly done by wheelmen.

"The power of carrying intrenching tools or materials for demolitions, added to the speed and silence, enables sudden raids to be made for offensive purposes.

"In the case of a force detached or otherwise, cyclists would in most cases be able to perform the scouting duties for the information and protection of the force. Probably under all the circumstances, they might not be able to perform all the duties as well as the cavalry, but there can be no doubt that they could reconnoiter more widely and rapidly than unmounted infantry."

The first test in war of the military bicycle has yet to be made, but the advocates of the wheel have no fear of its upsetting their theories.

A Large Railway Pier.

The great railway pier of the Southern Pacific Company at Santa Monica, Cal., is one of the most remarkable constructions of its kind in the world. Santa Monica is the terminus of the Southern Pacific road and the place of call of all the steamers of the company. The cargoes of great numbers of vessels are loaded and unloaded at this point, and the equipments of the great pier are very complete and efficient. The pier is 1,500 feet in length and has a maximum width of 130½ feet. In its construction some 5,200 piles of Oregon pine have been used, about 3,675,000 feet of lumber and 200 tons of iron. The cost of building the pier and grading the approach to it has been $500,000.

A notable feature of the pier are the huge coal bunkers built along the east side of the pier. The bunkers are 816 feet in length, 36 feet wide and 36 feet high and have a capacity of 10,000 tons. They are divided into four compartments and are provided with 51 chutes. A track runs beneath these on which cars may be run and quickly filled. At the end of the pier is a huge boiler works, with some thirty iron buckets which work automatically, and this contrivance makes it possible to coal a ship in one-third the ordinary time. The end of the pier is provided with another depot building 384 feet long and a freight house 68 feet long. Both of these are two-story buildings provided with sleeping accommodations and a restaurant for those on duty. The remainder of the building is but one story high and is used as an open freight shed. The pier is gridironed with tracks. The supply of lines is large, moor buoys are fixed at frequent intervals and a powerful steam tug is in constant use. The pier is also provided with telephone lines and there are a number of faucets and fire hose arranged along the wharf against a time of need. The equipments make it possible to handle cargoes of as many vessels as can be moored along the pier.

The Hydrophone.

The principal object of this simple apparatus is to give warning to a port or fleet of the approach of a torpedo boat, even if the latter is totally submerged and, therefore, quite invisible. As described in the London Times, it consists essentially of two parts, one submerged in the sea at a proper distance from the port or fleet to be warned, and at a depth sufficient to escape the surface agitation. This part may be described as an iron bell jar, which, on being plunged mouth downward into the water, retains a volume of air in the upper portion or bottom, where a copper box, protecting the sensitive organ of the apparatus, is fixed. The organ in question is merely a very delicate vibratory contact, which makes and breaks an electric circuit connecting the submerged bell with the indicator or second part of the hydrophone, situated on shore or on board one of the ships of the fleet. The contact is formed by a flat horizontal spring fixed at one end and loaded at the other by a heavy piece of brass, having on its upper surface a small platinum stud. A fine platinum needle, kept upright by a vertical guide, rests its lower end loosely on the platinum stud. The needle and the stud are connected in the electric circuit through the guide and spring, and when the needle dances on the stud the circuit is made and broken. An electric current from the ship or shore battery is always flowing through the circuit—that is to say, between the submerged bell and the indicator. Now, the propeller of a torpedo boat or of a torpedo sets up vibrations in the water, and these, reaching the submerged bell, agitate the trembling contact, so that the needle dances on the stud and interrupts the current. The consequence is that the indicator begins to work and announces the submarine disturbance. This part of the hydrophone consists essentially of an electromagnet through which the current passes, with an armature free to oscillate when the current is rapidly made and broken—that is to say, when the current becomes intermittent. The motions of this armature can be seen by an observer if he chooses to watch, but actual observation is not required, for the indicator itself gives the alarm. This takes place when the swing of the armature carries it within the attraction of a magnetic contact piece fixed near it. The armature is then drawn to the contact piece and held fast there. The swinging armature and the contact piece are connected in the circuit of a local battery, and, when they meet, the current flows to ring an electric bell or light an electric lamp. The torpedo boat thus announces its own arrival on the scene in spite of itself, and precautions can be taken against it.

The whole apparatus is beautifully worked out and comparatively inexpensive. Moreover, it is sufficiently sensitive to announce the passage of steamers a mile distant from the bell. Obviously such an instrument might also be used for submarine signaling, for a ship by stopping and starting her propeller could send a message in the Morse code and the shore could respond by flashing the electric lamp. In the case of another ship the response might be made by her propeller.—Proceedings of the United States Naval Institute.

THE director of the Lick Observatory, Dr. E. S. Holden, has been made a commander of the order of the Ernestine house of Saxony, in consideration of his services to science. The order, which was founded in 1690, is given by the combined duchies of Altenburg, Meiningen, and Coburg and Gotha, and is the only order conferred by them.

THE highest mountain ascents are those credited to Mr. W. H. Johnson, of the Indian Survey, between 1860 and 1865, in Cashmere. In 1865 he climbed three peaks of the Kuen Lun, one of which, according to the measurement of the Indian Survey, is 23,800 feet high.

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Strindberg on the Inferiority of Woman.

Woman is inferior to man—so at least says an interesting article by Strindberg in the Revue Blanche for January last, which attracted much attention in France. The author of "Pere" does not arrive at this conclusion by an exclusive analysis of woman's mental qualities; to a great extent he relies upon her structural and anatomical weaknesses. To begin with, her blood is not to be compared with man's, for it resembles that of the child and of the embryo; her spine, too, approaches theirs in formation, being longer and affording more evidence of that caudal appendage which is supposed to have been a distinguishing feature of the hairy ancestor of the human race. Woman's skull is closely akin to that of the child and the negro, and the gray matter of the brain is not so dense in the female as in the male. On the other hand, her nerves are much stronger, whence the capacity for supporting physical pain with comparative stoicism—a capacity which she shares with the savage, whose nervous system is somewhat similar. In connection with the inferiority of women, Strindberg propounds a strikingly novel theory. In the burial places of the Stone and Iron Ages have been found two different kinds of skulls, one brachyocephalous, the other dolichocephalous. It is opined that the first, an inferior type, are female; the second, a superior type, male. The women, he declares, evidently belonged to a lower race, the men of which had been exterminated, their wives and daughters having been seized by the conquerors. Men, then, are the descendants of the higher, women of the lower race. In France, for instance, the women are the descendants of the Celts, whom the Romans conquered, and from among whom they took their wives, as they had previously done in the case of the Sabines.

The motives which cause so many men in the present day to deny the inferiority of women Strindberg deals with at great length. Among them he places intense sexual desire, obscuring the faculty of thinking in many ordinary natures; a feeling for women which inspires adoration much as religion does; an intense tenderness and veneration for her, born of the recollection of early days spent in a mother's arms; and the idea that a quantity of masculine vices are not found in woman (who has other and greater ones of her own), whence a psychoptical delusion which causes him to consider her as more perfect than himself. The weakness of individual men is also a powerful factor, as, for instance, in "M. Edouard Rod," who declares himself inferior to woman—and with reason, maliciously remarks Strindberg. The so-called higher qualities of woman do not bear a very searching analysis. Her impressionability, of which we hear much, is merely that of the child; her hysterical and passionate outbursts when thwarted are the true equivalents of a child's screams and kicks when it is refused something it wants. Rarely does a woman possess the power of keeping her attention fixed on one subject for any considerable time; hence it is seldom that she entirely masters anything. Of sequence of ideas in a woman's mind there is little, doubtless the cause of her perpetual unpunctuality and inability to organize her occupations so as not to do two things at the same time. No woman can make a good cup of coffee; it is an impossibility, requiring as it does attention, exactitude, and a nice sense of time. Crime, even, demonstrates feminine inferiority, for there is generally no reflection or calculation of the probability of discovery in crimes committed by women. On this point it has often been said that, morally, men must be inferior, as statistics show a larger percentage of male criminals. Statistics can be twisted to any purpose.

In the conclusion of his article Strindberg, after expressing his absolute disbelief in the great queens of history, such as Elizabeth of England—whom contemporary historians, he says, magnified—goes on to reaffirm that woman is merely the complement of man. As his alter ego she may be invaluable, but alone she is useless. All feminine efforts toward independence must end badly. Feminine emancipation is a chimera, a dream from which there will be a sad awakening. Woman, if she wants equality, must drag man down to her level, for she can never attain to his. The complete success of the emancipation movement would mean a struggle against the laws of nature. What, asks Strindberg, is the cause of this unreasoning fury against man? for is it not he who, after all, has bestowed upon woman the benefits of culture, the right of holding property, and numberless other privileges? Man, not woman, has produced civilization. A bad feature of modern legislation is its tendency to rob the wage earner and father of the family of his daily bread in order to benefit the emancipated female, generally childless. That this will become a burning question in the future there can be little doubt. Already there are many men kept out of employment by women. Who will maintain that it is a good thing for a single woman to monopolize a position which might maintain a family? And why, asks Strindberg, does woman raise complaints about her lot? When young she has every opportunity of finding an honorable and noble independence as wife and mother, a position in which she can contemplate the future with confidence and equanimity. Is not this more than most men can hope for? Necessarily there must be some sacrifices, and it is against these that the crowd of so-called emancipated women, who are devoid of any feeling of duty toward humanity, raise their raucous voice; itself a proof of their unworthiness and unfitness for taking any part in the direction of the great social system.—Pall Mall Gazette.

Destroying Derelicts.

The unusually severe and frequent storms of the past month have caused a vast amount of destruction among ships at sea and many vessels have been wrecked on or near our coast. In view of this fact, the government has recently detailed the dynamite gunboat Vesuvius to systematically destroy these derelicts, which are a menace to navigation. The work is one of the utmost importance. The Vesuvius has been first employed in removing the wrecks in and about New York Harbor. After this work has been accomplished she will be sent up the coast as far as Cape Ann to attack the derelicts in that region. It is intended for her to next make way with the wrecks along the coast as far down as Cape Hatteras, and it is probable that she will then be sent to cruise in southern waters on the same mission.

The method followed in destroying these wrecks is very simple and effective. Large packages of guncotton or other high explosive are placed upon the wreck and connected by wire with an electric battery on board the Vesuvius. When all is ready the wrecking party retreat to a safe distance and discharge the torpedo by merely touching a button.

At times, however, the position of the wreck calls for considerable ingenuity. In one case, where the wreck had sunk so that only the tops of the masts were visible above the water, the work was accomplished by lowering torpedoes to the deck of the wreck and destroying only the masts and the rigging. Afterward the masts were cut into kindling wood to prevent them from doing any mischief.

Mention has been made in the columns of the Scientific American of the valuable service rendered to navigators by the records of the positions of derelicts which are published monthly by the Hydrographic Office of the United States Navy Department. The United States is the only country which publishes this unique report, and these records have come to be highly valued by mariners. These charts are freely distributed, so that the mariners of all nations may profit by them.

Science Notes.

New Substitute for Gold.—The Journal de l' Horlogerie claims that a new alloy which it describes is a remarkable substitute for gold. It is composed of 94 parts of copper to 6 of antimony. The copper is melted and the antimony is then added. After the two metals have been perfectly fused together, a little magnesium and carbonate of lime is added to increase the density of the material. The product can be drawn out, wrought, and soldered just like gold, which it almost exactly resembles when polished. It preserves its color, it is said, even when exposed to the action of ammoniacal salts or nitrous vapors. The cost of making it is about twenty-five cents a pound avoirdupois.

New Process of Extracting Gold.—According to the Technical World, a new process of extracting gold from auriferous ores has been devised by Mr. C. Lorsen. He electrolyzes a solution of bromide of potassium and thereby obtains an alkaline solution, which contains hypobromide and bromate, which is capable of dissolving gold. The ore is treated with an excess of this solution by rotating cylinders. The solution is then filtered, the gold precipitated by passage over a mixture of iron and coal, and the solution, which now contains bromide of potassium mainly, is once more electrolyzed, and again used for extraction.

New Process of Converting Salt Water into Fresh.—According to the Revue Scientifique, Mr. Pfister, an Austrian engineer, has discovered a curious property of the trunks of trees—that of retaining the salt of sea water that has filtered through the trunk in the direction of the fibers. Mr. Pfister utilizes this property for obtaining potable water for the use of ships' crews. The apparatus, which has been patented, consists of a pump, which sucks up the sea water into a reservoir and then forces it into the filter formed by the tree trunk. As soon as the pressure reaches from 1·5 to 2·5 atmospheres, the water is seen (at the end of from one to three minutes, according to the kind of wood used) to make its exit from the other extremity of the trunk, at first in drops and then in fine streams. The water thus filtered is potable, having been freed from every particle of saline taste. The tree trunk measures 15 feet in length by from 5 to 6 inches in diameter.

Notes on Aluminum.—According to the Moniteur Scientifique, half the aluminum manufactured at present is used up in the iron industry. The remainder is largely used in refining nickel and copper. When added to these metals, the reduction of the last traces of oxide is completed, the metals become more perfectly fluid, and, after cooling, can be easily worked. Any alumina formed in this action is completely insoluble in the nickel or copper, and rises to the surface and thus eliminates itself. The action of aluminum in steel is referred to by the same journal. Rammelsberg found that all the aluminum was used up in deoxidizing not a trace being found in the ingot obtained. At first it was thought that aluminum lowered the melting point of steel 200° to 300° C., and that its presence caused the great fluidity of the steel. Now the ingots are shown to contain no aluminum. The oxide of iron dissolved in steel renders it less fluid and more brittle, and this causes it to give off carbon dioxide, hydrogen, and nitrogen.

The following is proposed by Mr. B. J. Roman as a solder for use with aluminum or aluminum alloys: Silver, nickel, aluminum, tin, and zinc are mixed in the following proportions: Silver, 2 per cent; nickel, 5 per cent; aluminum, 9 per cent; tin, 34 per cent; zinc, 50 per cent. No flux is necessary, and an ordinary soldering iron or tool can be used, though one of aluminum is said to be preferable.

According to Dingler's Polytechnisches Journal, Mr. F. Andrews, after numerous experiments upon alloys of aluminum, has found that one composed of from 92 to 96 per cent of the latter metal and 4 to 8 per cent of nickel is particularly valuable, since it possesses greater hardness than the pure metal without being brittle. It is well adapted for the manufacture of small articles of jewelry, etc. The alloys of aluminum, copper, and nickel are remarkable by their beautiful color, the ease with which they may be polished, and their hardness. In order to restore their metallic aspect, it suffices to immerse them for a few seconds in a 10 per cent solution of caustic soda, wash them, and then immerse them in a mixture composed of 3 parts of nitric acid and 2 of sulphuric.

The Ageing of Liquors by Cold.—Mr. Raoul Pictet, the eminent French chemist, claims that he has discovered a method of ageing liquors artificially. His process consists in gradually cooling the liquor, brandy, for example, to 200° C. below zero, and then gradually bringing it up again to the normal temperature. According to the Revue des Revues, a frigoric laboratory in which this new discovery is to be applied is upon the point of being established in Paris.

Amalgamation of Battery Zinc.—The Elektrochemische Zeitschrift, in a recent number, makes known a process of amalgamating battery zincs which is due to Mr. Oppermann, and which is said to give excellent results. A nearly saturated solution of mercuric sulphate in water is prepared, and to it is added the quantity of sulphuric acid necessary to make the solution perfect. This solution is then mixed with oxalic acid until a grayish mass of the consistency of cream is obtained. To this a little sal ammoniac is added. The zinc is coated with this mixture and then vigorously rubbed. It has been found that zinc thus amalgamated resists acids and salts much better than when amalgamated by the ordinary process. If the zinc is not to be used at once, it should be dried before being put away.

A Community Without Vaccination.

Dr. Kerr, writing from Rabat, on the westerly shore of Morocco, states some facts that will serve to remind the anti-vaccinationists of England of the condition of their own country before the grand discovery of Jenner. Smallpox makes fearful havoc among the Moors, with whom Dr. Kerr has lived seven years. During an epidemic at Rabat over one thousand persons died from that disease in the course of two months. Rabat is a town on the Atlantic seaboard of Morocco having a population of 26,000. Of the condition of the town during the epidemic Dr. Kerr writes the following: "Often we felt it sickening when going through the streets to see young men and boys sitting at shop doors, flour mills, etc., covered with smallpox eruption, in every way facilitating the spread of the disease. Every one thinks that it is impossible for him to escape smallpox; hence no precautions are taken. It is painfully sad to see so many people who have lost the sight of one eye, while many are blind altogether. One day not long ago I paid a passing visit to a douar or collection of tents outside the city, and it was touching to see the mothers bring their children asking me to put the medicine in their arms to prevent the infection. I vaccinated all the children in the village, and although they were surrounded by smallpox, none took it."

These conditions, given by Dr. Kerr as to the Africa of to-day, are a simple repetition of what existed in England and Europe before Jenner's great boon to mankind was made possible.—Journal of the American Medical Association.

Tennant's Paint for Ships' Bottoms.

The paint consists of 8 pounds of resin, 1½ of "Cologne brown dry color," 15 ounces of shellac, 25 gills of spirits of wine, 6 gills of benzine, ¼ gill of toluene, and 10 drops of pyridine. As a finishing coat, a mixture of paraffin wax and white lead "boiled together" is applied hot.

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

TRAIN SIGNAL.—Augustus H. R. Guiley, South Easton, Pa. This is an improvement on a formerly patented invention of the same inventor for an electric block system for railways, the earlier patent providing for diagonal contact plates to be engaged by the lateral pressure of contact arms, while the present invention covers an improved form of contact plate and brush. Applied to a single track railway, the apparatus indicates to each other the presence of trains on different sections of track, whether the trains are running in the same direction or running toward each other.

MAIL BAG CATCHER AND DELIVERER.—Charles F. Sliger, San Antonio, Texas. This is a device which may be used at either side of a door opening in a car, to transfer mail bags from a hanger to the car while the latter is in motion, or to deliver a mail bag at the station, one operation not interfering with the other, the device being automatic in its operation and quite simple and inexpensive. A spring-controlled catcher arm carries a retaining arm and locking mechanism, a delivery arm being fulcrumed on the catcher arm and a locking device engaging the retaining arm, while there is a trip connection between the locking device and the delivery arm, there being also a carrier on the latter arm and a trip to throw it into open position.

Mining, Etc.

DRY WASHER.—Frederick E. McKinley, Albuquerque, New Mexico. This is a machine for placer mining, designed to save all the gold, both flour and nuggets in the sand, without the use of water and quicksilver. It consists of a sand roaster discharging into a nugget-separating machine leading to conveyors connected by elevators with the uppermost of a series of screens one above the other, each having riffles to retain the gold and an outlet for the tailings. The screens are graduated, and each has a hopper discharging into the next lower screen. The machine is run by a team attached to sweeps.

Mechanical.

LINK MAKING DIE.—Joseph Smith, Puebla, Mexico. This invention provides for sets of dies for successively bending, swaging, overlapping, and welding the iron to form a link, in such way as to greatly facilitate the manufacture of links for railway couplings and other purposes. The individual dies for bending the rod and performing the different operations may be in separate sets, or they may be assembled in two pieces, of which one carries all the female dies and the other all the male dies. By treating the rod in the manner provided for by the invention, links of great durability and strength may be very economically made.

GLAZIER'S GLASS BREAKER.—George A. Rogers, Allegheny, Pa. This is a tool for use in connection with a glazier's glass cutter, and may be used in combination therewith or as an independent tool. It is so constructed that, by the movement of a lever, a sliding jaw has movement in relation to a fixed jaw to accommodate glass of various thicknesses, the glass being received between the two jaws, and a strip or section of glass being then broken off quickly and cleanly.

Agricultural.

HAY SLING.—Samuel M. Jenks, Madison, South Dakota. This is a device which may be used as a substitute for a fork or other carrier, and made to carry a large quantity, binding the hay so completely that there is no scattering or dribbling, while it may be instantly tripped to deposit its load, which it leaves in excellent condition for pitching. It has two separable tripping or center heads, one with projecting arms having heads and the other with dogs to engage the heads, a bed plate on which levers swing and slide, a second lever working the swinging and sliding levers, and connecting rods extending from the swinging and sliding levers to the dogs. The device may be advantageously used in loading and unloading and in stacking.

Miscellaneous.

DUMPING GRATE.—Benjamin E. Weeks, New York City. This is a cheap and simple grate adapted to maintain an entirely level fire. It comprises a cradle formed of parallel bars, one of which is journaled in a support, and connecting cross bars, while a series of grate bars is arranged at right angles to the parallel bars and have transverse slots on their undersides to receive the journaled bar of the cradle. It is arranged in sections which may be successively dumped, enabling the good fire to be held on one while the ashes and poor fire are dumped from the other. A simple and strong mechanism is provided for holding the grates in position, and a very easily operated lever mechanism for working them.

COAL DELIVERY BOX.—Hermann Kehl, New York City. This is a box especially designed for supplying customers with coal in small quantities, without danger of soiling the apartments on delivering or removing the coal from the box as needed for household purposes, while also insuring the customer the proper amount of coal ordered. It has a sheet metal casing with hinged lid, a flat back and curved front, and has a screen-like false bottom under which is a removable receptacle. In the lower portion of the box a downwardly inclined plate extends nearly across the box, and below the plate is a door hinged to swing outward upon a level with the false bottom, the shovel being introduced in this door to remove the coal. A vertical slot, covered by a translucent strip, enables the customer to see at any time how much coal there is in the box.

HOISTING AND CONVEYING MECHANISM.—Frederick H. McDowell, Montclair, N. J., and Sebern A. Cooney, New York City. This improvement relates to tramways for hoisting material from a quarry or other cutting, and provides for duplicate fall ropes arranged to convey material to either terminal of the tramway, either rope being used to control the travel of the carriage. At one termiual of the carriageway are winding drums operative together or separately, there being on the drums duplicate fall ropes, one leading directly to the carriage and the other to the opposite terminal of the carriageway and returning to the carriage, while there are separate sets of sheaves and separate fall blocks for each of the fall ropes, forming independent tackle. Each fall is operative independently for lowering its block or for maintaining the carriage in place, and both of the independent fall ropes form, when in the raised position, a practically endless haul rope.

WINDMILL.—Peter A. Norberg, Roslyn, Washington. This wheel comprises a shaft from which extends sets of radial arms, the lower arm having a beveled recess forming limiting shoulders, and there being blades with vertical trunnions journaled in the arms, the lower end of each blade being beveled to fit into the recess to abut against the shoulders. The construction is designed to be very simple and durable, and is adapted to utilize the force of the wind to the greatest advantage.

FIFTH WHEEL.—Caleb R. Turner, Brooklyn, N. Y. This is an improvement in that class of fifth wheels in which roller bearings are used to enable the vehicle to turn easily. It provides oppositely-arranged circular angle irons forming top and bottom bearing plates, and constituting a strong but light housing for the rollers, where they cannot become clogged with dirt and dust and are also shielded from water. The improvement is designed to combine simplicity, cheapness and efficiency to the greatest possible extent.

THILL COUPLING.—George Cargin, Wells, N. Y. According to this invention a spring is held on the thill clip, and carries in its free end a shaft having a projection adapted to engage the eye of the shaft or pole, a handle on the shaft being adapted to extend across the pivot pin for the thill coupling. The device is very simple and durable, permits of quickly changing poles or thills, and prevents rattling or accidentally losing the pivot pin.

PRODUCING CHENILLE.—Nicholas Albrecht, Philadelphia, Pa. This inventor provides a method of forming the chenille strands employed in weaving chenille fabrics—first weaving a chenille cloth with plain or single-ply portions and alternating three-ply portions, all the warp threads being interwoven in the single ply and a portion only in each of the three superposed plies; second, cutting the single ply lengthwise between each two sets of warp threads, leaving the three-ply sections uncut, whereby the cloth is separated into three divisions or fabrics; and, third, cutting each of the three plies midway between each two sets of its warp threads.

PAPER GAGING MACHINE.—Louis Schopper, Leipsic, Germany. This invention provides indicating devices arranged on a roller over which passes the paper produced in a paper machine to visibly indicate the thickness and weight of the paper, and to transmit to various distances audible signals when the thickness or weight of paper has exceeded or fallen below certain limits. The indicating devices are constructed to show at any time on a scale the thickness of the paper passing over the roller and the weight per square meter or any other size, and the signals made on a change of product are produced by suitable electrical connections.

MEASURING AND DRAWING INSTRUMENT.—William S. Rowell, Muncie, Ind. This invention consists principally of a blade having at one end a fixed head with a triangular opening, the base of which passes through the center of the head, and a centering head held adjustably on the blade and having its arms parallel to the sides of the triangular opening. The instrument may be advantageously used for laying off any shaped figures inside the circumference of another figure, enabling the workman to very accurately draw the desired lines and figures on the work.

ROUND EXTENSION TABLE.—Nestor Lattard, New York City. This invention provides for a small or a larger increase in the diameter of a circular table by the addition of one or more circular series of segmental extension pieces, and also for a convenient storage compartment in the table for the extension pieces. Suitable leg supports are provided and the table is made strong and stable.

FILTER.—Joseph G. and Smith A. Sutton, West Newton, Pa. This is a filter especially adapted for use in wells or cisterns, and it is provided with a cleaning brush adapted to be normally held from contact with the filtering walls, while capable of being rotated and reciprocated over such walls to remove accumulations settling on them. A supplemental tank or water holder is also connected with the main filtering chamber, with a valve mechanism adapted to be set in operation as the filtering chamber becomes filled, producing back pressure on the water within the chamber to force it out through the filtering walls and clean them.

FRUIT PITTER.—James L. Hall, Kingston, Mass., and Frank H. Chase, Grand Rivers, Ky. This is an improvement upon a formerly patented seeder or pitter, providing an attachment in the nature of a ring encircling the spring prongs of the seeder, and serving as a guard to prevent the heads of the prongs spreading or expanding laterally, while also increasing the effectiveness of the device, by taking the place of a row or circlet of prongs, thus aiding in cutting the pulp and extracting and retaining seeds.

LOCK.—John S. Barney, Brooklyn, N. Y. This is an improved device for locking coats and other articles, and may be attached to the inside of a coat collar and worn without inconvenience. It may be conveniently locked to a hook or other hanger, to fasten the coat thereto, and may be quickly and easily unlocked by one knowing the combination. The combination is simple, but cannot very well be accidentally worked.

FASTENING DEVICE FOR SEATS.—Charles G. Taylor, Farmington, Wash. This improvement is to facilitate the securing in place of seats and chairs in school houses, halls, etc., in such way that the seats may be readily removed and replaced. An improved fastener is, according to the invention, applied to the legs or frames of the seat, the fastening attachment being adapted to engage fixed sockets or keepers on the floor, the sockets presenting little or no obstruction to the cleaning of the floor when the seats or chairs are removed.

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NEW BOOKS AND PUBLICATIONS.

POOR'S MANUAL. 1894. Twenty-seventh annual number. New York: H. V. & H. W. Poor. Pp. xvi, 1390, 104.

There is no need for us to review Poor's Manual. Its annual appearance is as much a feature of modern life as is that of the directory. For the past year of rather dreary achievements in railroad work, the manual possesses, perhaps, especial interest; notably a column of dividends paid during the eight years from 1886 to 1893, will be particularly interesting reading, in the light of present dividends and of probable future ones.

SCIENTIFIC AMERICAN BUILDING EDITION.

MARCH, 1895.—(No. 113.)

TABLE OF CONTENTS.

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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.
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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.

(6448) H. S. asks: To how low a degree can the spirit thermometer be read, also the mercurial thermometer? Will the mercury remain fluid in the cold as long as spirit? Which is the more reliable under all circumstances? Of what proof must the spirit be? A. The mercurial thermometer is the more accurate. It can only be read to —39·4° C. The alcohol should be absolute.

(6449) F. J. S. writes: Please give definition of sound, and can there be sound without an ear to hear it? A. According to the Century Dictionary, sound must be heard to exist. The definition reads: "The sensation produced through the ear, or organ of hearing; in the physical sense, either the vibrations of the sounding body itself or those of the air or other medium, which are caused by the sounding body, and which immediately affect the ear."

(6450) H. C. S. asks: Do incandescent electric lamps ever explode of themselves? I have had one or two complaints from customers of lamps breaking without being touched. One of these was from the postmaster, who said that on throwing a heavy mail bag on a table ten feet away from the lamp (which was suspended from the ceiling by drop cord), it exploded. A. It is possible and to be anticipated. In the case cited the concussion of the air was probably the determining cause.

(6451) S. N. asks: How many additional layers of wire are necessary to wind simple motor described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641, for dynamo? I have it wound now for motor. Fields are cast. A. We do not advise the use of the motor as a dynamo. The wire need not be changed in size or quantity. The windings depend on the results desired.

(6452) Rollins College, Fla., and F. L. F. ask how to make carbon paper. A. Melt 10 parts lard, 1 part of wax, and mix with a sufficient quantity of fine lampblack. Saturate unglazed paper with this, remove excess and press.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

March 12, 1895,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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Car door, grain, E. A. Burrage ... 535,353
Car dumping apparatus, A. Walker ... 535,647
Car fender, H. B. Ewbank, Jr. ... 535,688
Car fender, L. L. Seaman ... 535,733
Car fender, S. H. Shaw ... 535,776
Car fender, J. C. Sneden ... 535,741
Car fender, street, S. S. Kimball ... 535,763
Car fender, street, G. H. Modemann ... 535,388
Car life-guard, A. E. Wyatt ... 535,436
Car motor, street, J. C. Slaughter ... 535,734
Car rail brake, H. E. Boyd ... 535,570
Car sanding device, street, Baumann & Weinz ... 535,479
Car seat bridge, portable, G. M. Fadner ... 535,365
Cars, system and apparatus for applying brakes to electric, C. E. Davis ... 535,679
Carbon holder for arc lights, A. W. France ... 535,692
Carriage stump joint, T. R. Murdock ... 535,389
Carriage top hood, Mayer & James ... 535,711
Carriages, upholstery for baby, R. F. H. Williams ... 535,748
Cartridges, transparent top wad for, J. N. Lower ... 535,384
Case. See Show case.
Cash register, C. W. Swift ... 535,563
Casks, etc., machine for smoothing and finishing exteriors of, C. D. Ames ... 535,477
Casting apparatus, metal, E. H. Casgrain ... 535,671
Casting sash weights, mould for, A. B. Day ... 535,575
Casting steel, J. A. Potter ... 535,598
Casting window weights, W. Schwan ... 535,510
Chains of transoms, etc., fastening device for stop, W. F. Hall ... 535,795
Chair. See Barber's chair. Registering chair.
Chair, H. W. Bolens ... 535,347
Chair, Bolens & Gilson ... 535,348
Chair, W. Meyer ... 535,455
Chenille, apparatus for manufacturing, F. Watzlawik ... 535,606
Chimney and ventilator cap, F. C. & H. A. Stober ... 535,634
Chimneys, etc., attachment for, A. H. Blackburn ... 535,663
Churn dasher, C. H. Hudson ... 535,447
Cigar bunching machine, Hagen & Wieland ... 535,697
Cigar vending machine, A. J. Doughty ... 535,752
Clamp. See Girder clamp. Plowshare immersing clamp. Trolley wire clamp.
Clasp. See Collar clasp.
Clay tempering machine, automatic, W. F. Cook ... 535,676
Clipper, E. S. Hotchkiss ... 535,620
Clock striking mechanism, electric, F. L. Gregory ... 535,370
Cloth napping machine, N. H. Grosselin ... 535,581
Clothes pin, M. S. Pittman ... 535,399
Clutch, H. W. Hill ... 535,376
Clutch, F. L. Smith ... 535,738
Clutch, A. L. Taylor ... 535,744
Coin delivering and cash recording device, A. N. Rooks ... 535,628
Collar clasp, C. L. Jordan ... 535,762
Collar, horse, C. A. R. Ahl ... 535,633
Combination wrench, Bennett & Poe ... 535,480
Cooker, animal food, H. F. Winkelmann ... 535,434
Cooker, steam feed, J. W. Adney ... 535,652
Cooking utensil, J. Velie ... 535,473
Cooler for water, etc., G. F. Barron ... 535,526
Corkscrew, A. L. Qvarnstrom ... 535,726
Corset, I. M. Rew ... 535,627
Cot, obstetric or invalid, D. W. Scutt ... 535,419
Cotton cutter and cultivator, R. B. Morris ... 535,506
Cotton picker, J. Neighbors ... 535,769
Coupling. See Car coupling. Thill coupling. Vehicle coupling.
Cover fastening for cans, pails, etc., J. Musgrove ... 535,457
Crusher. See Ore crusher. Rock crusher.
Cultivator, J. O. Ford ... 535,690
Cultivator, A. A. Young ... 535,437
Cutter. See Cotton cutter.
Cutting machine, F. J. Richards ... 535,771
Damper, D. Slates ... 535,466
Damper, stovepipe, H. T. Smith ... 535,562
Dental heater and annealer, H. F. Libby ... 535,590
Deodorizing fats or oils, apparatus for, J. H. Filbert ... 535,792
Deodorizing sewage filters, G. E. Waring, Jr ... 535,516
Derrick, H. B. Gates ... 535,537
Desk, music, S. W. Rork ... 535,558
Display figures, means for operating, J. B. Heibecker ... 535,699
Dissolving apparatus, G. M. Newhall ... 535,719
Door check, T. McGrory ... 535,507
Door check, P. McMahon ... 535,768
Door lock, C. A. Dies ... 535,791
Dovetailing machine, Erickson & Leonartson ... 535,492
Drag and harrow, combined, A. K. Schaaf ... 535,732
Drilling and tapping machine, E. A. Searles ... 535,420
Dust collector, automatic, J. F. Cole ... 535,675
Dust pan, R. G. Hebden ... 535,372
Dyeing apparatus, A. Whittall ... 535,519
Eaves trough, H. Andrews ... 535,656
Egg beater, C. H. Warrington ... 535,474
Electric cableway, R. Lamb ... 535,703
Electric generator, thermo, H. B. Cox ... 535,488 to 535,490
Electric generators, indicating system for thermo, H. B. Cox ... 535,491
Electric lighting system, J. I. Conklin ... 535,443
Electric machines, construction and regulation of dynamo, C. D. Haskins ... 535,796
Electric machines, regulation of dynamo, C. D. Haskins ... 535,797
Electric switch, M. W. Dewey ... 535,533
Electrical controller, E. A. Sperry ... 535,511
Electrical fixture, L. Stieringer (r) ... 11,478
Elevator. See Tobacco elevator.
Elevator, N. C. Bassett ... 535,343
Engine. See Locomotive engine. Steam engine. Wind engine.
Engine, F. C. Rinsche ... 535,463
Engine indicator, steam, F. M. Clark ... 535,485
Engine steering device, traction, Webster & Hutchens ... 535,567
Engines, framing of steam, M. R. Moore ... 535,714
Engines, link shifting mechanism for, E. F. Smith ... 535,603
Evaporator, fruit, A. H. Blackburn ... 535,662
Exhibitor, sample, B. Palladino ... 535,551
Extractor. See Stump extractor.
Eyeglass holder, W. Mack ... 535,450
Fan, centrifugal, G. M. Capell ... 535,483
Faucet, duplex self-closing, H. S. Teal ... 535,468
Feed mixing and measuring device, D. E. Sampson ... 535,417
Fence, S. H. Cook ... 535,531
Fence wire fastener, H. B. Swartz ... 535,637
Fender. See Car fender.
File, bill and letter, J. M. Keep ... 535,622
File box, P. J. Pauly, Jr ... 535,459
File for newspapers, etc., W. I. Reed ... 535,401
Firearm sight, J. A. Kennedy ... 535,379
Fire escape, J. & J. Anderson ... 535,523
Fire extinguishing purposes, cellar pipe for, J. M. Baker ... 535,478
Fireproof floor or ceiling, W. H. Brown ... 535,612
Fishing reel, G. E. Medley ... 535,386
Flue cleaner, J. Bott ... 535,661
Forge, portable, M. Mehu ... 535,712
Furnace. See Smoke consuming furnace.
Furnace, F. H. Richards, 535,403, 535,406, 535,407, 535,409 to 535,412 ... 535,730
Furnace and boiler, combined, J. Cotter ... 535,354
Furnace floor for traveling grate furnaces, F. H. Richards ... 535,402
Furnace traveling grate, E. B. Coxe ... 535,355
Furnace, traveling grate, F. H. Richards, 535,404, 535,405 ... 535,408
Furniture, cabinet, G. F. Ruby ... 535,509
Gage. See Micrometer gage. Oil gage.
Game apparatus, H. Gardner ... 535,535
Garment support, W. E. Jackson ... 535,377
Gas wells, apparatus for discharging liquids from, J. F. Woods ... 535,569
Gate, A. Heim ... 535,799
Gate, spring, F. W. Lechner ... 535,381
Generator. See Electric generator. Steam generator.
Girder clamp and hanger, C. MacTaggart ... 535,707
Governor, Weinman & Euchenhofer ... 535,475
Grading machine, road, A. Barbite ... 535,785
Grass and similar fibers, process of and apparatus for treatment of rhea, H. H. Boyle ... 535,665
Grate, A. Schrag ... 535,418
Grinding balls, machine for, J. J. Grant ... 535,794
Guns, ejecting mechanism for breakdown, M. Bye ... 535,528
Hair picker, V. Ullman ... 535,645
Hammer, power, E. Hammesfahr ... 535,446
Harrow with grain drill attachment, disk, W. A. Lee ... 535,544
Harvester attachment, A. McConnell ... 535,715
Harvester, corn, Cool & Myers ... 535,613
Harvester, corn, H. Sommerfeld ... 535,422
Harvesting potatoes, machine for, T. F. Maxwell ... 535,710
Hat pressing apparatus, J. Rowley ... 535,773
Hat securing attachment, W. G. Wilson ... 535,780
Hay carrier elevating pulley and yoke, J. E. Porter ... 535,725
Hay press, P. L. Hider ... 535,374
Hay rake and loader, C. W. Baird ... 535,750
Head rest, G. W. Archer ... 535,783
Heater. See Dental heater.
Heating apparatus, electric, M. W. Dewey ... 535,363
Hides or skins, machine for treating, I. Vaughn ... 535,777
Hook. See Snap hook.
Hydrant, fire, W. W. Corey, Jr ... 535,614
Hydraulic machine, F. Hessenbruch ... 535,586
Hydraulic motor, A. A. Wood ... 535,568
Ice discharging apparatus, G. O. Rinman ... 535,415
Indexing, J. C. Brashear ... 535,351
Indicator. See Engine indicator. Prescription indicator.
Injector, Davies & Metcalfe ... 535,356 to 535,360
Ink well, S. W. Carter ... 535,771
Insect powder duster, H. C. Adams ... 535,439
Insulator, W. J. Belcher ... 535,660
Iron, manufacture of Russia, A. Hiles ... 535,587
Jack. See Smoke jack. Wagon jack.
Jar fastener, F. Monler ... 535,549
Jewel protector, roller, A. N. Gauthier ... 535,633
Joint. See Carriage stump joint. Wire joint.
Kiln. See Brick kiln.
Knife. See Pruning knife.
Knitting machine, A. Lee ... 535,705
Knitting machine looping attachment, circular, F. C. Rehm ... 535,461
Knitting machine tension take-up device, McMichael & Wildman ... 535,392
Knob, drawer, C. Tollner ... 535,564
Lacel holder, G. H. Richter ... 535,462
Lace tag and tie fastener, boot or shoe, A. E. Davis ... 535,680
Lace tagging machine, shoe, J. L. Faire et al ... 535,493
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Wooden stopples, process of and apparatus for treating, R. F. Radebaugh ... 535,770
Wrench. See Combination wrench.

DESIGNS.

Bedstead, S. Schlesinger ... 24,103
Bottle cap, siphon, H. Landgraf ... 24,111
Button, cuff, J. A. Flomerfelt ... 24,091
Button, link cuff, J. A. Flomerfelt ... 24,092
Cabinet, C. J. Backhaus ... 24,104
Carpet, H. Horan ... 24,099, 24,101
Carpet, J. Mattbews ... 24,098
Carpet, A. M. Rose ... 24,100
Carpet, E. G. Sauer ... 24,102
Curb for chain pumps, covered, O. P. Schriver ... 24,116
Curtain pole bracket, C. W. Smith ... 24,105 to 24,108
Finger ring, M. L. Powers ... 24,089, 24,090
Flower pot, A. H. Snapp ... 24,109
Fringe, E. Walliser ... 24,097
Game cube, C. A. Fetters ... 24,112
Metal tube, R. S. Crawford ... 24,114
Pail hook, S. C. Cary ... 24,110
Pattern for printed fabrics, L. Kuenemann, 24,194 to ... 24,196
Razor blade holder, F. Kampfe et al ... 24,093
Stove, oil, C. Whittingham ... 24,115
Tuyere, M. L. Williams ... 24,117
Type, font of printing, J. F. Tenney ... 24,113

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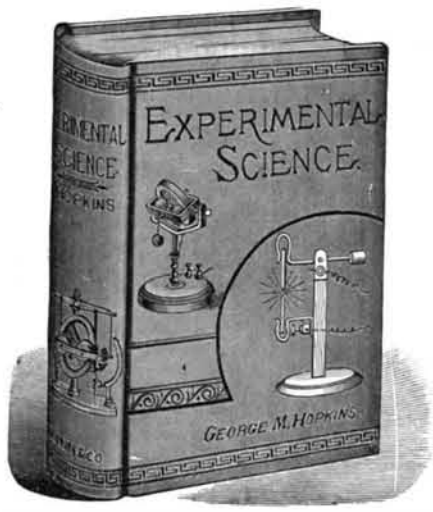

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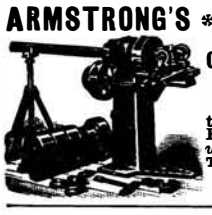

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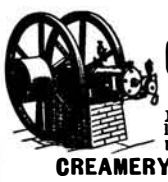

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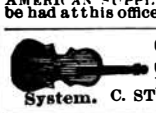

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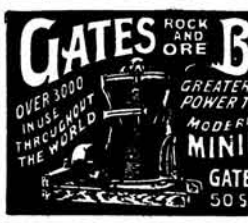

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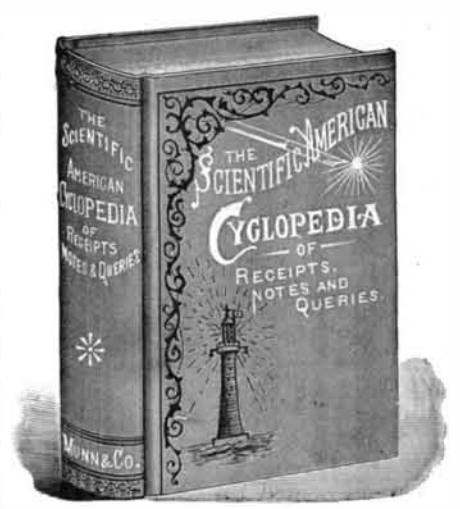

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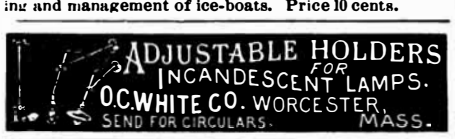

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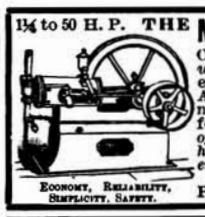

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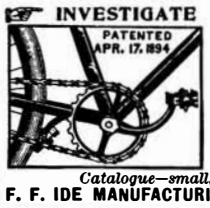

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