SCIENTIFIC AMERICAN

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A CITY UNDER ONE ROOF—THE MASONIC TEMPLE.

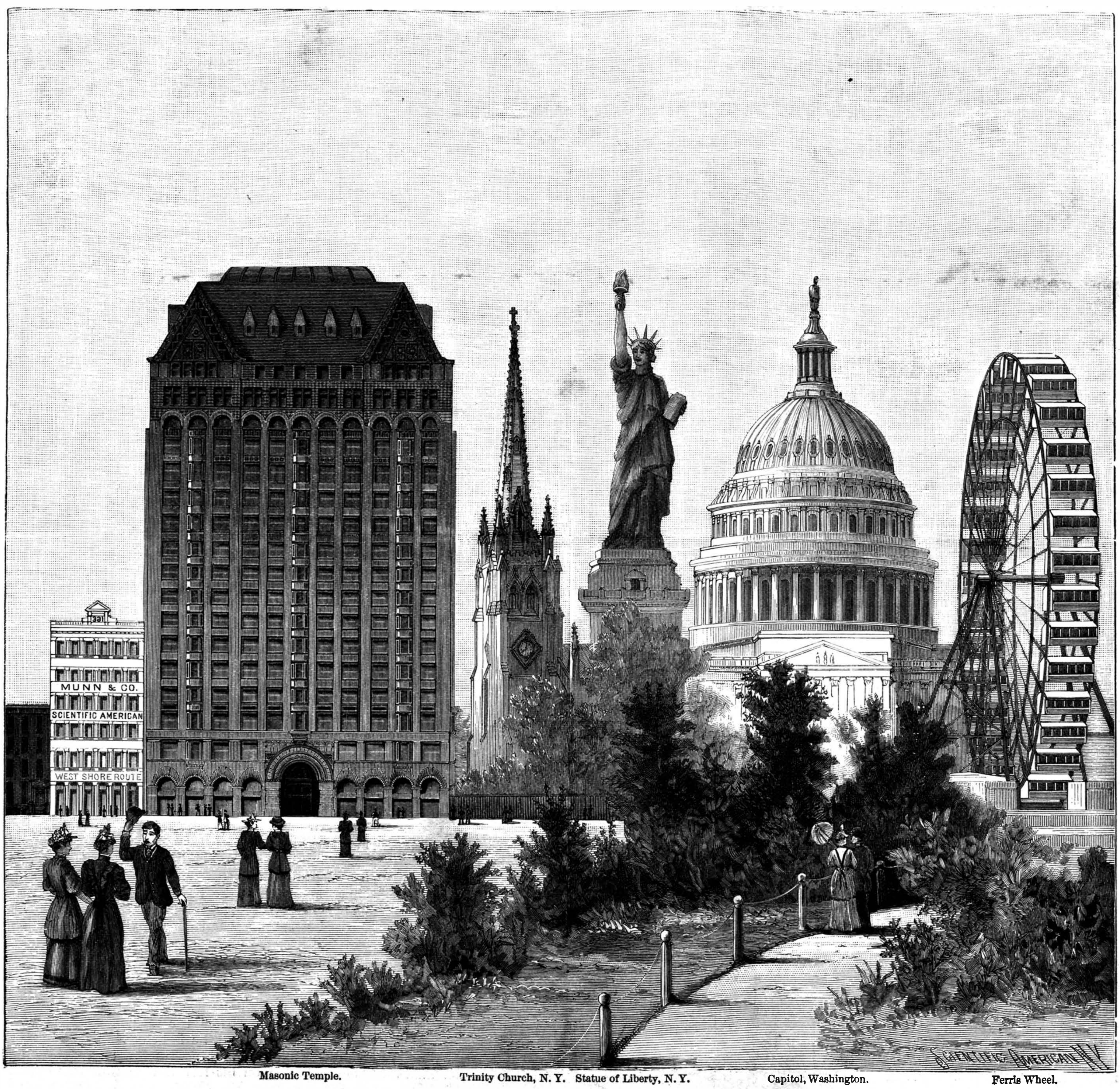
The World's Columbian Exhibition may justly be said to have commemorated the quadricentennial of America, not only by the exhibition of the arts and industries of the globe, as brought together in the White city by the Lakes, not only by the lovely architecture and land- and water-scape there created, but by the city of Chicago proper, the worthy exponent of American progress and growth, the typical American metropolis. Of all the buildings of our Western sister Chicago, none is more remarkable than the Masonic Temple, a structure which, in its functions, dimensions and construction, is one of the unique buildings of the world. In spite of its name, it is proudly claimed to be the "highest commercial building in the world." In it we find exemplified the union of Freemasonry and commerce, a four and one-half million dollar building supplying beautiful halls and parlors for Masonic rites, as well as an unequaled collection of business offices.

The building is situated on the corner of Randolph and State Streets, in the heart of Chicago. It is constructed of granite, marble, steel and terra cotta as the principal materials of construction, and is fireproof throughout. From street level to apex it measures three hundred and two feet; this in absolute height of structure, not in the mere elevation of a lantern surmounting a dome. For one of the peculiar features of the building is its plainness and uniformity of design, the main features being repeated story after story until the sloping roof is reached. There is no tower or dome added simply to break the record. The building is just what it claims to be and no more.

The architects were Messrs. Burnham & Root, of Chicago, Mr. Burnham being widely known as Director General of Works of the Columbian Exposition. The street fronts are of dressed granite up to the sills of the fourth floor windows; above that they are of terra cotta and brick, matching in color the granite. The foundations are of concrete and steel, the latter being horizontal beams arranged to distribute the column loads, so that a uniform pressure of 3,500 lb. to the foot on the clay is produced. The building is of steel frame type, a method of construction now generally followed in large buildings.

The floor loads are sustained by steel columns; all of the building above the fourth floor is carried by steel columns, except for six piers, which are self-sustaining and support no additional load. Even the great arch in front has but a small load, a twenty-five ton girder running across it at the fourth floor level. Tension bracing, consisting of heavy steel rods, extends in two systems from top to bottom of the building in the direction of least width. The vertical columns are two stories in height, and alternate columns break joints.

The general dimensions are one hundred and seventy feet front and one hundred and thirteen feet depth. It is the front which appears in our illustration. The entrance is beneath a granite arch forty feet high and thirty-eight feet wide, and opens into a great rotunda, lined with Italian marble, and opening upward, through twenty stories. Ornamental iron staircases lead up from either side. Back of this great



Masonic Temple. Trinity Church, N. Y. Statue of Liberty, N. Y. Capitol, Washington. Ferris Wheel.

A CITY UNDER ONE ROOF—THE MASONIC TEMPLE, CHICAGO.

court is a sort of semicircle of elevators arranged like lights in a bay window. There are fourteen of these, lining an arc fifty feet deep and of seventy feet chord. The court is seventy feet each way, square in front and semicircular in the rear, the rear lines being determined by the elevator fronts.

The elevator plant is one of the features. Of the fourteen passenger elevators, seven are for express service only, not stopping below the tenth floor. The others stop at any floor desired. Owing to the great height of the building, the weight of the steel suspension cables became a serious problem, and was dealt with by counterweight chains attached to the bottom of each elevator and drawn up by it. These prevent any irregularity in the weight to be raised, due to difference of elevation, which, otherwise, would have been very great. The elevators run at a speed of nearly nine miles an hour, and ascend 258 feet. Allowing continuous ten hour service for each, their aggregate travel in one year would be over 123,000 miles. Thirty seconds is ample time for the full ascent. There are also two freight elevators. The wire ropes of the elevators aggregate sixteen miles in length.

The rotunda is surmounted by a glass roof 302 feet above its mosaic floor. The windows and balconies of the twenty stories open upon this shaft. The twenty-first story is properly the roof. It is a roof garden, and is devoted to purposes of observation, and may be used for commemorative or festival occasions. It forms a great platform, inclosed by walls and ceiling of glass, with oak panels, steam heated, and capable of accommodating 2,000 people at one time. It is the highest point of observation in the city, and gives grand views in all directions.

Around the rotunda galleries are carried for the first ten stories. Shops open on these galleries, with show windows, exactly as in a street. The stories from eleventh to sixteenth inclusive are for offices; the remainder are for Masonic uses. The general features of the court and balconies include mosaic floors, marble soffits or under surface of the balconies, alabaster-cased columns, bronze-finished hand rails and metal work, and marble-lined walls.

The water supply plant comprises pumps with a combined capacity of 2,000 to 3,800 gallons per minute. The pumping machinery circulates each day, if reckoned in gallons passed through the pipes, enough water to fill a reservoir 240 feet long, 100 feet wide and 50 feet deep. The roof tanks alone provide storage for 7,000 gallons. The cellar has still larger tanks of 18,500 gallons capacity.

Wrought iron pipes with screw joints are used for water supply and for sewage, all taking vertical courses and placed in special pipe chambers or pockets. Part of the drainage goes directly to the sewers; part is delivered to a tank in the basement, whence it is forced by steam ejector into the sewers.

For heating about 40,000 square feet of steam radiator surface on the overhead system is provided, and a sixteen inch steam pipe is used for their supply.

The electric light plant includes some 7,000 16 c. p. incandescent lamps, operated by six 1,000 lamp dynamos, the latter driven by high speed engines. Two sets of electric mains are carried through the building, all cross connected and of large size, to prevent any danger from heating. It is estimated that there are 53 miles of electric wires, and the weight of the rest of the electric plant has been put at 50 tons.

To allow for settling, the building was started a little above the proper street level. The settling was so accurately calculated that it is now at the proper level.

Our illustration is designed to show the great size of the building. On the right of the cut is seen the great Ferris wheel, 265 feet high, next comes the Capitol at Washington, 288 feet high, the Statue of Liberty in New York harbor, 301¼ feet from water level to the torch, then Trinity Church spire, 284 feet high, and then the Masonic Temple. To bring it within every day comparisons we show adjoining it a typical New York City fireproof, first-class office building, and next to that, on the extreme left, a four-story "brownstone front." It will be seen that the mammoth pile dwarfs everything shown.

The Silk-Spinning Spider.

The silk spider of Madagascar forms the subject of an interesting article in *Die Natur*, by Dr. Karl Muller. Its native name is Halabe, meaning great spider. This Halabe, or *Nephila Madagascariensis*, spins threads of a golden color and strong enough, according to Maindron, to hang a cork helmet by. The female spider may attain a length of 15 cm., while the male does not exceed 3 cm. A single female individual, at the breeding season, gave M. Camboue, a French missionary, some 3,000 m. of a fine silken thread during a period of about 27 days. The thread was examined with a view to creating a new industry. Specimens tested at a temperature of 17° C. showed an elongation of 12·48 per cent under a weight of 3·27 gr. Small textures woven of these threads are actually used by the natives for fastening flowers on sunshades and for other purposes.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 945.

For the Week Ending February 10, 1894.

Price 10 cents. For sale by all newsdealers.

HAULAGE BY HORSES.

Mr. T. H. Brigg, who has spent the better years of his life in the investigation of the fundamental principles of economic haulage by horses, read an instructive paper on this subject at the World's Engineering Congress, in Chicago, last July. The question discussed by Mr. Brigg is one which, from a financial, humane, scientific or civilized point of view, affects the commercial interests, comfort and well-being of every civilized country in the world, and which, notwithstanding its apparent simplicity, must be approached by scientific methods. While man, says the author, is continually devising methods to lighten his own labors by substituting the forces of nature for his own strength, the horse is required to bear his burdens and haul his loads under the same disadvantages that have hampered him in the past. Much attention has been paid to the development of speed in horses, and the result has been a vast improvement in their strength, beauty and speed; but the animals are still so handicapped by the unscientific methods under which they are required to labor that there is an absolute loss, in many cases, of fifty per cent of their strength.

The amount of resistance that a horse can overcome depends upon his own weight, his grip, his height and length, the direction of the trace and his muscular development, which determines the power to straighten the bent lever represented by his body and hind legs against the two resistances—the vehicle, through the trace attached to the shoulder, and the hind feet against the ground. Many erroneous notions exist as to the best inclination of the trace for the horse. For instance, if a horse can haul a given load up a given hill with a deep inclination of trace and cannot do so with a horizontal one, it is generally thought that the former is the better angle. It is, indeed, for that particular hill, but when once the latter is surmounted it becomes a very bad angle, inasmuch as it involves a great loss of power. To pull through a low trace, or to have a man, or even two or three men, on a horse's back, is advisable, and even necessary, if a horse is expected to haul a load requiring the full force of his muscles at any particular moment, and for the moment, under such conditions, he would be able to draw a much greater load than without the added weight; but any one can see that the animal could not travel far with any vehicle if he had to carry three men on his back in addition to hauling his load. It is utterly impossible, says Mr. Brigg, for a horse to pull through a permanently oblique trace, or through shafts, such as are so commonly used in America, without the animal being compelled to carry a part of the vehicle, just as effectually and with the same extravagant and painful result as sedan chair carriers experience in carrying their loads.

The question has been asked, Should the horse support the vehicle, or the vehicle the horse? The lighter the load, says Mr. Brigg, the more the vehicle ought to support the horse. When, however, the load increases, the horse ought gradually to lose that support until, with a very excessive load, he ought to support a part of the vehicle itself. If the load is heavy and difficult to move and the horse is compelled to make a horizontal thrust, without increasing his grip and mechanical conditions, it fails. But, if the conditions remove some of the weight from the load and place that on the horse, it is equal to allowing the thrust to be an obliquely upper one. Again, a load that a horse can draw up any ordinary gradient should never require the horse to support either any part of the vehicle or the load on a hard level road.

Human beings are constantly moving, resting first on one foot and then on the other in search of relief. Generally, they can sit down, but horses cannot do so without being smartly beaten for their effort to relieve themselves. For generation after generation, we have kept on yoking horses by methods that compel them, in the shafts of a four-wheeled wagon, to rest their entire weight on their feet. It is not realized that a horse exerts from ten to a hundred times more force and expends that much more energy in transporting himself from place to place than in hauling a two-ton load on fairly good roads. The horse is compelled, absolutely unnecessarily, to exert himself under conditions such as no engineer in the world would for a moment think of applying to the steam horse, under which to waste its energies and knock itself to pieces in practically no time.

The result of Mr. Brigg's investigations is that, having ascertained the fundamental and economic principles involved in the haulage of vehicles, and the transportation of living or inanimate matter, he has devised a special contrivance applicable to all kinds of four-wheeled vehicles or sleighs, which he claims will, at all times, automatically afford the horse all possible assistance. It does not matter whether he be traveling on smooth, level roads, up hill or down, with a heavy or a light load, he cannot fail to receive a direct advantage from the very moment he is attached to the moment he is detached. The relief is afforded while he is walking, running or even standing. The percussion on his feet is reduced at every stride during the day. His muscles are less strained, his energy is economized as one would economize the energy of a locomotive, and his legs and feet are saved from an enormous amount of battering, which proves so fatal on all conditions of road.

In an experiment tried before his audience with his invention, which was exhibited at the World's Fair, at Chicago, Mr. Brigg used a two-seated wagon with ordinary shafts. From the latter a line was carried back seven feet to a small platform bearing a chair on which was seated a man of middle weight. Two people climbed into the seats of the wagon. A strong, heavy man now tried to haul the affair, but failed. The automatic appliance was then attached to the shafts and the wagon was hauled easily, notwithstanding a second man had taken his position on the platform drag. The hauler had been relieved of part of his weight, and the strength in his pull had been added to that much.

PROGRESS AND INVENTION.

In the course of his remarks recently upon the part that had been played by the American inventor in the development of the country, the Hon. Thomas Reed among other things said: "To hear the discussions in Congress you would suppose that invention dropped from Heaven like manna to the Jews. You would suppose that James Watt reached out into the darkness and pulled back a steam engine. It was not so. All invention is the product of necessities and of pressure. When the boy who wanted to go off to play, so rigged the stop-cocks that the engine went itself, he was not only a true inventor, but he had the same motive—his personal advantage—that all inventors have, and, like them, it was urged on him by business necessities. What originated Bessemer steel? Sir Henry Bessemer? No; but the necessities of railroads, which would, every one of them, have been bankrupt without steel rails. If Sir Henry had not invented the process, somebody else would. It detracts not one iota from the fame of Alexander Bell that a dozen men were close on his track. It has been so in every great invention. I say, therefore, that it was the diversification of our industries that stimulated inventions. Otherwise all the inventive power of America would have run to waste; and when a man calculates the wonders of American inventive genius, he knows where some of our wealth comes from.

"As a further proof that invention is born of necessity, tell me why great inventions never come until the world is in such shape as to enjoy them? What would the Crusaders have done with railroads? There was not money enough in the world, or travel, or merchandise to keep them going a week."

A New Sanitary Building.

Dr. W. Van der Heyden, of Yokohama, Japan, in a recently published pamphlet, describes a sanitary building devised by him, which he has occupied for a year, and in which he believes that he has solved the twofold problem of the construction of a dwelling for use in both arctic and tropical climates. The new structure is composed of glass boxes filled with a solution of alum and made air and water tight. The application of glass for building purposes is not altogether new, however, since hollow glass bricks have already been made and houses built of them.

The boxes employed by Dr. Van der Heyden are formed of two panes of 4·10 inch thick glass, fixed in cast iron frames that are screwed together. These boxes, which have thus far resisted the influence of cold and heat, shocks and earthquakes, rest upon cast iron supports. The necessary gaps between two rows are filled with felt and then covered with boards. The series of boxes above each other and next to one another, with as little space between them as possible, and such space filled with felt, form the external walls of the house. The roof, which is flat and is supported by the cast iron pillars that carry the boxes, can be made in exactly the same mould.

In the house under consideration, glass panes pressed against each other, but with strips of rubber between them, form the horizontal ceiling. Above this there rests a thick layer of ashes, upon which there is a light framework of wood, covered over with cement. This, of course, renders the roof non-translucent, but it defends the room well against the radiant heat, and, being made of bad conducting material, the heat of the interior is not lost. As the four walls are totally translucent, there is more light than in any other description of dwelling.

A house built in such a way is an entirely closed hollow space, without windows or doors. As there are no openings and no fissures, it is practically impermeable to air, moisture, heat, cold, dust, microbes and insects. Since the panes are of rough plate glass, objects within the inclosure cannot be seen from the outside. At convenient places, some may be replaced by transparent glass to serve as windows giving a view of the exterior. Doors are not needed, since the entrance can be made through the floor by means of a staircase from an underground room, which receives no direct light from the sun. The walls of this room are made of ordinary bricks, plastered inside and protected outside by a thick layer of clay to exclude moisture. The light is admitted through glass boxes set into the four corners of the ceiling, which forms the floor of the room above. This floor is made of double planks, with a thick layer of sawdust between them. The planks facing the upper room are painted and varnished, but may be saturated with paraffine. Those facing the under room are plastered, as are also the walls. There is a mild, diffused light in the lower room, sufficient to read by. At night, both compartments are lighted by electric lamps.

As in winter the solution in the glass boxes might freeze, and would certainly do so in cold countries when the temperature falls to —18° C., a covering of ordinary glass set in wooden frames surrounds the whole building, so as to form an envelope of air, which is a very bad conductor of heat. This air space can be easily warmed if required. In the summer of moderate climates, and all the year round in tropical ones, the same glass window frames are put within the house, so as to shut off the heat by means of these badly conducting air cushions. The dwelling is entered from the exterior through a staircase leading to a corridor that communicates with the subterranean room, and that can be closed by doors, so as to let in as little cold or heat as possible while a person is entering.

Between the walls and the ceiling, there is a space leading outside to a belt covered with window glass and partially surrounding the building. From this external air space a tube leads to a stove (which stands out of doors) and conveys the air directly under the grate. There is thus a constant withdrawal of air from the house as long as the fire burns. This vitiated air is replaced by pure air that has been warmed in passing through tubes placed around the pipes that carry the heated gases from the furnace to the chimney. This air, before entering the heating space, comes from the lower room, where it has already taken the temperature of the surrounding earth. The heated air rises in a tube laid under the ceiling of the lower room and escapes through openings in the floor of the upper room. The temperature of the air is controlled by valves.

In the summer of moderate climates, and always in the tropics, the renewal of the air is effected in a different way. The vitiated part escapes, as in winter, near the ceiling. From there it enters a prismatic chamber of wood and glass, which is carefully closed in winter by a wooden cover, but is left open in summer. This apparatus, which Dr. Van der Heyden calls a "sun belt," performs the functions of a stove, in causing a useful draught, through the heating of the inclosed air by the solar rays. The expanded air, in rising and escaping freely at the top, is followed by the denser air from the room. The arrangement acts automatically when the sun shines. When it rains, the more the rain and the harder it falls, the greater the draught, while every slight movement in the external air promotes the withdrawal of air from the sun belt and house.

In a hygienic building, it is of great importance to have the fresh air constantly entering the apartments free from dust and microbes. This result is obtained as follows: Both in winter and summer, the air for ventilation is taken from the cellar room. The air to replace this enters through a large glazed earthenware pipe or a plaster-lined brick tunnel extending underground to a distance from the house, and then rising vertically to some height above the surface and opening in the free air. It is here covered with wire gauze to filter the air from insects and rough particles, and is sheltered from direct sunshine by a wooden roof. In the opening that communicates with the lower part of the cellar room there is placed a wire cage filled with loose cotton, which filters the air from the finest particles of dust and from microbes. In front of this cage is placed a pane of glass covered with glycerine or moist glue. The air coming from the pipe strikes this surface, leaves thereon the microbes that may have passed through the cotton, and then expands in the interior of the room. The rooms of such a building are thus made as aseptic as a wound-dressing of Lister.

Dr. Van der Heyden, believing that the air of one's neighbors ought not to be vitiated by allowing the air leaving the house to carry with it bacteria, or poisonous gases due to the expiration of the inmates, purifies the air of his building more fully by having curtains stretched under the ceiling with woolen tassels attached to them by hooks and eyes. Into some of these tassels a strong alkali and into others Nestle's reagent is drawn by capillarity. The air, striking along the ceiling before it leaves the cornice openings, deposits there its carbonic acid and its organic alkaloids, besides the greater part of the dust that may have collected. In this manner an endeavor is made to have the air that leaves the house as pure as it was forced to be on entering.

The wash and kitchen water is rendered innocuous, before it is allowed to enter the drains, by passing it through an unglazed chinaware filter, on the principle of that of Chamberland, but differing in construction. On the same principle of not allowing any matter containing infection to remain in the house or to leave it undestroyed, the water closet used is so constructed as to permit of the quick oxidation of the urine, fæces, sputa and other refuse through the action of sulphuric acid and nitrate of soda. Different organic salts are the result, all the organic matter is destroyed, and nothing that is of great value as a fertilizer is lost.

Railroad Development.

To complete the Transandine Railway, which would give uninterrupted communication between points in Chile and Buenos Ayres, the capital of the Argentine Republic, it is necessary to build only 33 kilometers (20½ miles), as trains can now run over 1,189 kilometers out of a total of 1,222 miles. The Argentine section is nearly completed as far as Puenta del Inca, so that in 1894 there will remain to be constructed 15 kilometers, including two tunnels at the summit. Work on this remnant of the Argentine section will be commenced as soon as the line on the Chilean side is sufficiently far advanced to permit the work being prosecuted in such a manner that the two sections—the Argentine and the Chilean—shall be finished at the same time. Thus, the only obstacle to the completion of the road has been the lack of satisfactory arrangements for constructing the Chilean section. The contractors, John and Matthew Clark, having found it impossible to raise money for this link under the guarantee of the Chilean government, asked the Chilean congress to increase the guarantee from 4 to 5 per cent, and this having been done, it is said there will be no difficulty in completing the road.

The Chilean congress has granted a concession for a railway to connect the Southern Line of Chile with the Argentine Great Western, at La Paz. The road will be mostly in Argentine territory, namely, 175 miles from La Paz to the Andine pass of Tinquiririca and 75 miles further to a point on the main trunk Southern Railway, between San Fernando and Curico. The road is expected to be of special use for the valuable cattle trade across the southern passes of the Andes into Chile.

From a report by Mr. C. C. Mallet, British consul at Panama, it appears that steady progress is being made in the construction of the important railway from Cartagena to Calamar, on the Magdalena River, in Colombia. The concession for this road was obtained in 1889 by Mr. S. B. McConnico, representing some American capitalists. The funds for the enterprise were raised in the United States, but work was delayed for nearly three years, because of the difficulty experienced in securing an amount sufficient to complete the road. Construction was commenced in June, 1892, and one year later, June 15, 1893, the first section of the railway, from Cartagena to Turbaco, a distance of 14 miles, was formally opened. The next section, to Arjona, 8 miles, was to have been opened in October, and it is expected that the road will be completed to Calamar by June, 1894. At the time of Consul Mallet's report, in September last, 1,800 men were at work on the road. The road is being built with care and is equipped with the best American cars and locomotives. The distance from Cartagena to Calamar is 65 miles. Most of the land adjacent to the line is suitable for fruit culture and cacao. The trade from the upper Magdalena, a large part of which, it is hoped, will be diverted to the port of Cartagena, is expected to give the road substantial profits.

A Fish with a Rubber Corset.

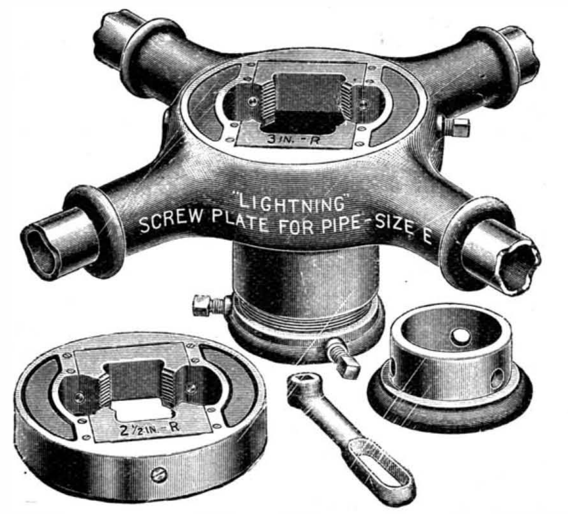
Forest and Stream speaks of a curious find in the Cape Ann fish market, at Gloucester, Mass. It was nothing less than a mackerel with a rubber band around the body. The band had been put on the fish when quite small, and stayed there in spite of the rapid growth of the wearer. The fish's body under the band did not grow, which caused a depression in the full-grown body of about three inches in depth. The depression was covered with a healthy skin in no way unlike that on the rest of the body. The fish measured in length fourteen inches, diameter of body each side of the depression, seven and three-fourths inches, diameter of depression, five inches. The fish was undoubtedly in a healthy condition, and the band was sound and could be stretched like any other band.

Cleveland's Portable Engine Brake.

In describing this improvement, in our issue of December 16 last, it was inadvertently stated that the brake might be applied to a portable engine "for braking purposes on reaching a down grade." The brake is not intended for such use, but to prevent oscillation of the engine when driving machinery. The illustration clearly indicated its thorough effectiveness for the latter purpose, the simplicity of its application, and the readiness with which the chains could be tightened to lock the wheels immovably, no matter how severe might be the work the engine was called upon to do. The device is strong and durable, and may be stored on the engine when not in use. The improvement was recently patented by Mr. E. W. Cleveland, of Rounthwaite, Manitoba, Canada.

SCREW PLATES FOR PIPE.

The particular superiority of this screw plate over others lies in its having its dies ready for use in their holders without the trouble and delay of changing and setting them. They are as simple in use as solid dies and at the same time they are readily ground when dull; are capable of being adjusted so as to take irregular sized fittings, etc., and are of the very highest



"LIGHTNING" SCREW PLATES FOR PIPE.

quality as to material and finish. They are manufactured by the Wiley & Russell Manufacturing Company, of Greenfield, Mass.

A SWEDISH SLED—THE SPARKSTOTTING.

The *sparkstotting* is an exceedingly light sled that the inhabitants of Norrland, a province situated at the north of Sweden, employ during the winter as a means of locomotion. The use of it now extends throughout entire Sweden, where races upon this original vehicle constitute one of the most highly appreciated sports of winter. Among other people of the North, in Russia, Scotland, Germany, this sport is entirely unknown—a fact that is somewhat extraordinary, seeing that the sparkstotting can be employed in all countries in which the rigors of winter permit of the use of ordinary sleds.

The sparkstotting is constructed entirely of Norway spruce. It is straight, of elongated form and weighs no more than 30 pounds. It consists of two runners, curved upward in front, and 6½ feet in length. To each of the runners is fixed an upright that serves both as a point of support and a tiller. The entire affair is connected by two or three cross-pieces, one of which supports a light seat placed at

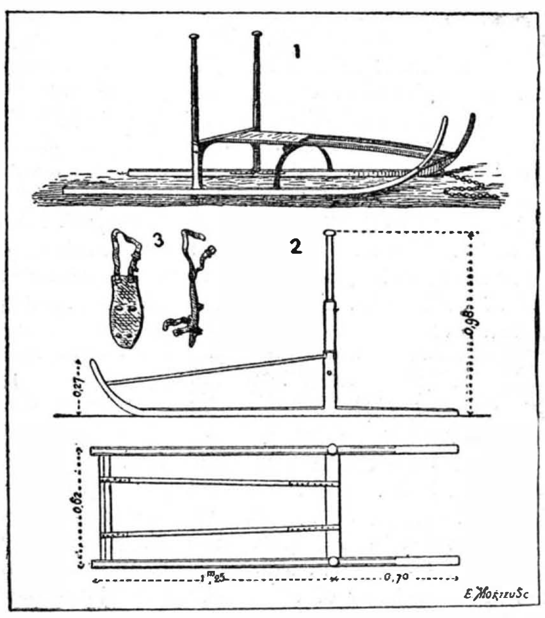


Fig. 1.—THE SPARKSTOTTING OF SWEDEN.

1. General view. 2. The Sparkstotting of Norway—section and plan. 3. Shoe calks.

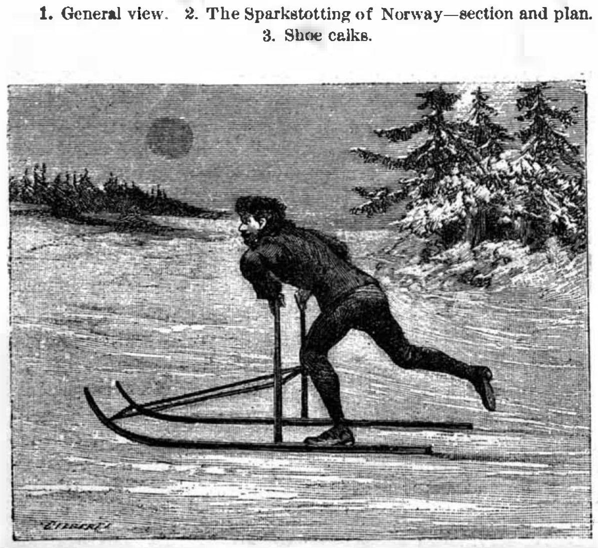


Fig. 2.—METHOD OF USING THE SPARKSTOTTING.

12 inches above the surface. Fig. 1, No. 1, represents a type of sparkstotting in use in Norrland.

It differs perceptibly from the Vesterbotten type, in which the runners, which are much shorter, are not shod with iron, but are well greased or impregnated with boiling tar. The lightest and best type for racing is the one manufactured at Umea in Norway. The dimensions are given in No. 2 of Fig. 1. In order to push the sparkstotting, the racer, bearing with both hands upon the extremities of the uprights, places his left foot upon the runner to the left, and then, with the right foot, strikes the ground at regular intervals, so as to propel the sled forward (Fig. 2). If the snow is very hard and the racer is not provided with spiked shoes, it is necessary for him to fix steel calks to the soles (Fig. 1, No. 3). In recent times a horizontal bar, breast high, has been placed between the uprights. This modification renders the steering easier, and, besides, permits of governing with a single hand. Upon a level route the sparkstotting reaches a pretty good speed without great effort. An experienced racer, when the snow is in good condition, can easily attain the speed of a horse on a trot. In ascents, it is necessary to push the sparkstotting or to drag it, but this does not cause much fatigue, seeing its lightness and the feeble surface in contact with the snow.

With this sled it is possible to run very long races, provided the snow is sufficiently compact. It is stated that an experienced racer made the distance that separates Tornea from Pitea in 24 hours, and which is estimated at 21 Swedish leagues (125 miles). A groom who had been sent by his master to look for a horse traveled from Umea to Sundswall (180 miles) in three days, his sled being loaded with a valise.

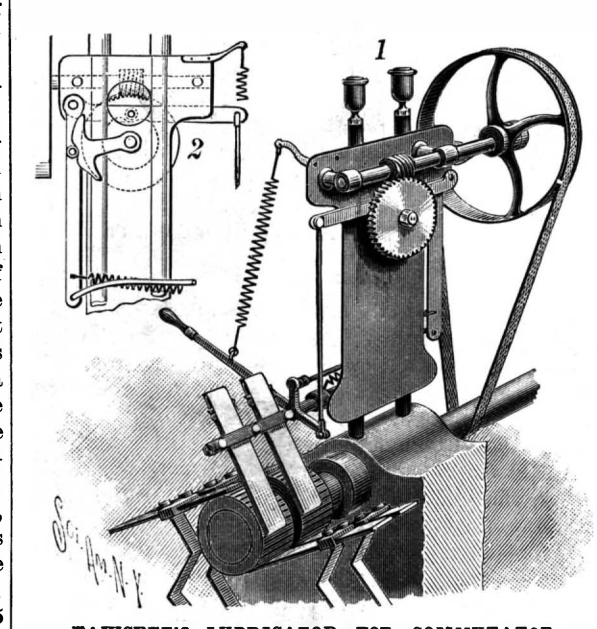
The sparkstotting is the favorite vehicle of the laborers and peasants of Norrland, since it permits them to get over the ground quickly and cheaply. It is to the population of the north of Sweden what the horse is to the Cossack and Arab.

In certain regiments of the Swedish army an endeavor has been made to employ this sled for scouting service. Each of the soldiers sent upon a reconnoissance is provided with a sparkstotting, upon which he places his gun and equipment. It appears that the experiments have given satisfactory results.

At Stockholm and in southern Sweden the sparkstotting is considered rather as a sporting instrument, the use of which is tending to become more and more widespread among the young people. Why might not this new sport be tried in those departments of France in which snow covers the roads for several months and entirely prevents bicycle racing? Why, when winter has arrived and their machines have been stored away, might not our young bicyclists adopt this light sled with which it is so pleasant to run over frozen roads? It is not difficult to learn how to use it, and no falls are to be feared. Moreover, a detail that has its importance, this "winter bicycle," as the Swedes call it, has the advantage of being cheap and easily constructed.—*La Nature.*

A LUBRICATOR AND WIPER FOR THE COMMUTATORS OF DYNAMOS.

This improvement is applicable to any electric motor, wiping the commutators with a swab and applying just the little oil necessary as frequently as desired, after the same manner as a swab would be applied by hand. It has been patented by Mr. Lindley Fawcett, of Eureka, Cal. Fig. 1 shows the application of the improvement, Fig. 2 showing a portion of the apparatus in section. Extending upward from the box in which the armature shaft is journaled are the usual oil tubes, on which is held a plate supporting a portion of the apparatus. Projecting from one side of this plate, and parellel with the armature shaft, is a stationary shaft on which is a loose sleeve carrying a swab holder, provided with parallel plates or slats of wood, over each of which a cover of suitable absorbent fabric is secured by means of an adjustable bail or clamping frame. Endless canvas strips may be used for such covers, the strips being moved on the slats as portions are worn, until almost the entire surface of the cloth is worn out. Clamped to one end of the sleeve is a handle lever, normally held by a spring in such position as to keep the swabs in contact with the commutators, while an opposite extension of the lever is connected with a pitman pivoted at its upper end to a horizontal lever. This lever at its other end is pivoted on a stud, and the lever has a roller which rolls on a cam on a short transverse shaft, giving an up and down movement to the pitman, in combination with the spring connected to the handle lever, and correspondingly raising and lowering the swabs, for the application of the oil at the proper intervals. To move the swabs laterally, a crank arm carrying a two-winged cam, as shown in the sectional view, is secured on the transverse shaft, this cam contacting with a roller on a swinging lever whose lower end is connected by a pitman with an arm on the swab-holding sleeve, a spring combining with the cam motion to move the sleeve in and out, at each revolution of the shaft, so that every portion of the commutators will be touched by the swabs. The transverse shaft is driven by a worm wheel meshing with a screw on a horizontal shaft on whose outer end is a pulley connected by a belt with the armature shaft, although other speed-reducing gear may be employed as desired. When the swabs are to be changed, or other work done on the holder, the handle lever is



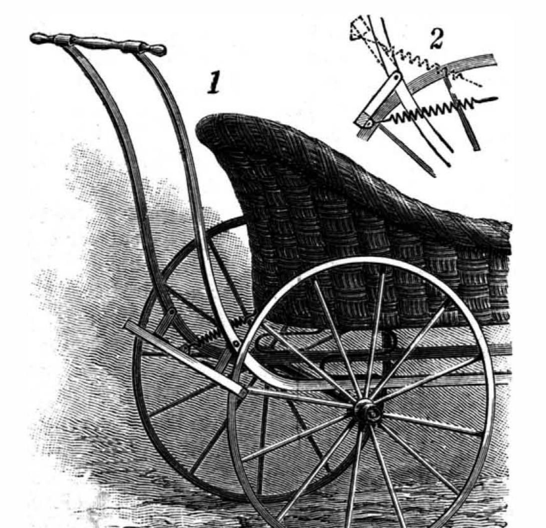
FAWCETT'S LUBRICATOR FOR COMMUTATOR.

depressed, and may readily be fastened down with a cord. The inventor of this apparatus has for years had charge of electric light works, and the improvement was devised by him to prevent the cutting of the commutators and wearing of the brushes, for which it is said to work admirably.

A NOVEL method of street lamp lighting is being introduced by the Cutter-Hammer Manufacturing Company, of Chicago. Each lamp post is fitted with two sal-ammoniac batteries, and a spark coil placed in an iron box at the foot of the lamp. In the lantern a miniature gas holder of about 2 cubic inches capacity is pivoted on a hinge and held down by weights. Directly over this is an automatic gas lighter, of the ordinary pattern, connected with the cells aforementioned by wires. To light the lamps of a city it is only necessary to open a valve connecting one of the large gas holders of the works with the mains. This causes a rise of pressure in the mains, in consequence of which the miniature holders, fitted in each lantern, rise about ⅛ inch against a platinum stop, and complete the battery circuit, thus putting the automatic lighter in action and lighting the lamp.

BRAKE FOR CHILDREN'S CARRIAGES.

This is a simple form of brake, applicable to any style of carriage that is pushed along by means of the handle bar at the rear. The improvement has been patented by Mr. Frederick O. Boës, of No. 1591 First Avenue, New York City. It consists of a bar adapted for engagement with the tires of the rear wheels, the bar being roughened or covered with leather or other suitable material at the places of contact, and being attached to the handle bars by short pivoted links. This pivotal connection is such that when the brake bar is in its lower position it rests



BOËS' BRAKE FOR CHILDREN'S CARRIAGES.

against the wheel tires, as shown in full lines in Fig. 2, being removed from contact therewith when not required for use by being thrown upward, as indicated by the dotted lines. The bar is held in either of the two positions in which it may be placed by a spring extending centrally from the bar to the back of the carriage.

The Tasmanian Exhibition of 1894-1895.

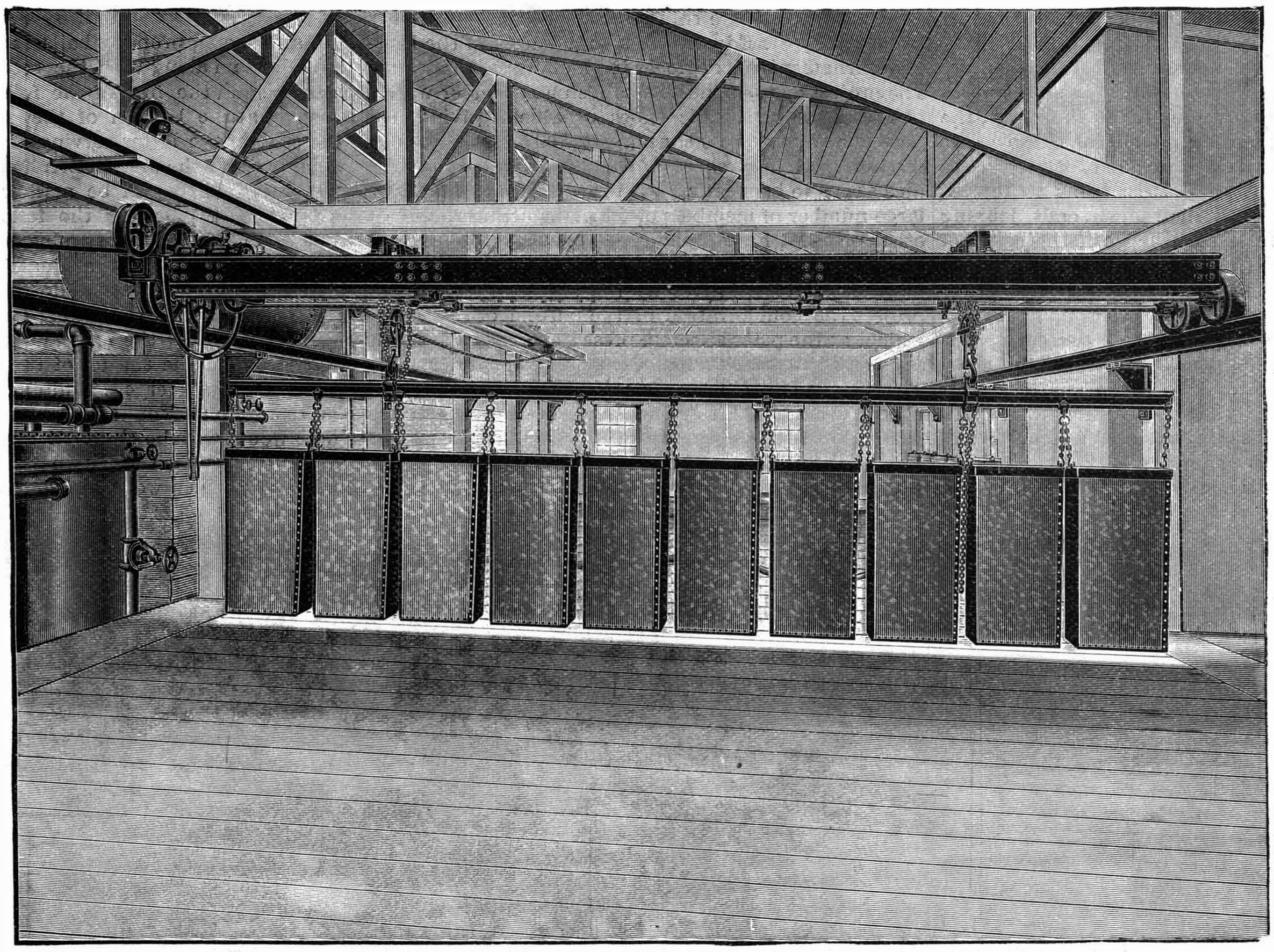
Far in the antipodes, in Hobart, Tasmania, under the auspices of the Tasmanian government, is to be opened an international exhibition of arts and industries. The colony of Tasmania has a population of 150,000, and the neighboring colonies contiibuting to the affair make a total of over 4,000,000 of inhabitants. The site for the buildings, about eleven acres in extent, has been granted by the government.

The period for the exhibition comprises the Tasmanian summer, some six months, from November, 1894, being chosen. The ground plan of the buildings shows an irregular triangle, containing one main building with a long exhibition building, forming a perimeter for the triangle, and with two cross buildings running across it at right angles to each other. The entire arrangement is novel and apparently excellently well adapted for an exhibition whose purpose is to exhibit things, and not to form a world's playground.

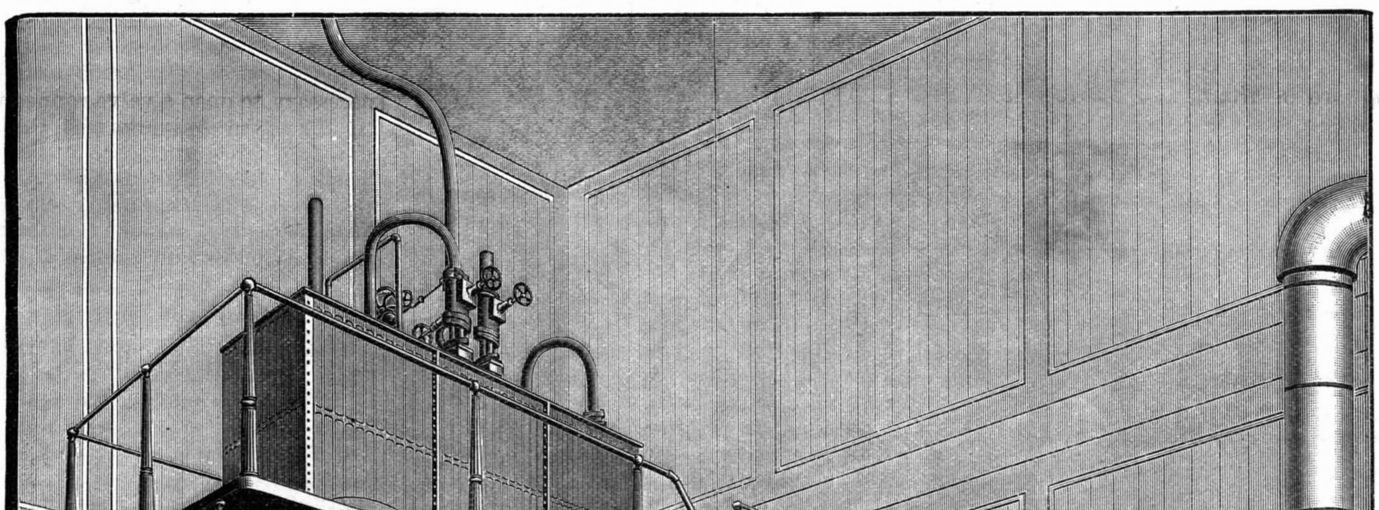
After the great Chicago Fair everything of this nature seems dwarfed. But placed under a powerful and influential directorate, with the full sanction of the colonial government and with a simple and easily understood code of regulations already in official print, there is every reason to believe that the dwellers on the other side of the line will make their exhibition a grand success. One hundred and fifty-six classes, in twenty-four groups, are organized as the division of exhibits.

The idea is to make the occasion of direct utility for those desiring to purchase supplies. It seems obvious that for the manufacturers of the United States an excellent opportunity is afforded to extend their market by exhibiting their products here. A small charge for space is made, and the rules affecting exhibitors seem excellently conceived and well designed to secure fairness and satisfaction. The firm of Woltmann, Keith & Co., No. 11 Wall Street, New York, represent the exhibition, and intending exhibitors should apply to them for full details and particulars.

A NEEDLE passes through eighty operations before it is perfectly made.



SIXTY-TON ICE MAKING PLANT PHILADELPHIA—POWER CRANE IN POSITION HOISTING 3000 POUNDS OF ICE.



SIXTY-TON ICE MAKING PLANT, PHILADELPHIA—THE ST. CLAIR COMPOUND COMPRESSOR.

A LARGE PHILADELPHIA ICE MAKING PLANT.

The Knickerbocker Ice Company, of Philadelphia, for many years engaged in the business of harvesting, delivering, and shipping ice, and owning large houses on the Hudson River and in Maine for the storage of naturally frozen ice, has recently established in Philadelphia a large plant for making ice artificially. The company had previously taken up the production of artificial ice, having had several plants therefor in continuous operation for sufficient length of time to make it certain that the business had passed the experimental stage; but this new establishment is the largest and most important of them all, having a capacity of sixty tons of ice daily. The company has sought to make this plant a model one for the production of artificial ice, sparing no expense in obtaining the best mechanical contrivances and facilities, that the cost of manufacture might thereby be reduced to a minimum. The work was executed by the York Manufacturing Company, Limited, of York, Pa., under the direction of Mr. Stuart St. Clair, of that company.

The compressor of this plant, shown in one of our illustrations, is the St. Clair compound, having two low pressure or evacuating cylinders 18 by 30 inches, vertical and single acting. The duty of these cylinders is simply that of evacuation and compressing at low tension, maintaining nearly a constant temperature in the cylinders, thereby saving the large percentage of loss that accrues from highly heated cylinder walls. These low pressure cylinders and the receiver of same are water jacketed. The high pressure or delivery cylinder is 15 by 30 inches, and its duty is to simply deliver the partially compressed gas to the condenser. This cylinder works under nearly constant temperature, and is also water jacketed, the temperature of the gas at no point in the delivery ranging higher than 130° Fah. The compressor pumps are operated by one of the York Manufacturing Company's balanced valve engines, 26½×30 inches, controlled by a cut-off governor of their own make. The claim made for the efficiency of these engines is very high. The engine and ammonia pumps are operated without any internal lubrication whatever, and, it is said, without any increased friction, demonstrated by careful tests.

The power crane for raising and transferring the ice cans, delivering the ice where desired for storage, is a great labor saver. As shown in one of the views, the crane raises at one lift ten 300 pound cans, the crane being then moved with its load to where the ice is to be stored, when the cans are lowered so as to rest in an inclined position, with their open ends looking down the slide ready for the discharge of the cakes of ice to the dumping platform. In lowering the cans they are dropped between a series of perforated pipes, from which, when the cans are in position, hot water is ejected to sprinkle the surface of the cans, thus liberating and discharging the cakes upon the platform in the manner shown. By this means it is said that one man can easily harvest and put away in storage thirty tons in his twelve hours' watch. Three men on each watch is the total crew required to operate the system at this factory. For our illustrations and particulars as to this plant we are indebted to *Ice and Refrigeration.*

Petroleum Briquettes.

The method of making fuel bricks of crude petroleum adopted by Engineer Maestracci, of the Italian navy, is as follows: The bricks are of similar form and size to the coal briquettes extensively used in France and Germany. The mixture is made in the proportion of 1 liter of petroleum, 10 per cent of resin, 150 grammes of powdered soap, and 333 grammes of caustic soda. The mixture is heated and stirred at the same time; solidification begins in about 10 minutes, and the operation must then be carefully watched. If there is a tendency to remain liquid, a little more soda is added. The mixture is stirred until the mass becomes nearly solid. The thin paste is then poured into the moulds, which are placed for 10 or 15 minutes in a drying stove. The briquettes are then cooled, and are ready for use in a few hours.

Signor Maestracci recommends the addition of 20 per cent of wood sawdust and 20 per cent of clay or sand, which will make the briquettes cheaper and more solid. In trials made at Marseilles on several tug boats the petroleum briquettes furnished about three times as much heat as coal briquettes of the same size. They were burned in the ordinary boiler furnace, without any special preparation, and gave out very little smoke, leaving also little or no ash. The advantages claimed for the petroleum briquettes for marine use are the absence of smoke and a large reduction in bulk of fuel which must be carried, as compared with coal, while the risks attending the carrying of liquid fuel are avoided.

THE tunnel which carries the Colorado Midland Railway through the Rocky Mountains, at Hagerman Pass, Col., has just been completed. The tunnel is close upon two miles long, and it is bored through solid gray granite. Its completion involved three years and twenty days' work, each day comprising twenty working hours. The tunnel is 10,890 feet above the sea level.

A Projected Tubular Railway between Calais and Dover.

There is at the present moment a question of a new project having for its object the connection of the European continent with England by railway. It is a problem that has for a long time attracted the attention of engineers and for which many solutions have been proposed. The solution under consideration is proposed by Sir Edward Reed, a member of the English Parliament and engineer in chief of the Admiralty. His project consists in the establishment, under water, of one or more metallic tubes capable of giving passage to a railway, and thus avoiding the principal objections that his predecessors have encountered. The idea seems to be meeting with favor in England and a large number of members of Parliament, hostile to all other projects, have pronounced themselves partisans of the tube.

Sir Edward Reed gives as the *raison d'etre* of his project the configuration of the bottom of the strait, which, at the place selected, presents a relatively plane surface, or, at all events, exceedingly gentle slopes. The tubular line would start from a point of the French coast situated to the south of Cape Gris-Nez, would pass to the northeast of the shelf of the Varne, which it would entirely avoid, and would end at the English coast between Folkestone and Dover, to connect with the Southeastern and London-Chatham-Dover lines. In following this general direction the bottom is found at depths much less than might be expected. The greatest depths are found at about a third of the distance between France and England, where they reach 185 feet. The greatest difference of level between any two of sixteen consecutive soundings a mile apart on the direction line is about 39 feet, which for a length of a nautical mile corresponds to a slope of scarcely 0·08 inch to the foot.

Sir Edward proposes the adoption of a double-walled tube of iron or steel plate. The annular space would be strengthened by a series of longitudinal I-girders, and then filled in with beton of Portland cement. Such a tube under conditions of resistance easy to determine by calculation would be perfectly tight and offer guarantees of almost indefinite duration. As for the putting of it in place, that is a subject that has received special study, and the method proposed forms the most original part of the project. It is proposed to construct the tube in sections of 300 feet, each of which would be hermetically closed at the two ends, so as to be capable of floating and of being towed to the place of submersion. It would be attached by one of its extremities to a huge caisson designed to form at the bottom of the water a very low pier for its support.

It is clear that if we have a floating tube, and that by any means whatever we force one of its extremities to descend to the bottom of the water, the other extremity will emerge, the tube as a whole taking an inclined direction. That is precisely what occurs here. The tubular section is brought near the emerging extremity of the section that has preceded it. The floating caisson is attached to it by means of large hinges, and, after being properly ballasted, is made to descend to the bottom along with the second extremity of the first tube and the first of the following. The tube is thus laid at the bottom of the water section by section, each of the latter serving as a guide to the following. After the first section has been properly laid and directed there can be neither error nor difficulty in putting in place all the following, which adjust themselves in a line in the prolongation of one another. As for the forming of the final joints under water, there are numerous ways of doing that.

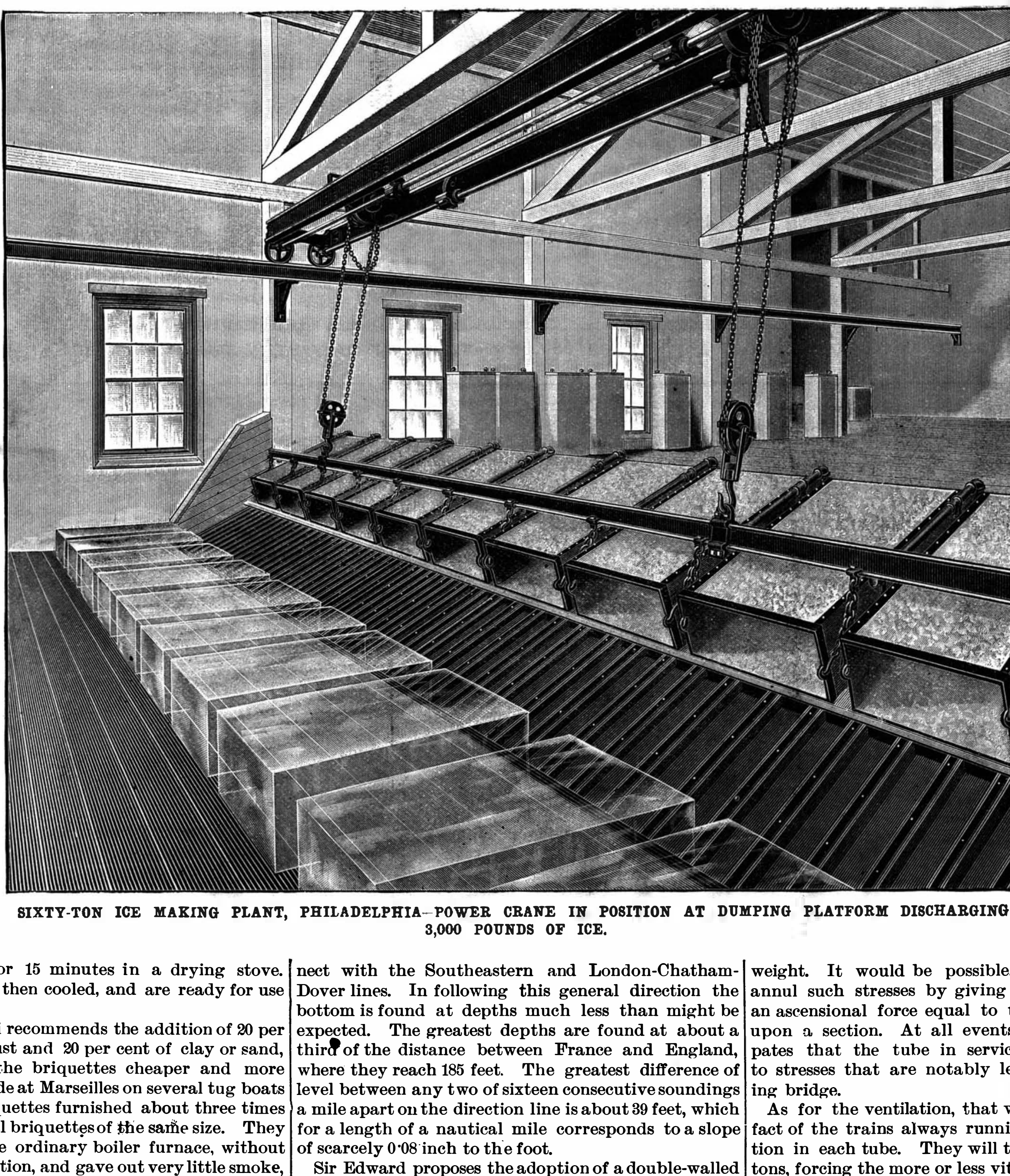
In order to resist the transverse stresses that may occur when one of the extremities of the tubular section remains at the surface of the water, Sir Edward proposes to submerge simultaneously two tubes 70 feet distant and connected by metallic crosspieces. There would thus be obtained a sort of huge horizontal girder, of which the two tubes would form the chords, and which would present sufficient rigidity to resist all the stresses due to the motion of the water. Each of these tubes would contain but one railway track, designed for the running of trains in a single direction.

Finally we have seen that the tube would be supported by very low submarine piers. It appears preferable, in fact, not to allow them to rest upon the sea bottom. There is assured in the first place a free circulation of the currents above and below, and, in the second place, the laying is greatly facilitated without recourse to submarine dredging, since it is possible to regulate the height of the piers in such a way as to avoid all unevennesses and the slight changes of level of the bottom. As the tube is held at the bottom by the weight of the piers only, it is submitted to upward stresses that may be regulated at will by properly calculating its own weight. It would be possible, even, to completely annul such stresses by giving the submerged tube an ascensional force equal to the weight of a train upon a section. At all events, the projector anticipates that the tube in service will be submitted to stresses that are notably less than in any existing bridge.

As for the ventilation, that will be assured by the fact of the trains always running in the same direction in each tube. They will thus act like huge pistons, forcing the more or less vitiated air before them and sucking in a new column of pure air. There is nothing in the way, however, of having recourse to artificial ventilation, which could be easily established. Electric propulsion would naturally be employed.

According to the calculations of Sir Edward, the total cost of the tubular railway ought not to exceed 375 millions at a maximum, and the construction of it might be effected in five years. Navigation would experience no obstacle, since the tube would be at least 65 feet beneath low water at a short distance from the coasts, where it is very easy to establish beacons.

In case of war, there would be numerous means of inundating the tubes immediately.



SIXTY-TON ICE MAKING PLANT, PHILADELPHIA—POWER CRANE IN POSITION AT DUMPING PLATFORM DISCHARGING 3,000 POUNDS OF ICE.

Correspondence.

How to Restore a Dry Cell.

To the Editor of the Scientific American:

I advise J. H. M., in query 5605, to restore his Dr. Gassner dry cell by the passage of the current of two Bunsen cells (in tension) for about an hour, in a direction contrary to that in which the dry cell yields, *i. e.*, connecting the zinc and carbon poles of the Bunsen cells with the zinc and carbon poles of the dry cell. In this case the dry cell acts like a secondary battery. This method saves the trouble of opening the cell, and, moreover, it regains more or less its original activity.

F. HAUSHAHN.

Propaganda, Rome, Italy.

Drawing in General Education.

D. R. AUGSBURG, SALT LAKE CITY, UTAH.

Language and number have heretofore been the beginning and end of education in the common schools.

Language is here taken as the general name for reading, spelling, and grammar, and number for mathematics. These two studies have been pursued with a persistence which has led to the popular belief that they were all in all, and that nothing more was needed to lay the foundation of a well rounded and complete educational training.

But modern education has kept pace with modern thought and ideas, until to-day training along these two lines alone is found to be insufficient; that with these two for a foundation the superstructure is one-sided and incomplete; that if the end sought is a harmonious and well rounded education, the foundation must be made broader and stronger.

Modern education recognizes three grand divisions of educational training: body training, mind training, and soul training. The harmonious development of these three is the sum total of education. Of these, mind training receives the most attention in the common schools. Four studies are at the basis of mind training. They are *number*, *language*, *drawing*, and *music*.

Drawing here is taken in the widest sense as representing the elements of both form and color. It is the mental process by which ideas are represented both pictorially and in solid form.

Of these four studies, drawing alone seems to be viewed by the masses with suspicion. Because it was not taught in their day, and they do not feel the need of it, they pronounce against it. By the same argument, the successful business man who has had no schooling in his early days pronounces all scholastic study humbug. It may be said of any department of knewledge, that one does not understand its importance until he enters into its domain himself, or sees another put it to practical use in the affairs of life. So those who have not learned drawing do not, in their own experience, know what they have lost.

But if number, language, drawing, and music are the fundamental studies, then all others are but branches, and these four studies are the elements of which they are composed. This is even so, for without a knowledge of these studies, it would be difficult to acquire a knowledge of other branches. For example, the elements that enter into the study of geography are number, language, and drawing. In other words, in order to understand geography one must have a knowledge of mathematics, language, and form, because these are the elements on which it is based.

In the same manner number, language, and drawing are the foundational aids in acquiring such branches as physiology, physics, geology, etc. The trades are almost entirely based on these three studies.

In proportion to the knowledge of and ability to use these four elements, the branches become easy and the time for their mastery is shortened.

Drawing is largely the basis of the trades. The stone cutter cuts a capital out of marble with chisels, the draughtsman draws it on paper with pencil; the manual process differs, but the mental process is the same. The blacksmith draws a horseshoe with a hammer, the draughtsman draws it with a pencil; the manual process differs, but the cerebral activity is the same. In like manner the painter draws with a brush, a carver with chisels, a tailor with shears, a mason with trowel, and the carpenter with various tools. The lathe is a machine for drawing different forms in iron and wood, the band saw for sawing out designs, the loom for drawing fabrics of all sorts. With all these machines, if a pattern is not used, the operator is the artist, and designs his own work. If a pattern is used, the one that designed it is the artist, and the operator is but a part of the machine. He is an artisan.

If a blacksmith can draw beautiful designs on paper, he can hammer them out of iron. If the draughtsman can draw a horseshoe on paper, he can hammer it out of iron as soon as he has overcome the technical difficulties. If a person can draw a design on paper, he can construct that design in any trade or department as soon as he has overcome the mechanical difficulties of that department.

Outside of the mechanical arts, drawing is the basis of a large number of branches. It is the basis of *the decorative arts*—frescoing, tapestry, embroidery, and lettering; *the plastic arts*—carving, moulding, modeling, and sculpture; *the reproductive arts*—etching, engraving, lithographing, printing, photography; *the productive arts*, which include original work in any department.

Drawing shortens the school course.—By cultivating the perceptive powers, the time is shortened in acquiring those branches that wholly or in part depend on observation. Trained perceptives add wonderfully to the powers of the imagination. A cultivated imagination enables the pupil to see a river in a rill, a mountain in a hillock of sand, or a lake in a pool of water; will enable him to journey with you in imagination across the trackless ocean, through the jungles and forests, up the rivers, over the plains, and across the mountains; will enable him to see forms beyond the range of vision, and compass magnitudes too vast for measurements. Imagination is the creating faculty.

Drawing is one of the surest means of acquiring knowledge.—To draw an object requires intelligence and close observation; to reproduce that object, a cultivated memory; to reproduce a modified form of that object, a trained imagination; and lastly, to represent an idea from that object requires knowledge, memory and imagination. For example, it requires close observation to draw a cat; an acute memory to recall the image, and reproduce it on the blackboard; a trained imagination to be able to represent the cat climbing a tree; and lastly a combination of these three to associate cats together, making a harmonious composition.

Drawing cultivates the hand and lays the foundation of technical education.—It is a study that seldom, if ever, becomes involuntary, like writing, but is always under the direct supervision of the mind. To draw even the most simple object requires the concentration of the mind in directing the hand for its reproduction. This constant working of the mind and hand in harmony with each other leads to great precision and accuracy in the use of the hand. The precision and accuracy may be utilized in any department of work.

Drawing is the basis of accurate observation.—To reproduce an object requires the closest scrutiny of that object, not only of the details, but of the whole form taken as a unit; not only the shape of the tree, but the character of its branching and foliage as well. Not only the form and color of a flower, but the number and arrangement of its petals, stamens, and pistil. A trained observation will see that a cat is similar to a tiger, a dog to a wolf, and a rat to a beaver; will see the similarity of an island to a lake, a strait to an isthmus, and a cape to a bay. Observation gives ideas.

Drawing is a study peculiarly adapted to children.—Children love drawing. The perceptive powers are the most active in childhood. Mental activity begins in the senses. A little child lives in his senses. He delights to see, hear and feel. His eyes are sharp, his ears acute, and his fingers are busy. He learns best by seeing and doing. Drawing is seeing and doing.

To the teacher drawing is a great help, not only in awakening interest, but in lessening her labor and making school more attractive. There is no limit to the resources which this subject places at her command. She can bring into the school room a lake, a mountain, or a river; all kinds of animals, birds, and reptiles; all kinds of trees, shrubs, and plants, fruits and flowers. She can show how the Eskimo lives in the frozen regions of the North, and the savage among the tropical forests of the South. She can bring into the school room the Pyramids of Egypt or a Chinese pagoda. She can use drawing in object lessons and for busy work. It can be used in the reading, number, and language classes; in the geography, history, and physiology classes; and as the handmaid of the sciences. She can illustrate what she sees, thinks, and imagines. She thus opens a new field, a new world, and makes life wider and broader and deeper.—*Education.*

What Our Contemporaries Think of It.

THE SCIENTIFIC AMERICAN is—by all odds—the most interesting of all the many publications which come to our office. It claims the largest circulation of any scientific paper in the world, and we don't doubt it. It is finely illustrated and its articles are so written that even a child can follow them understandingly. It is a great educator. Its publishers, Munn & Co., New York City, are patent solicitors, and are ranked among the best. Every patent taken out by them receives a free notice in the SCIENTIFIC AMERICAN.—This gives the article a good "send off."—*Varnish, Philadelphia.*

THE SCIENTIFIC AMERICAN.—We note with pleasure the addition of the SCIENTIFC AMERICAN to our exchange list. This paper has stood for the last forty years at the head of its class of publications—it has no superior. As a scientific and mechanical journal it cannot be excelled. The patent agency of Munn & Co., connected with it, is one of the few strictly reliable agencies in the United States. Those of our readers who desire to obtain a patent, and wish to have their interests well attended to, cannot do better than to address Munn & Co., New York, for their pamphlet containing full information about patents, caveats, etc.—*The Texas Courier-Record, Dallas, Texas.*

THE MOST POPULAR SCIENTIFIC PAPER.—The SCIENTIFIC AMERICAN, of New York, an unrivaled periodical now in its forty-ninth year, continues to maintain its high reputation for excellence, and enjoys the largest circulation ever attained by any scientific publication. Every number contains sixteen large pages, beautifully printed, elegantly illustrated. It presents in popular style a descriptive record of the most novel, interesting, and important advances in all the principal departments of science and the useful arts, embracing biology, geology, mineralogy, natural history, geography, archæology, astronomy, chemistry, electricity, light, heat, mechanical engineering, steam and railway engineering, mining, ship building, marine engineering, photography, technology, manufacturing industries, sanitary engineering, agriculture, horticulture, domestic economy, biography, medicine, etc. A vast amount of fresh and valuable information pertaining to these and allied subjects is given, the whole profusely illustrated with engravings. The most important engineering works, mechanisms, and manufactures, at home and abroad, are represented and described in this instructive periodical. The publishers of this journal, Munn & Company, are the well known patent attorneys, and those desiring to procure information pertaining to the securing of patents should not hesitate to consult them, as they have had nearly fifty years' experience at this business and are capable of obtaining patents quickly.—*Army and Navy Register, Washington.*

To Measure a Room for Wall Paper.

To determine the number of rolls of paper to cover the walls of a room, measure the circumference, from which deduct the widths of doors and windows and divide the remainder by 3.

Example.—Let us suppose a room 12 × 16 feet, which has two doors and two windows, which average 4 feet wide:

12 × 12 × 16 × 16 = 56, circumference.
4 × 4 = 16, doors and windows.

56
16
3)40
13½, or say 14 rolls.

This rule is calculated for a room of not less than 10 or more than 12 feet in height. For a room under 10 feet high, having a frieze, say of 6 inches, we will proceed as before with the measurement of the room, deducting the widths of doors and windows. But in this case multiply the remainder by 2 and divide by 15; for this reason, that we can cut 5 lengths out of a double roll, which, placed side by side on the wall, cover a space 7 feet 6 inches from the ceiling, and instead of multiplying by 7 feet 6 inches, we multiply both by 2.

Example.—Take a room 14 × 14, with two doors and windows:

Circumference of room	56
Less for doors and windows	12
	44
	2
	15) 88
	5 13/15

Say 6 double rolls, or 12 pieces. Of course if a dado is required its width will determine how much paper will have to be deducted.—*The Carpet and Upholstery Trade Review.*

Duroline.

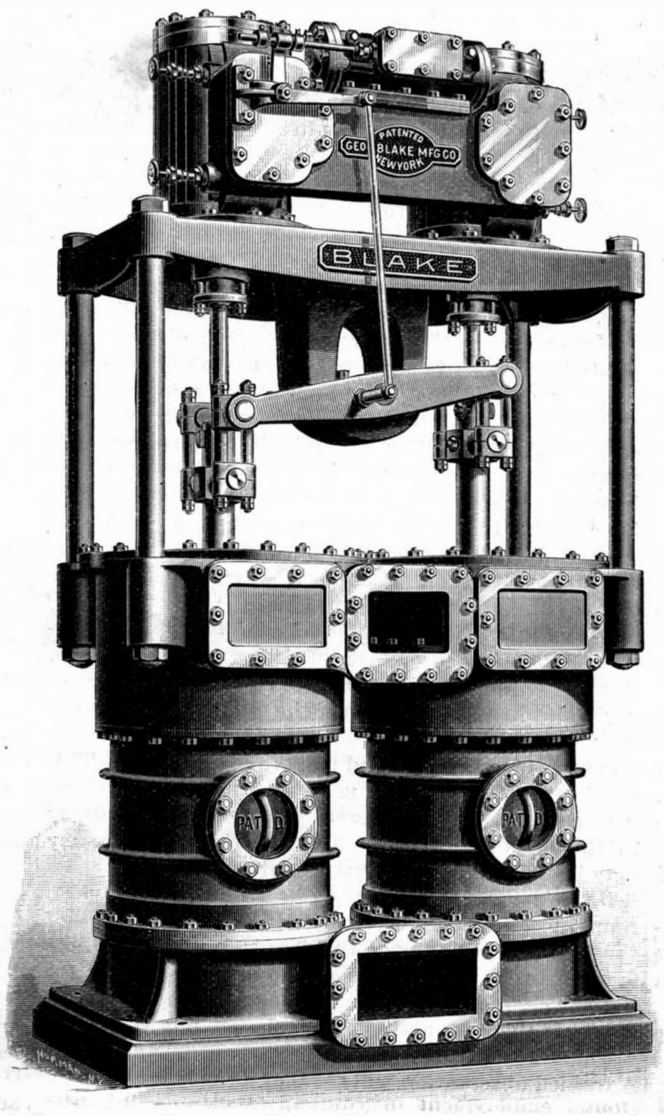
Duroline is a translucent, waterproof, pliable material, recommended and used as a substitute for glass for roofing large buildings, etc. It has for its basis a web of fine iron wire with warp and weft threads, and is covered with a thick translucent varnish. It is easily bent, can be cut with strong scissors, and is said to be weather and heat proof. Samples of it were sent to Kew in October last by the manufacturers, inviting "attention to the special applicability of our patent unbreakable glazing material duroline for the glazing of Wardian cases, in which plants are sent and received from abroad. We believe much damage and annoyance results from the breakage of glass in these cases."

Six Wardian cases were, therefore, "glazed" with this material, and were dispatched filled with plants to Ceylon, Australia, Jamaica and Lagos during the summer. In every case they were favorably reported upon, and some of them have been returned to Kew filled with plants which reached us in good condition. The only drawback we have found in duroline as a substitute for glass in Wardian cases is its stickiness inside after it has passed through the tropics, and the consequent gluing to it of the plants where they touch. This stickiness is due to the moisture and warmth inside the case. The manufacturers say "the more duroline is exposed to weather, the harder it becomes." On the whole, we can report favorably upon duroline for Wardian cases. We also think it might be used for many purposes in the roofing of sheds and plant structures in tropical countries.—*Kew Bulletin.*

AIR PUMPS OF THE CRUISER NEW YORK.

The independent air pumps of the cruiser New York, built by the Geo. F. Blake Manufacturing Company, are quite novel in construction and performance. The New York, like all the government vessels, has very little room to spare for engines and their auxiliaries, consequently the design of the air pump had to be one combining compactness, minimum weight and maximum efficiency. As shown by the illustration the design of this pump is of the vertical direct acting type—Blake system. The air cylinders are of the vertical single-acting pattern, operated by double-acting steam cylinders; there being two air cylinders, the flow of the water and vapors is practically continuous. The piston rods are connected to the beam by means of links, etc. The air cylinders and the working parts of same are entirely of gun metal composition, which is the usual practice in the United States navy. The piston rods of the steam cylinders are of steel, as also the valve gear, which latter can be adjusted by hand even while the pump is in operation, thus securing full stroke at all times.

These pumps are particularly remarkable for the low percentage of power required to operate them in comparison with the power of the main engines. From the official report of the trial trip the I. H. P. of the Blake air pumps was less than one-quarter of one per cent of the I. H. P. of the main engines. The explanation is, perhaps, due to the very complete and perfect arrangement of the steam valve gear, which so thoroughly controls the operation of the pump that a very low rate of piston speed is sufficient to give a first-class working vacuum. The average speed of the air pumps on the trial trip of the New York was less than 16 double strokes per minute, while the minimum speed was only 9½ double strokes. The pumps can be run at practically any speed necessary without danger of "dead center." These air pumps are to be placed on all the vessels building for the navy by the Cramps, viz., the Columbia, Minneapolis, Brooklyn, Indiana, Massachusetts and Iowa. Each of the New York's air pumps has two double-acting steam cylinders, each 12 inches diameter, two single-acting cylinders, each 25 inches diameter. Stroke of all, 18 inches. The working parts of these air pumps are exceedingly simple and strong. The steam valves of the steam cylinders are plain "D" slide valves, which, by means of levers, are operated by a supplementary piston which moves in the horizontal steam cylinder shown. This supplementary piston is also operated by a plain "D" valve connected to the valve rod which has adjustable collars for regulating stroke. This valve rod is moved by means of the rod attached to the working beam from which it gets its motion.



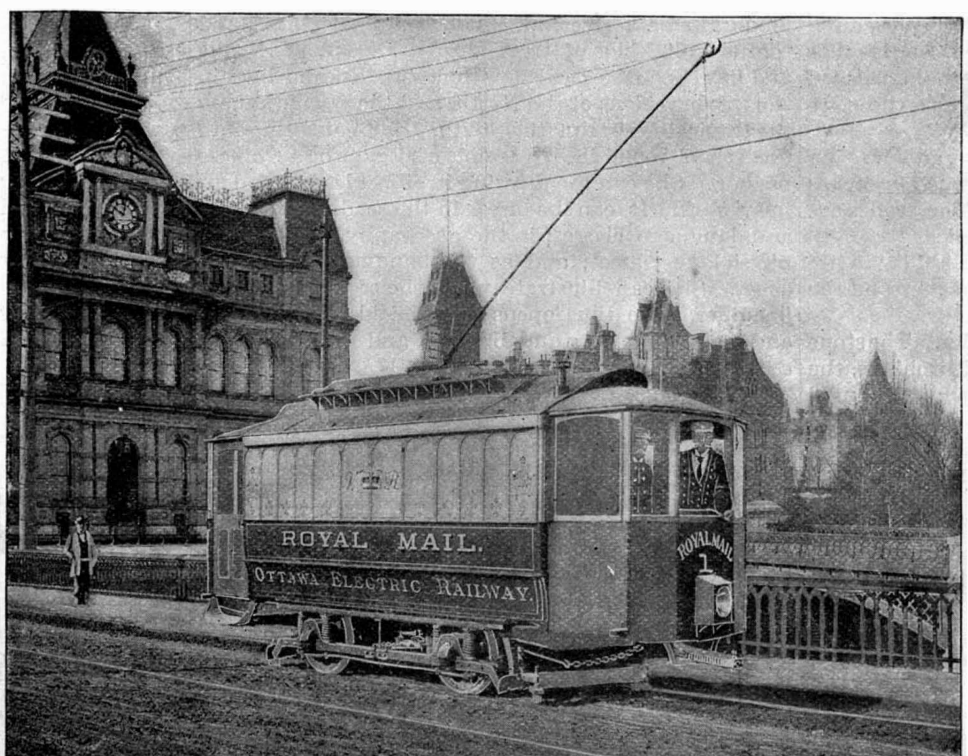
BLAKE'S VERTICAL TWIN CYLINDER AIR PUMP.

ELECTRIC RAILROAD MAIL SERVICE IN OTTAWA, CANADA.

In recent numbers of the SCIENTIFIC AMERICAN we have had occasion to speak of the utilization of cable and electric cars for the distribution of mail. It seems practicable to greatly improve the house to house delivery of mail, as well as the collection of letters from lamp post boxes, by utilizing the street cars for post office service. The cut accompanying this article shows how our northern neighbors are employing the electric car in post office service. The carrying of the mail "experimentally" from the Ottawa, Can., railroad station to the post office in the same city began on November 10, and the service has proved very satisfactory, so much so that other cities in Canada will undoubtedly adopt the same system, and the post office is expected to extend the operations to suburban places.

In Ottawa three cars have been put in service, one of which is shown in the above cut, for which we are indebted to the *Street Railway Review*. The cars were built by the Ottawa Car Manufacturing Co., specially for the post office work. Each car is twenty feet long, with vestibuled platforms, and is driven by a 30 horse power Westinghouse motor. The interior is arranged with the requisite facilities for loading and unloading the pouches. No sorting is done on the car, so that the usual glass windows are dispensed with.

A special alarm gong is provided for each car, which gives a different sound from the gongs on the passenger cars, thus making its approach known. Special sidings have been laid for the car at the post office and railway yard. The motormen and other employes are uniformed. The contract with the electric railroad company calls for a compensation of $4,000 per annum for the work, the motorman being supplied by the railroad company; the post office employes act as messengers. The delivery by horse and wagon formerly cost $3,000 a year. Thus there is no direct economy shown, but the efficiency of the service is presumably worth the difference.



ELECTRIC MAIL CAR No. 1, OTTAWA, CAN.

ACCORDING to a French statistician, there were in 1893 51,000 breweries in the world. Germany heads the list with 26,240, producing annually 4,750,000,000 liters of beer (the liter is equal to 1¾ pints nearly). England comes next with 12,874 breweries, the output being 2,600,000,000 liters. The United States is third, with 2,300 breweries, producing 3,500,000,000 liters. Austria, with 1,942 breweries, produces 1,300,000,000 liters. Belgium has 1,270 breweries and France 1,044; the former produces 1,000,000,000 liters and the latter 800,000,000 liters. The annual allowance of beer per head of the population in Bavaria is 221 liters; in England, 143; in the United States, 31; in Sweden, 11; and in Russia, 5.

The Nansen Expedition.

Dr. John Murray, the well known authority on Arctic and Antarctic exploration, has made the following statement with regard to Dr. Nansen's expedition:

"In all probability we shall not hear any more of Nansen for a long time to come. The last news from him clearly indicates that he was able to push his way through the Kara Sea early in August. By the time he arrived in the Nordenskjold Sea he most probably found the dogs an intolerable nuisance on board his small ship, and very likely he had made up his mind that they would be of little use to him, except in the improbable event of his finding a large stretch of land toward the North Pole. Supposing the expedition to be all well off Cape Chelynskin, there seems no reason why it should go south to Olenek. Nansen had no intention of going as far east as the new Siberian Islands, supposing an opportunity offered of penetrating the ice to the northeast of Cape Chelynskin, and all reports tell of open water in this direction during the past season. The chances are that he is now fixed in the ice somewhere between the longitudes 120 and 130 east and latitudes 78 and 80 north. If so, he is then in the most favorable position for progress next summer. During the winter it is not likely that any great advance will be made, but in the spring and summer months it is believed that the drainage from the Siberian rivers and the wind pressure on the surface of the ice floes combine to set the currents and ice from opposite the mouths of the Lena across the Pole and down into the Norwegian Sea between Spitzbergen and Greenland. If the Fram is carried through the Polar basin without being crushed among the ice floes, she will have an extraordinary run of good luck. It is possible, but not probable, for I have no great faith in her being lifted up on the ice, should she come in for a "nip." But supposing the Fram be crushed, Nansen's expedition is not at an end. In all probability he will be able to save his boats, transfer his stores to the ice floes, and there construct comfortable quarters. Should his supplies fall short, he will always be able to fish up from underneath the ice plenty of food in the form of minute crustaceans by means of tow nets let down through holes in the ice. Once when frozen in between Spitzbergen and Greenland, I procured enormous numbers of animals in this way which made an excellent soup. I presented the Nansen expedition with a large number of silk nets for this purpose. Nansen may be five or many more years in passing across the Arctic basin, he may fail altogether, but I shall be disappointed if he be not heard of to the north of Spitzbergen during the summer after next."

The Crozier-Buffington Disappearing Gun Carriage.

The value of disappearing gun carriages, especially for coast defense, has been clearly demonstrated. A gun on an ordinary barbette carriage offers an inviting target, and a fleet would naturally try to dismount it. The gunners are also exposed with a barbette carriage. A number of disappearing gun carriages have been invented and tried in this country. The Crozier-Buffington disappearing gun carriage is somewhat lighter and more graceful than the Gordon carriage, and the tests have been highly satisfactory. In the firing position of the Crozier-Buffington carriage the trunnions of the gun rest in sockets at the ends of a pair of huge levers which swing freely, and are attached to a large counterpoise. This is lifted and held up by a pawl and ratchet. When the gun is fired the piece recoils and the levers sink. With an 8-inch breech loading rifle the counterpoise weighed 37,000 pounds. Connected with the breech of the gun is a pivoted framework which keeps the gun in exactly the same position. In addition to the counterweight, which takes up only about one third of the recoil, there are two hydraulic cylinders which receive the remainder. The cylinders are horizontal and fixed while the pistons are stationary. The new carriage holds the record for speed, as ten rounds were fired in twelve minutes and three seconds. The time of firing a round is divided about as follows: In loading fifty-five seconds were consumed, in raising to position five seconds, in firing one second, and one second was required for the recoil. The new gun carriage is highly efficient and reflects great credit on the American inventors.

THE COLUMBIAN EXPOSITION—FORESTRY EXHIBITS.

The Forestry building, notwithstanding its bad location in the so-called "back yard" of the Exposition, was constantly filled with visitors who were anxious to see the curious and instructive exhibits. In no other building in the grounds, save, perhaps, the Anthropological building, could so much be learned in a single visit. The collectors were, in many cases, enthusiastic amateurs who spent months in preparing the exhibits. We illustrate herewith some of the curious things in the line of forestry. We can trace the life history of trees and elucidate the systematic workings of nature in regard to them; we can explain what has been learned by patient investigation in regard to natural forces as exhibited in the plant world, but we are occasionally startled by a wild freak of nature and we are left in wondering admiration of the subtile and almost incomprehensible power which has produced the abnormal. An example of this was shown by the curious natural graft which we illustrate in Fig. 1. The

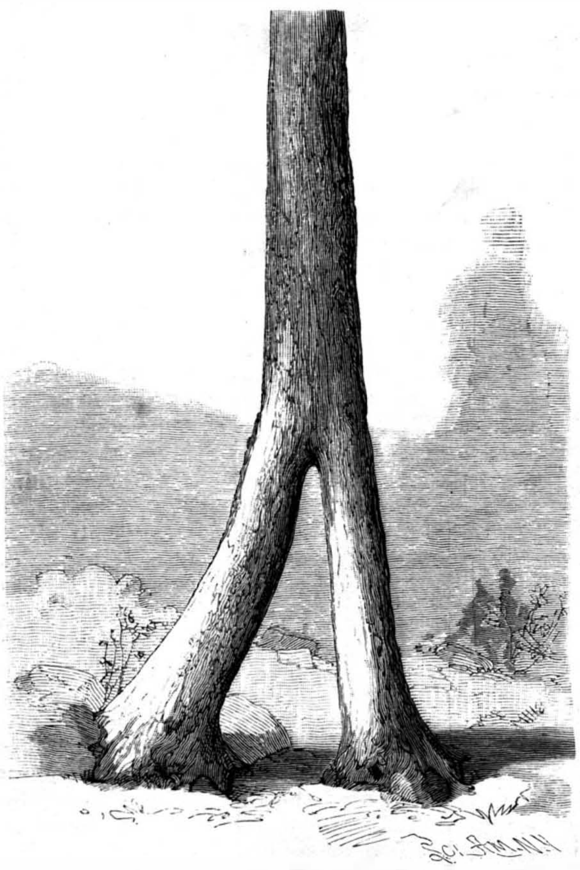


Fig. 1.—CURIOUS CASE OF NATURAL GRAFT.

two trees are a white pine and a rock or sugar maple. The crotch formed by the graft was three and one-half feet long, and the total piece exhibited was, perhaps, six or seven feet long. The union of two such trees, when accomplished in a natural way, presents an interesting field for speculation. How were the trees denuded of their bark when they were young saplings, so as to allow of grafting ? Deer or other animals may have scraped or eaten off the tender bark, or the saplings may have been scraped by a falling tree. Possibly the young trees were blazed in making a forest path, but this is hardly likely to have been the case, as young trees are rarely selected to blaze. However the bark may have been removed, it is probable that they were brought together during a storm in the spring time, when the sap was running. This specimen came from Wisconsin, as did the two following, and the bugle illustrated in Fig. 6. All were collected by Mr. H. A. Batchellen, who gathered many of the specimens on exhibition, in winter, with the aid of snow shoes. Fig. 2 shows another natural graft of two white pine trees which is even more extraordinary than the last. The white pine is a hardy tree and accommodates itself to almost all kinds of soils, but at the same time it is very susceptible to influences which retard or warp its growth when it is young. This is shown by the curious growth illustrated in Fig. 2, which is also a piece of a white pine tree. The specimen resembles the gnarled and twisted stone pines which add so much to the charm of the scenery on the Italian shore of the Adriatic.

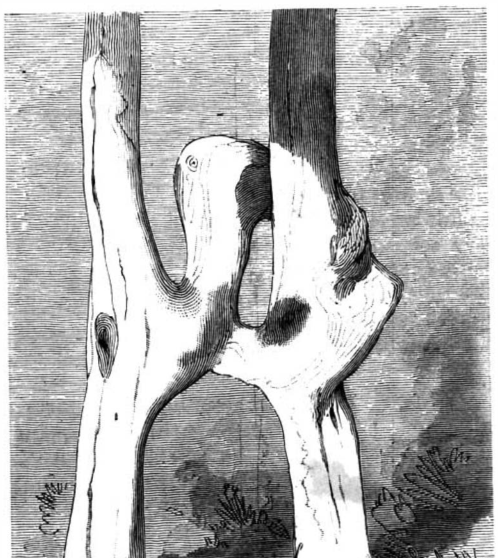


Fig. 2.—A VEGETABLE BOW KNOT.

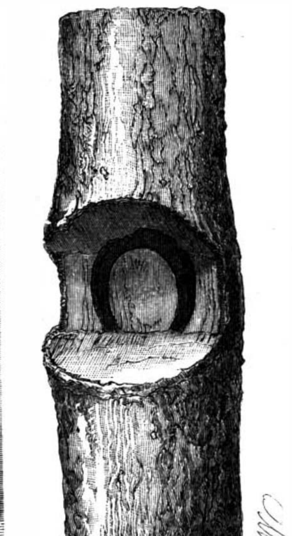


Fig. 3.—HORSESHOE EMBEDDED IN A TREE.

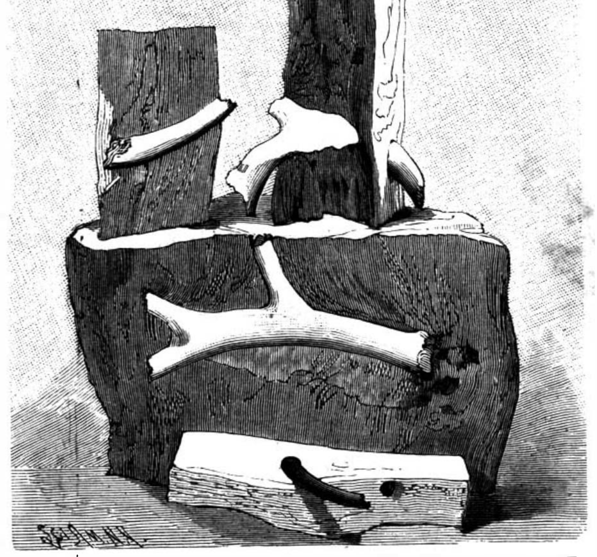


Fig. 4.—ANTLERS EMBEDDED IN TRUNK OF A TREE.

Fig. 4 shows deer horns embedded in wood, the trees being burr oak and whitewood. It is no uncommon thing to find in the great deer parks of England the antlers of deer, and even a foot which was caught in the branches and torn off through fright and pain. The antlers embedded in the wood can probably be accounted for in this way, the wood growing around them.

At the bottom of Fig. 4 will be seen an iron ring embedded in the wood. Some one hung the ring on the limb of a hickory tree and the tree grew over it, covering it until it was again exposed to view by the woodman's ax. These specimens were all from the Michigan exhibit.

Fig. 3 shows a similar curious growth of a tree around a horseshoe. The horseshoe was hung on a small branch and was gradually embedded in the heart of the tree. This interesting specimen was shown by Mr. B. B. Brabham, of York County, Nebraska.

The woodsmen of the great Northwest find time hang heavy on their hands when their arduous labor is finished, so that they frequently spend their odd hours in fashioning some odd little trinket out of wood. The birch bark bugle, which we illustrate in Fig. 6, was really used as a dinner horn in a Wisconsin logging camp. The bell portion of the trumpet was composed of three pieces, which were shaped and joined after the fashion of the gores to a balloon. The portion of the instrument thus constructed was afterward covered with narrow strips of birch bark wound around and around, forming a smooth covering. The turn was made entirely of the strips of bark. This bugle does not call for any particular skill, and it would make an interesting occupation for young people to make them during the summer vacation in the country.

Fig. 5 shows a novel method of cutting clapboards which was exhibited by the Trout Creek Lumber Company, of Trout Creek, Michigan. For this exhibit they received a premium. This method, called quarter sawing, has marked advantages, the sawing being very economical and the grain is the same in each clapboard. The loss on account of cracks is minimized. In large trees two or more layers of clapboards are cut out. The log shown in our illustration was about sixteen inches in diameter.

Motormen.

Within the last few years a large number of men have found employment in running electric street cars. Members of this body have been given the name of motormen, and in some parts of the country they are known as motorneers. The motormen were, at first, recruited from the ranks of the horse car drivers, but the demand for them has been so great that men knowing nothing about street car work have, after a little practice, been placed on the front platform of an electric car. Street car companies have, as a rule, selected for this position men who possess intelligence and are not easily confused. The position of a motorman in a crowded city is not an enviable one. He has a great deal of responsibility resting upon him and is in a position to receive much blame and but little commendation.

There has been much discussion among street railroad engineers as to the advisability of giving the conductors and motormen instructions about the electrical mechanism which propels their cars. Some companies hold that a simple knowledge of the method of operating the switches, rheostat handle and break is sufficient, and that by keeping the operator in ignorance of the electrical principles involved, a proper respect for, and dread of, the system would be installed in his mind, and thus cause him to keep strictly to the running rules and not make any experiments on his own account. In case of trouble with the motor or connections the car has to be delayed till the arrival of an inspector. It is hardly necessary to say that the policy is not a good one, either to the company or to its employes. An ignorant man handling electrical apparatus is very much more likely to cause damage than a man well informed on the subject, although the latter may make a few experiments. If the experiments are made by one not conversant with electrical principles, the results are usually disastrous. The writer knows of a case where a man who, having in charge the running of several motors, wished to see what would be the effect of placing a short copper wire across the terminals of a 250 volt switch. He found out. He does not do it now. The practice of most railroad companies is to instruct their car employes in elementary electric principles, so that they are able to remedy any of the minor troubles occurring *en route*. In case of any serious defect the car is sent to the repair shop. If possible the motorman should be instructed in the "whys" as well as the "hows" of the machinery under his control. Being thus equipped, he will be a more efficient motorman and will be better fitted to cope with any emergency.—*Electrical Age.*

The Coin-in-the-Slot Telephone.

The Chicago Telephone Company, so the *Western Electrician* says, has just placed in several of its public pay stations instruments provided with a slot arrangement which may prove of considerable value to the company, by putting a stop, in a great measure, to the dead-heading at public stations which has been the source of much annoyance to the telephones in general. The idea is not a new one, but it is regarded

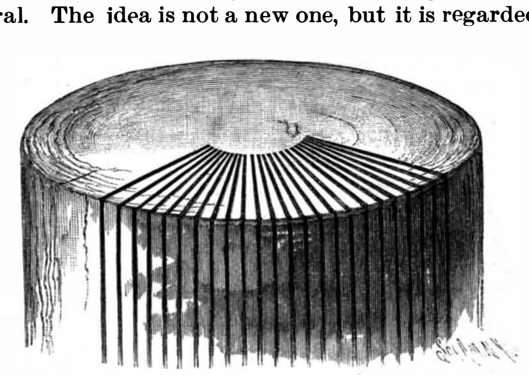


Fig. 5.—METHOD OF CUTTING CLAPBOARDS—NO WASTE.

with displeasure by those who have been accustomed to use telephones without paying for the service. The battery box is much larger than is ordinarily the case. On the top are five slots, respectively large enough to admit a silver dollar, half, quarter, dime and nickel. Each slot has a chute running directly to a bell inside the box. From the top of this box there is a transmitter to carry the sound of the five bells to the transmitter through which the user of the telephone talks. The bells differ in tone, and with a little practice the operator at the exchange can readily distinguish the

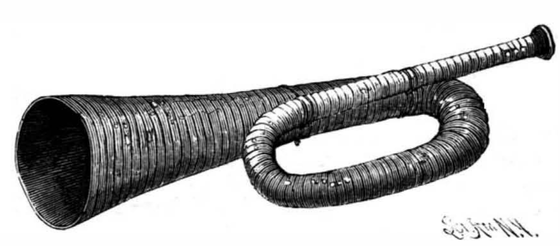


Fig. 6.—BIRCH BARK HORN.

sound of each. Each instrument is equipped with a metallic circuit and long distance transmitter, so that calls for any station that the telephone reaches can be made. These instruments have been in operation in New York and Boston for some time, and are said to have filled the requirements made upon them with a good degree of satisfaction.

A PHYSICIAN who got rid of some of his steel instruments and bought others made of aluminum says that he is sorry that he changed. The aluminum probes, sounds, tongue depressers, and that sort of thing do not oxidize, to be sure, but he finds that they are deficient in elasticity, and stay bent after pressure. He declares, moreover, that he likes to feel as if he had a hold on something when he uses an instrument, and aluminum is so light that it makes him feel as if he could put no trust in it.

A NEW LAKE STEAMSHIP.

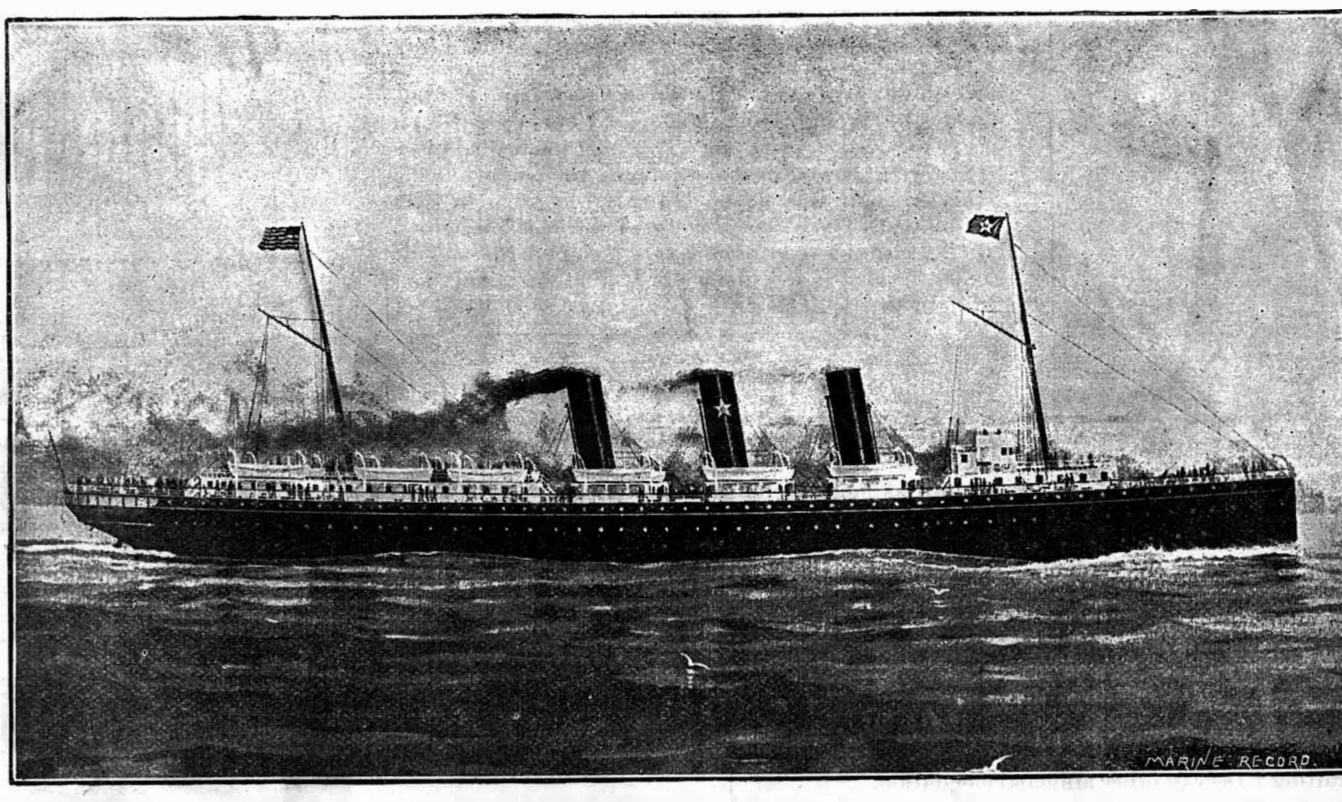
The rapid progress which is being made in steamship building in the West is well illustrated in the latest production of the Globe Iron Works, at Cleveland, O.

The steel steamer Northwest, the largest and certainly the finest built and equipped vessel that ever floated on fresh water in the United States, built for the Great Northern Line, was successfully launched from the shipyard of the Globe Iron Works Co., Cleveland, O., on the 6th of January, in the presence of a vast crowd of spectators. Nearly every lake port between Buffalo and Duluth was represented by delegations of vesselmen. A number of Atlantic coast shipbuilders were also present.

Her general dimensions are as follows: Length over all, 383 feet; length between perpendiculars, 360 feet; breadth, moulded, 44 feet; depth, moulded, 26 feet; depth to spar deck, 34 feet 5 inches.

The vessel has been built of mild steel throughout, with an inner bottom extending from the collision bulkhead forward to the afterpeak bulkhead aft. She has been built under special survey in order to obtain the highest classification in the United States Standard Register of Shipping.

The hull has been specially strengthened and subdivided through transverse and longitudinal bulkheads into numerous water-tight compartments. The construction throughout has been planned and carried out with the view of making the vessel not only the most modern and luxurious, but also the strongest and safest on the Great Lakes. She is fitted with two vertical quadruple expansion engines of 3,500 horse power each. The engines, when turning 120 revolutions per minute, will indicate 3,500 horse power each, and with a total horse power of 7,000 the vessel is expected to make an average speed of over twenty statute miles per hour. The propeller wheels are four-bladed, sectional, 13 feet in diameter and 18 feet pitch. The vessel cost about $600,000. We are indebted to the *Marine Record* for the foregoing particulars and for our illustration.



TWIN SCREW PASSENGER STEAMER NORTHWEST.

The Borgalle Tunnel.

The Borgalle tunnel on the Parma and La Spezia railroad, of Italy, has recently been completed. The tunnel is five miles long, 20 feet high and 25 feet wide, and accommodates two lines of rails. The cost of the tunnel was about $7,500,000. The new line will shorten the trip from Milan to Spezia and will prove of special value to travelers from Venice or other cities in the northeastern part of Italy. As Spezia is an important naval station, the new line will prove of great benefit to the government.

Beams and Floors of Concrete.

As the strength of concrete is much less in resisting tensile than it is in compressive stress, its employment for beams has not met with much success. It is true, indeed, that for floors, lintels, staircases, concrete has been used with considerable advantage, as being conveniently handled and placed *in situ*, yet there exists the disadvantage of not being able to test its strength transversely with any degree of reliability. The data furnished by authorities are not generally satisfactory; the proportions of cement and aggregate differences of age and other conditions are varying in the tests given. The proportion of sand is a material factor: the greater the quantity the weaker the result. It is obvious, moreover, that to obtain an approximate estimate of the transverse strength of beams made of concrete, a series of experiments, including a variety of aggregates and ages, would have to be made. One fact is pretty clearly established, and that is that the transverse strength of good concrete is quite equal to, if not greater than, natural stone. To take a few of the tests made with concrete beams supported at the ends: Kirkaldy gives for a beam of 1 of Portland cement and 1 of coke breeze, 7 days old, 3 inches broad, 5 inches deep and 72 inches clear span, loaded at center, an average breaking weight of 3·85 hundredweight, allowing one-half weight of beam between supports 0·22 hundredweight, or a total central load of 4·07 hundredweight; with an aggregate of 2 crushed bricks, 2 or 3 months old, a beam 12 inches by 8 inches deep and 60 inches span, gave in center an average breaking weight of 13·25 hundredweight, and a total center load of 15·08 hundredweight. Another result of a beam of 1 of cement to 0·6 of gravel, 90 days old, 12 inches by 12 inches, 36 inches span, gave an average breaking weight of 46·67 hundredweight on central 6 inches. These are taken at random from a table in Mr. E. L. Sutcliffe's useful book on "Concrete" we lately noticed; but they differ so much in composition, age and scantling that no reliable result can be obtained. It is evident that the addition of sand very considerably reduces the transverse strength, the beam made of neat Portland cement being three times stronger than one of 1 of cement to 2 of coarse sand, the average breaking weights being given as 57·80 hundredweight for the neat specimen and 18·30 for the one with sand.

But we place little confidence in tables of tests, though we gather from them the general fact that good concrete is quite equal, if not superior, to many natural stones for beams, lintels, flooring slabs and other purposes in which transverse strength is necessary. When the ends of concrete beams or slabs are fixed or "pinned" into the wall or built upon, considerably more strength is gained than when they simply rest on the walls. Mr. C. Colson's tests of two beams of concrete 9 feet long, 21 inches wide and 9 inches deep, are instructive in this connection. He placed one of these beams simply resting on supports. At the end of 14 days the scaffolding below was carefully removed, when the beam at once broke with its own weight; the other beam was prevented from spreading by counterforts at the ends, and showed no sign of weakness. After remaining unsupported for 16 days longer, a weight of a quarter of a ton in the center produced a faint crack; with 0·635 ton the crack increased to half the depth. The load was increased to 1·292 tons, when the beam gave way. The experiment at least shows the advantage of preventing spreading or lateral movement. In point of fact, the beam with its ends backed up becomes practically a flat arch, as the crack only appeared on the upper half of the beam, the lower segment of the mass adding nothing to its strength. The same experimenter found by other similar tests that confining the ends of the beam increased its strength nearly three times, and he also proved that flat segmental arches of concrete had great strength. Whatever the value of these experiments may be, they at least establish the assumption that a beam of concrete with its ends securely supported or confined becomes a flat arch, the resistance of the material being mainly compressive and confined to the upper half of the section, within a curve or segmental line from this point of the center to the beds of the beam. In other words, we may imagine a segment struck within the thickness of the lower half or depth of the beam, all below which curve may be cut away. We have a notable example of this fact in the concrete arched floors which spring from the bottom flanges of girders, of which we have instances in Dennett and Ingle's fireproof floors and in those of Homan and Rodgers. When all the four edges of a concrete slab are fixed into walls, as in the case of stair landings and floors, the increase of strength is more than double that in which only two ends are fixed.

It is clear from these experiments that if we can incorporate into the body or mass of the beam or slab iron ties in the lower half of the concrete, we shall greatly add to the strength. Some years ago we remember seeing some beams and floors at Stoke Newington which the late Mr. Allen had introduced, in dwellings let out in flats, in which floors iron tie rods were embedded. Mr. Hyatt, whose treatise we noticed some years ago, inserts iron ties or tension plates in the lower section of his concrete beams, which materially adds to their strength, and the idea of inserting iron rods in the lower half of beams and slabs to assist in the tensile resistance has been greatly developed in several ways. Blocks, soffits, beams, cupolas, and entablatures of concrete, with iron bars introduced, were largely used in the S. K. Art and Science Schools, the details of which are illustrated. One of the first objects was to prevent the rods slipping or drawing through the concrete; but experiments have proved that the iron bars under a considerable strain on the beam preserve their hold when they are left with their natural surface. The use of twisted rods gives a better grip. It has been found that the most advantageous position for the iron tension rod is near the bottom of the beam, and that the ratio of iron rods to the concrete (coke breeze) should not be less than 1 in 20. The tension rods or plates should be so proportioned and at such a distance from the neutral axis of the beam that the compressive resistance of the concrete of the upper half of beam shall not be greater than the tensile resistance of the iron rods. The ratios between these two resistances of concrete vary according to the cement and aggregate used, so that we can only ascertain the sectional area of iron rods required when we know the actual ratio subsisting in a given beam. It is safer to make the iron rods equal to the crushing strength of the concrete, neglecting the tensile resistance of the latter.

The architectural use of concrete for beams, lintels, floors, and as a substitute for stone, has already been tried. In blocks of dwellings, in flats, in which a large number of window heads, door heads, floors, and landings of one type is necessary, the value of concrete is undeniable, and a considerable saving in cost must accrue. More has yet to be accomplished in extending the material constructively. In pier building we may yet hope to see progress made, so that we should not altogether have to rely upon iron stanchions and pillars.

For beams, floors, bressummers, arches, and domes, the combination of concrete and iron promises to yield results even greater than we have seen, when once the practical difficulties of manufacture have been overcome. Whether deposited *in situ* or laid in large flags, concrete has become an important material for town paving, and many manufacturers of artificial stone—like the Victoria stone, the patent artificial sandstone, the granite concrete flooring of W. B. Wilkinson & Co.—have solved the obstacles that were once apparent. For wall building and for architectural purposes the material has not yet appeared to have made much progress, owing to the advantages offered by brick and terra cotta; but for sea, river, dock and quay walls, the value of concrete blocks has long since taken the place of natural stone. For town dwellings the external facing concrete, or slab, offers several advantages, if only architects could adapt this superficial mode of treatment to their wants.—*The Building News.*

Prickly Heat.

Photographers in some parts of the country no doubt suffer from this distressing affection, and will thank "Brown Slick," of the *Journal of the Photographic Society of India*, for the following, according to him, "magical" remedy. He says: "Simply rub the skin with the hand wet with the ordinary fixing solution, and allow it to dry. In a couple of days there will be no trace left of the irritation."

RECENTLY PATENTED INVENTIONS.

Engineering.

HEATING FEED WATER.—Gregory M. Mullen, Baltimore, Md. This is an improvement in devices by which the feed water is heated by steam and water from the boiler, the water supplied from the pump or other feeder being discharged into the heater, where it circulates and is heated by steam and water fed to the steam and water spaces of the heater, passing to the boiler at a comparatively high temperature. A pipe conducts the condensations in the steam space of the heater back into the boiler in such manner as to partially heat the feed water before it reaches the heater proper.

Railway Appliances.

CAR VENTILATOR.—Alexander A. Miller, Goldsborough, N. C. This improvement not only supplies fresh air to the cars, but also carries off the smoke and cinders from the stack and discharges them at the rear of the train. Near the smoke stack is arranged a fan chamber, from which a pipe leads to cooling chambers in each car, from which valved discharge pipes lead to hooded discharge ends near the car seats. A damper in the smoke stack is arranged to overcome the exhaust blast and cause all the escaping products of combustion to pass into a pipe extending rearward over the cars to the rear end of the train.

FREIGHT CAR DOOR.—John J. Mulligan, Vicksburg, Miss. This is a metallic door which, when closed, will closely hug an extension of the door opening, and when opened slightly will hang perpendicularly free from the extension of the door casing, having wheeled and guided action upon the outer surface of the car in such manner as to enable the freight handler to readily expose the entire door opening. Devices are also provided whereby the door, when closed, will be automatically carried to a binding engagement with the extension of the door frame.

CAR DOOR PACKING.—Ferdinand E. Canda, New York City. A novel arrangement of packing tubes and bearing edges, in conjunction with the door frame and door of a car, are made, according to this improvement, to form a durable packing for hermetically sealing the doors of refrigerator cars. When the door is closed the meeting corners of the door and frame present only a narrow edge or ridge to the exposed surface of the packing tubes, and only a slight effort is required to force the door onto its seat, compressing the tubes. The several tubes for one joint are made in the shape of a frame having at one of its sides an inlet opening suitable for connection with an air pump.

Electrical.

COMMUTATOR.—Harry Lee Fee, New Orleans, La. An improved means is provided by this inventor for preventing the short circuiting of coils of armatures where the terminals of the coils are connected with flexible arms extending radially from the commutator wires. The improvement consists in slipping over the free ends of the commutator wires insulating thimbles, preventing contact between the outer ends of the bars, the form of the thimble varying to adapt it to machines of different sizes and kinds.

ANNUNCIATOR SYSTEM.—Alonzo L. Vogt, Delaware, Ohio. This system is based upon the plan of arranging a code of signals for the parties between whom communication is to be held, there being electrical connection, so that the signals may be made by a push button, and is more especially designed for expediting communication between physicians and their patrons, and to insure accuracy in the reception and transmission of written messages and electric calls and signals, as well as to facilitate the filling and prompt delivery of prescriptions for patients.

SUBMARINE MINE FIRING APPARATUS.—Giulio Bertolini, Venice, Italy. This apparatus is designed principally to prevent vessels entering harbors and similar warlike purposes, by the electrical explosion of submarine mines or torpedoes at the required time. It is also adapted for use for the firing of guns on board ship or in a shore battery. The main part of the apparatus consists of an instrument for closing an electrical circuit through any one of several torpedoes or guns with which it is connected by suitable conductors.

COIN-OPERATED TELEPHONE SWITCH.—Charles F. Brown, Yarmouth, Canada. The coin chute, according to this improvement, forms part of the local circuit, as does also a spring stop arm held normally in the path of coin dropped in the chute, and there is a mechanical connection between the stop arm and the gravity switch. On calling the central station and removing the receiver from the gravity switch, a coin dropped in the slot rests against the spring arm, permitting conversation over the line, but when the receiver is replaced on the gravity switch it moves the spring arm and drops the coin into a receiver, leaving the circuit open.

PRECIPITATING METAL SULPHIDES.—Henry Hirsching, Salt Lake City, Utah. This invention relates to precipitating metal sulphide out of a hyposulphite solution, such as hyposulphite of sodium, hyposulphite of calcium, etc., containing precious and other metals, from being in contact with compounds of ores, chloridized, calcined, or raw, by subjecting the insulated hypo solution to the action of an electric current from an external and independent source. The precipitate settles rapidly and the clear hypo solution is used over again in the leaching vats for further dissolution of precious and other metals.

Mechanical.

SCREW CUTTING MACHINE.—Casper W. Mettler, Boonton, N. J. This machine is designed to completely form slotted head screws from a rod or piece of wire in a very rapid and economical manner. The whole operation is automatic, the rod being fed forward and turned down to form a shank, which is then threaded, the head is measured off and the screw grasped by a special device, cut from the rod, and delivered to the slotting device, which cuts the slot in the head and delivers the finished screw to one side of the machine.

WRENCH.—Lewis P. Davidson, Owen, Wyoming. This is a tool of very strong, simple, and inexpensive construction, which may be quickly and conveniently adjusted, and which has shoulders on the lock-nut by which the distance that the nut must turn cannot be miscalculated.

CONSTRUCTION OF LATHES.—Carl A. Windmuller, Chemnitz, Germany. According to this improvement the slide rest has a guided movement on the bed of the lathe and is provided with a slotted lateral extension to which is hinged a socket, a screw secured to the socket passing through a slot in the extension, and there being a nut for locking the socket in relation to the slide rest. The invention also embraces other novel features connected with machinery or tools for turning shafts, flanges, spheres, cones, wheels, hollow channels, screw cutting, etc., as well as for cutting tooth wheels, planing and shaping.

PORTABLE BORING AND MORTISING MACHINE.—Edward K. Thoden, Brooklyn, N. Y. This is a wood-working machine to be operated by hand power, and adapted for connection to any suitable firm support, the machine being readily separated into parts which may be conveniently packed and carried by a workman. It has a frame plate with attachable and adjustable support for material and a slidable carrier plate, with means of moving and locking it, in combination with an upright reciprocating and inclinable slide bar, with a rocking support therefor, and on which is a rotatable wood-boring device. Connected also with the slide bar is an adjustable arm with rack teeth, operated by a gear wheel and handle lever, there being an adjustable chisel stock on the slide bar.

AIR CUSHION FOR SAW MILL HEAD BLOCKS.—William E. Dean, Ruddock, La. A spring-pressed lever is, according to this invention, pivoted on the head block and a link pivotally connected with the lever, while a dash pot in which works a piston is pivotally connected with the link, a valve controlling the air inlet to the dash pot. The device is simple and not liable to get out of order, but is very effective for relieving the head block carriage and other parts of the mill from the blows or concussions incidental to the canting of the logs toward the knees.

Agricultural.

PLOW.—Frederick S. Moore, Hanford, Cal. This is an improvement upon a formerly patented invention of the same inventor, providing means whereby a shifting device may be quickly and easily applied to a single plow, to shift the beam laterally either to the right or left at the handle end of the plow. With this improvement the line of draught may be instantly changed, and the plowshare made to travel closer to or farther from whatever plants may be under cultivation. The device is very simple and inexpensive.

CIRCLE HARROW.—Hermann Jaenisch, Tschirnau, near Guhrau, Prussia, Germany. Upon the stationary rear crank axle of this machine is mounted a mechanism by which the harrow may be raised and lowered and also inclined relatively to the ground, or the harrow may be held in raised position when being taken from place to place. The driving mechanism is also arranged to alternately raise and lower the harrow while it rotates, any desired inclination being given to the harrow to bring only one part into action when desired, the machine being operated with great facility.

Miscellaneous.

MINCING MACHINE.—Arnold Scheithauer, Berlin, Germany. In this machine the material to be disintegrated is fed along in a casing by a worm or spiral and pressed through a perforated disk. A cross-shaped knife is always pressed evenly against the disk, whether the latter be oblique to the feed screw or not, the boss of the knife being conical or ball shaped, and fitting a recess in the worm around the round pin of the latter, on which the knife and the disks are arranged to give a certain amount of play. The casing is formed in halves, so that the perforated disks may be readily removed to facilitate cleaning.

GATE.—William E. Wieland, Los Pinos, Col. This is a self-closing gate, which is also automatically opened by approaching it, a depressible platform forming the approach. It also has a lock which prevents its being opened except when a certain part of the mechanism is touched. The gate is made without springs, and has provision for excluding snow or rain from the operating mechanism. The gate and its mechanism are sustained by a suitable frame resting upon foundation beams, but without posts entering the ground.

INVALID BED.—Joachim Eggert, Berg, Island of Femern, Prussia, Germany. The head and foot boards and side rails of this bedstead may be of the ordinary form, but in the bed bottom or support is a central opening in which is arranged a sliding bottom section, facilitating the giving of needed attention to an invalid, and the patient having substantial support without changing the natural position.

BILLIARD TABLE, BOOKCASE AND DESK.—Sterne A. Faribault, Elsdon, Ill. This is a combination article of furniture, of such design that it can be afforded at a very moderate cost. When the bookcase is erect, the case and desk may be used in the ordinary way, but by tipping the case downward and leveling it in a manner provided its back may be used as an ordinary billiard table, being made perfectly smooth and covered in the usual way.

FOLDING STAND.—Thomas A. Clarke, Chicago, Ill. A stand which may be readily set up or knocked down and folded to be packed in small space has been designed by this inventor. It is more especially designed for use in hotels or stores for exhibition purposes.

FOLDING FOOT BENCH.—Albert Epstein, Breslau, Germany. This is a simple article of furniture comprising a board composed of hinged sections and detachable tapered legs which may be slid one into the other, the board having on its under side means for securing the upper ends of the legs, and leg-receiving recesses which entirely inclose the legs in folded position, so that in the folded state the exterior surfaces of the bench will be substantially smooth.

PAPER FILE.—Moritz Kragen, Berlin, Germany. In the filing case or portfolio provided by this inventor there is in the back or cover a pad having a penetrable facing and an impenetrable under layer, to hold documents, etc., in combination with pins, the latter being held between the facing and under layer, and so that they cannot penetrate the back or cover.

ATTACHMENT FOR MUSICAL INSTRUMENTS.—Michael J. Betz, Philadelphia, Pa. This device comprises a sliding button engaged by the free end of a flat spring secured on the under side of the bridge, and on which is pivoted a finger piece, the latter carrying a flexible finger adapted to pick a single string or a number of strings forming the desired chord. The improvement is applicable to zithers and similar instruments, permitting the performer to sound the chords for accompaniments, etc., without striking the individual strings with the several fingers of the hand.

GOODS EXHIBITOR.—Daniel B. English and Stephen H. Hinnant, Way Cross, Ga. A suitable case is arranged with drawers one above the other, there being rollers journaled in the drawers and outlets at their front, where display racks are provided, each projecting slightly farther from the front of the drawer than the next upper rack, the racks being composed of inner and outer rods or bars. The case is especially designed for keeping and exhibiting dry and fancy goods, as laces, edgings, embroideries, ribbons, etc.

COLLAR AND COLLAR STIFFENER.—Stephen D. McElroy, New York City. A shell made of linen or other fabric is made the desired shape of the collar, according to this invention, and the lower edge of the shell is left open, forming a compartment to receive a stiffening plate of sheet metal, cardboard, celluloid, or other material to retain the shell in proper shape. When the collar is to be washed the stiffening plate is removed, the shell only being washed.

REFLECTING PROPERTIES IN JEWELRY, ETC.—Joseph Esser, Barmen, Germany. To produce light-reflecting properties, according to this invention, a pattern is produced on a reflecting foundation plate, different parts of which differently reflect the light, while a transparent cover plate is likewise provided with a pattern and placed on the reflecting surface. The base plates may be made of aluminum, silver, etc., and the cover plates of celluloid, horn, tortoise shell, amber or tracing cloth. The invention is particularly adapted for the production of buttons and articles of bijoutry.

ATTACHABLE FILTER.—Thomas C. Andrews, New York City. Whether a hydrant nozzle or water tap is exteriorly threaded or is smooth, this filter is readily attachable thereto, and is designed to effectively cleanse and deodorize water passing through it. It has a removable cover, a central screen cup, and concentric porous cup filled with silex, there being a perforated disk above the porous cup, while the case is packed with granulated charcoal. Connection is made with the water faucet by a yielding ferrule insertible in the neck of the filter cover.

OPENING LEVER FOR BAIL STOPPERS.—William Noe, Marconnier, N. J. This lever has a forked outer end to receive the bottle neck, and loop-receiving recesses in the arms. It is a very simple device for application to the bail of a stopper to force the latter from a bottle without applying the fingers or hand to the bail.

VENT PEG FOR BEER CASKS, ETC.—John P. Harding, London, England. A rotary plug valve is combined with this peg, the valve being normally turned to closed position by a spring, and being tapered and held to a tapered seat by another spring which permits the plug to be raised by excessive internal pressure, the self-closing and self-opening motions being quite distinct, the latter taking place only to relieve too high gaseous pressure generated in the cask by continued fermentation.

BUILDING BLOCK.—Octavius B. Schmall, Cincinnati, Ohio. These blocks are interlocking and have each a longitudinal series of ducts and parallel key slots across their ends between the ducts, keys being fitted in such ways to interlock the adjoining ends of the blocks and form partitions between the ducts. These blocks are adapted to form walls of buildings, underground conduits, pavements, etc., when used in buildings, improving their sanitation and increasing the lateral strength of the walls, as well as affording ready means of forming electrical or other conduits.

MAGIC TOY.—Ross Armstrong, Onawa, Iowa. To magically illustrate the coining of money from blanks, as a source of amusement, is the object of this toy, which consists of a die in the form of a drop bottom adapted to receive the blank, there being a coin receptacle over the die to trip it, remove the blank and deposit a coin in its place.

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

NEW BOOKS AND PUBLICATIONS.

STANDARD TABLES FOR ELECTRIC WIREMEN, WITH INSTRUCTIONS FOR WIREMEN AND LINEMEN, UNDERWRITERS' RULES, AND USEFUL FORMULÆ AND DATA. By Charles M. Davis. Fourth edition, thoroughly revised and edited by W. D. Weaver. New York: The W. J. Johnston Company, Ltd. 1893. Pp. 128. Price $1.

This book is altogether a practical one. The fourth edition having been reached, in spite of the lamented death of the author, indicates its value. To make it still better in the future, suggestions from those using it are cordially invited by the publishers. A short index and a number of very clear diagrams of different elements of electric lighting are given.

THE CORLISS ENGINE (by John T. Henthorn) AND ITS MANAGEMENT (by Charles D. Thurber). Edited by Egbert P. Watson. Third edition, enlarged. With an appendix. By Emil Herter. New York: Spon & Chamberlain. London: E. & F. N. Spon. 1894. Pp. 95. Price $1. No index.

The fact that this little work has reached its third edition and is enlarged speaks well for its acceptability to engineers. It is a short, concise work, quite practical, and while its title would indicate its limitation of subject, much that is in it will be found applicable to general engineering practice. Its value would be greatly enhanced by an index.

BOOKKEEPING AT A GLANCE. By J. T. Brierley, A.C.A. New York: Excelsior Publishing House. Pp. 141. Price 75 cents.

We quote from the title page an abstract of what this work contains: "Instructions for the correct keeping of books of accounts, and numerous explanations and forms used in a commercial business, showing an entire set of books based upon actual transactions, how to take off a trial balance sheet, and finally close and balance accounts." This shows that the author claims to have produced what must be a very serviceable little work, and we are convinced that it will be found such. A peculiar thumb index is supplied to enable instant reference to the desired parts, whose titles are stamped on the cover. This is a most excellent and useful feature.

PIGMENTS, PAINT, AND PAINTING. By George Terry. London: E. & F. N. Spon. New York: Spon & Chamberlain. 1893. Pp. xi, 392. Price $3.

The composition of the different paints in use by painters, embracing the consideration of a large variety of the same, their examination for quality, the subjects of vehicles and driers for paint, of machinery and painting proper, are the topics treated by our author. the result being the production of a very satisfactory and useful book, telling one what the different trade colors are made of, how they are made and what uses and qualities are the result. Such a work written up to day and date and in a scientific manner has, to a certain extent, been needed, and we believe that Mr. Terry has done technology a service in his compilation.

☞Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & Co., 361 Broadway, New York.

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.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
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.

(5752) C. E. H. asks: I am annoyed constantly with the odor of gas from the ordinary rubber tubing, such as dentists use in laboratory work. Can you suggest a coating for the tubing which will prevent the leakage? A. Possibly inside and outside treatment with shellac varnish would help it.

(5753) L. R. A. asks: 1. I wish to obtain an ink that will be visible for four or five days and then fade entirely away and cannot be restored in any way to vision. What liquid is a solvent for iodo starch? A. Water. 2. If I take an apparatus used for electrolysis which is constructed of a U tube, the ends of which are sealed, and if this current is kept up, the volume of the gases must of course be contracted, for their volume is much greater than that of the H_2O. Will this pressure interfere with the action of the electricity in any way? A. The gases will continue to accumulate until the apparatus bursts? The pressure will not interfere with the electrolysis.

(5754) S. says: Please inform me what is the meaning of three balls over a pawnbroker's shop. A. Money to let. It is derived from the Lombard merchants who used the three balls as a sign. It was also used by the Medici family in Florence.

(5755) B. W. S. asks: 1. Would there be any material difference in winding the induction coil like a spool of thread, insulating each layer with a brushing of paraffine and covering of bond paper, than there would be in the method described in "Experimental Science"? A. Yes. Disk winding is preferable. 2. As an insulator for static currents is shellac better than paraffine or resin? A. It is better than resin and inferior to paraffine. But their relations are affected by impurities, so that for some samples other relations may obtain. 3. What is the maximum primary current that is safe to use with that coil, considering the heating by Foucault currents and the liability of the paraffine to melt? A. You need not fear Foucault currents with the wire core. 4. Would it be a serious shock to allow the current to pass through one's body, similar to the experiments with a frictional machine? A. The coil gives quite a severe shock.

(5756) R. P. E. asks: What power would a spring of water, flowing 40 gallons per minute, with a a fall of 500 feet at two miles from the spring, give? A. By using a 4 inch pipe you can realize four horse power with an impact wheel of the Pelton type.

(5757) O. H. asks: 1. What is the cost of obtaining a knowledge of electrical engineering? Also civil? A. No estimate of cost can be given. Address Armour Institute, Chicago, or Mass. Institute of Technology, Boston, Mass., Cornell University, Ithaca, N. Y., giving courses in both civil and electrical engineering, for their catalogues. The same education will cost one man thousands of dollars and another man almost nothing beyond his time. 2. How long does it take to complete a course of the study in them? A. The college course alone is three or four years. The preparatory course takes one to three years, and after graduation the study should fill a lifetime. 3. What are the prospects for a first class engineer of either branch? For a first class man the prospects are good; but the professions are overcrowded. Few men are really first class.

(5758) H. E. H. asks how to make a storage battery capable of running four 16 candle power 70 volt lamps one hour; also how many gravity batteries will it take to charge the same? A. The manufacture of a large storage battery is attended with so many difficulties that we do not advise it. One is described in the SCIENTIFIC AMERICAN; also see our SUPPLEMENT, Nos. 838, 845, 931. For each storage cell over two gravity cells in series must be provided, and almost any quantity in parallel. As you need 36 storage cells, several hundred gravity cells would be needed.

(5759) C. L. S. asks: 1. How to make a camera obscura. I want one to copy landscapes with from nature. A. See our SUPPLEMENT, No. 158. 2. Also one to enlarge photographs, both by sunlight and lamplight. A. See our SUPPLEMENT, Nos. 276 and 451. 3. What can I apply to windows that makes beautiful large crystals on it? A. Sodium sulphate in hot solution.

(5760) A. S. asks: Supposing a distillery warehouse, in which whisky or spirits are stored, is heated to a temperature of 100° and kept closed for a period of a few weeks, would there be any danger of an explosion from the consequent evaporation of spirits, should some one strike a match or enter with an uncovered light? What percentage of alcoholic vapor in the atmosphere of a warehouse would be likely to cause an explosion? A. There would be such danger. One part alcoholic vapor to thirty to sixty of air would be explosive.

(5761) L. D. M., P. W. T., and many others, say: Please give me a receipt for making a good ink for rubber stamps. Also one for making a good indelible ink for name stamps. A. The usual rubber stamp inks are prepared with water-soluble aniline colors and glycerine.

1. Blue rubber stamp ink:

Aniline blue, water sol., 1 B	3	parts.
Distilled water	10	"
Pyroligneous acid	10	"
Alcohol	10	"
Glycerine	70	"

Mix them intimately by trituration in a mortar. [The blue should be well rubbed down with the water, and the glycerine gradually added. When solution is effected, the other ingredients are added.]

Other colors are produced by substituting for the blue any one of the following:

2. Methyl violet, 3 B	3	parts.
3. Diamond fuchsin I	2	"
4. Methyl green, yellowish	4	"
5. Vesuvin B (brown)	5	"
6. Nigrosin W (blue black)	4	"

7. If a bright red ink is required, 3 parts of eosin BBN are used, but the pyroligneous acid must be omitted, as this would destroy the eosin. Other aniline colors, when used for stamping ink, require to be acidulated. 8. The ordinary stamping ink, made by diluting printing ink (which is made of lampblack and linseed varnish) with boiled linseed oil, stands pretty well, if enough is used, but when poorly stamped, will wash off. Dr. W. Reissig, of Munich, has recently made an ink for stamps which is totally indelible, and the least trace of it can be detected chemically. It consists of 16 parts of boiled linseed oil varnish, 6 parts of the finest lampblack, and 2 to 5 parts of iron perchloride. Diluted with ½ the quantity of boiled oil varnish, it can be used for a stamp. Of course it can only be used with rubber stamps, for metallic type would be destroyed by the chlorine in the ink. To avoid this, the perchloride of iron may be dissolved in absolute alcohol, and enough pulverized metallic iron added to reduce it to the protochloride, which is rapidly dried and added to the ink. Instead of the chloride, other salts of protoxide or peroxide of iron can be used. From the "Scientific American Cyclopedia of Receipts, Notes, and Queries."

(5762) H. C. S., Iowa, asks what to put in boilers to prevent the formation of a carbonate of lime scale. The water here contains considerable lime and forms a very hard white scale, which I would like to know some way to prevent. A. You cannot prevent the deposit of scale, except by the use of pure water. It can be softened and removed by the application of a half pound of caustic soda to the feed water once a week, two weeks or a month, according to the amount of scale forming. Boil the caustic in the boiler for the working day, then blow down and clean out the boiler. After once thorough cleaning a little caustic every few days and blowing down two cocks a few times the next day will keep the boilers in good order for two or three months when they should have a thorough cleaning.

(5763) C. H. S. asks: 1. How many watts does it take for a 1 candle power? A. 2½ to 3½ watts in an incandescent lamp. 2. Can you give me the drawings or sketch, so that I can make an outfit to put on cart wheel, so that it will register the number of miles traveled. A. Odometers can be bought of dealers in surveying instruments. Consult our advertising columns. 3. Have you "Dynamo Electricity," by Carl Hering? A. We can supply it by mail for $2.50.

(5764) D. S. C. says: Making an allowance of ⅛ for friction how heavy should a weight be to fall 20 feet and furnish ⅛ horse power for one hour of time? 2. It will require a weight of 139,320 pounds. 2. Respectively, what is the horse power of a 10 foot, also a 12 foot wind wheel in an 18 mile wind?—of course the wheels are to be first class, and are supposed to be held squarely in the wind. A. The 10 foot mill should equal one-fifth of a horse power, 12 foot mill, one-quarter of a horse power, in an 18 mile per hour wind.

(5765) W. McV. writes: 1. What is the resistance of a 6×8 Crowfoot gravity battery? A. About 4 ohms. 2. What is the E. M. F. of a battery with plates of carbon and iron? What is the E. M. F. of a battery with plates of copper and iron? A. It depends on the solution. From ⅛ to 1 volt perhaps. 3. What is the E. M. F. of a thermo couple composed of iron and copper, also iron and zinc, and copper and zinc for a difference of 100° Fah. in temperature between the ends of the couples? A. The relative differences of potential are iron-copper 6·2, iron-zinc 5, zinc-copper 1·2. We cannot give the exact voltages, and the above can only be considered an approximation. 4. Please mention some good work on thermo-electricity and its cost. A. We can supply Rust's "Thermo-Electricity," 78 cents by mail. 5. Are the natives of the Sandwich Islands negroes, or Indians, or neither? A. Neither. They are of the great Malay race.

(5766) J. N. F. writes: I would like to know the exact number of inches and fraction that a body will fall in still air the first second of time. The philosophy states that a body will fall without resistance 16 feet 1 inch the first second. The encyclopedia states that it will fall 16·1 feet the first second. Which is correct? What does "without resistance" mean, in still air or in a vacuum? A. The distance varies with difference of location. On the equator a body falls a less distance than at the poles. Without resistance means in a vacuum.

(5767) F. M. C. asks: In a ball bearing of a bicycle, which will run the easiest by applying the least power? I mean one with eight five-sixteenths balls or one with eight one-quarter inch balls? What effect would increasing the number of balls have? A. There should be no difference of any amount between the sizes named. A rough surface for the balls to roll upon would make the larger balls superior to the small ones. Increasing the number of balls would have little or no effect.

(5768) G. B. asks: 1. How would electricity compare to gas at $2 per M for cooking purposes in regard to cost? A. 50 watt hours would heat a maximum of 175 pounds of water one degree Fah. This is the most you could do with electricity. In practice it would be much less. Gas would be far cheaper. 2. Is it practicable for cooking in a private house, and would it be an expensive means? A. Yes; it is practicable, but expensive.

(5769) A. M. G.—The following is a receipt for stereotyper's paste. To 1½ gallons water add 2½ pounds of Peter Cooper's glue. Allow to stand overnight, after which place it on the fire and cook slowly for two hours. Take ½ pound of best English Paris white and one pint of flour, packed tight in the measure. Place them together in a basin and add sufficient water to make the mixture the consistency of buttermilk; add this to the glue when cooked as above, and allow the whole to cook for one hour, when it will be ready for use.

(5770) T. P. A. asks: 1. In using the earth as part of an electric circuit, what is the resistance per mile? A. The resistance is zero. There is resistance at the grounding points, varying according to the nature of the soil and area of ground plates or equivalents. 2. Will a straight electro-magnet, wound with very fine wire, operate a bell (only one end of the magnet to be used to attract the armature) through a line one mile, with ground return, and using one sal ammoniac battery? If not, how many batteries would be required? A. A very feeble ring could be thus produced. Five or six cells would not be too many. The resistance of the circuit and quantity of current required to ring the bell determine the cells needed.

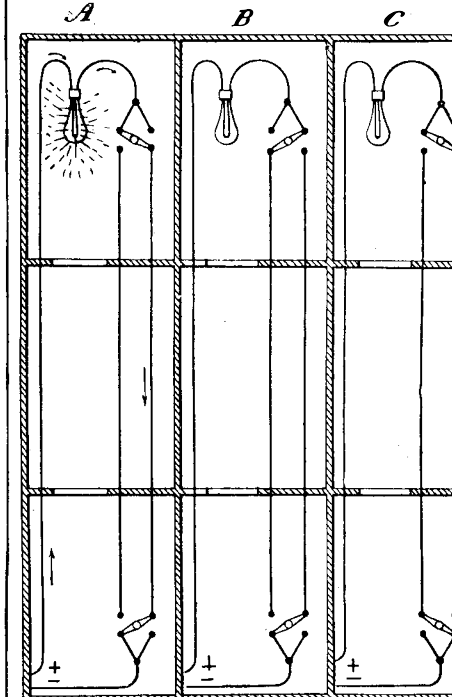
(5771) G. L. R. asks for the best fluid batteries for operating electro-motors under one-eighth horse power. A. The bichromate batteries, Bunsen or plunge type, See SUPPLEMENT, 792, are the best of the primary batteries. Secondary batteries are preferable and are far more economical. See SUPPLEMENT, Nos. 838 and 845.

(5772) A. M. H. asks: Cannot a "coil" be put into a kitchen stove for the purpose of heating another room, on the principle of the article on "Combined Water Heating and Hot Air Furnaces," described in SCIENTIFIC AMERICAN, page 19, January 13, 1894? Could not the pipes used to heat water for kitchen and other purposes be used to heat air for another room? A. The heating of a room above the kitchen can be done by a coil in the stove and a suitable radiator coil in the room, with an expansion tank above, on the same principle as in greenhouse heating. The water from a kitchen boiler can also be circulated in a coil above for heating purposes.

(5773) C. D. asks: 1. What are the elements and exciting acid in a chloride of silver dry cell? A. Metallic silver and zinc are the electrodes, silver chloride the depolarizer, and ammonium chloride solution the exciting fluid. 2. Can such cells be recharged, and how? A. They can be cleaned out and new silver chloride and solution introduced. 3. What is the voltage and amperage of a cell 2 inches long and ¾ inch wide? A. E. M. F. 1·03 volts. The amperage cannot be exactly stated—perhaps ½ ampere at first.

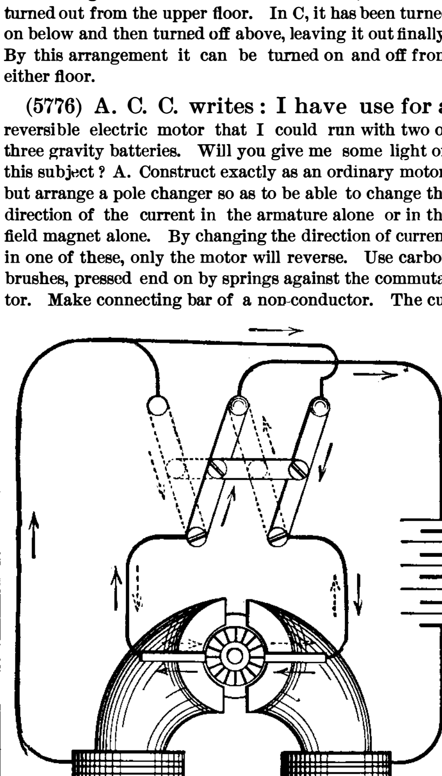
(5774) G. W. C. asks: 1. How many storage batteries will a 25 volt 8 ampere dynamo charge, and how long would it take? A. It depends on the size. It will charge eleven in series, each having 200 square inches area of positive plate. 2. What is the voltage and amperage of simple electric motor used with cast iron fields? A. 7·2 volts and 4 amperes for field. The armature can absorb 5 amperes at 7·2 volts. 3. Will the SCIENTIFIC AMERICAN give me a comprehensive description of the Niagara formation, also of the rocks of the Upper Silurian period? A. The Niagara formation is the first period of the Upper Silurian. It includes the Oneida conglomerate, shaly sandstones of the Medina group, hard sandstones, flags and shales of the Clinton group, and shales and limestones of the Niagara group. The Upper Silurian includes four periods—the Niagara as above, the Salina, Lower Helderberg, and Oriskany. The Salina rocks are sandstones and shales; the Syracuse, N. Y., salt wells derive their brine from rocks of this period. The Lower Helderberg rocks are mostly limestones. The Oriskany beds are rough sandstones. The Niagara and Lower Helderberg rocks abound in fossils, radiates, trilobites, brachiapods, and other mollusks. The above refers to the American rocks.

(5775) C. T. V. writes: Can you give me a diagram of a circuit using the multiple system, where, by placing a push switch in hall of first floor, a lamp on second floor can be lighted, and upon arriving at the top the lamp can be extinguished, and then by going down stairs again you can go through the same operation without having made any change? A. The diagrams show how this can be done. In A, the lamp



has been lighted from the lower floor. In B, it has been turned out from the upper floor. In C, it has been turned on below and then turned off above, leaving it out finally. By this arrangement it can be turned on and off from either floor.

(5776) A. C. C. writes: I have use for a reversible electric motor that I could run with two or three gravity batteries. Will you give me some light on this subject? A. Construct exactly as an ordinary motor, but arrange a pole changer so as to be able to change the direction of the current in the armature alone or in the field magnet alone. By changing the direction of current in one of these, only the motor will reverse. Use carbon brushes, pressed end on by springs against the commutator. Make connecting bar of a non-conductor. The cut



gives the connections necessary for a reversing motor. You must let it come to rest before reversing, as otherwise there is great danger of burning out the armature.

(5777) F. H. W. writes: 1. I have constructed the motor of which drawings are given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641. I wish to construct plunge battery to run same. Will you kindly inform me what size cells to use, how many, and also how to connect them? A. The dimensions of the proper battery are given in the article in SUPPLEMENT, No. 641. For description of a plunge battery, we refer you to our SUPPLEMENT, No. 792. 2. Will the same rules apply in regard to winding for 110 volts? What number of wire on field, and also what number and amount on armature? A. See answer to query 5692. You need not use No. 32 on the armature—No. 29 would be fine enough. Always use a rheostat in starting the motor.

(5778) D. & C. write: 1. We are building simple electro-motor described in SUPPLEMENT, No. 641, to run from a 110 volt incandescent circuit. Should any change be made in winding of fields or armature? A. See query No. 5692. You may use No. 29 wire on armature. 2. What power will said motor develop on above circuit? About how many revolutions will it make per minute with full load? A. This is uncertain—about one twelfth horse power. Revolutions, about 2,000 per minute. 3. By introducing into the above circuit a rheostat, could not current be used for electroplating? How many volts and how many amperes does it require to run about 50 gallons of plating solution? A. Yes; but at enormous loss in economy. The voltage and amperage for plating depend on size of work and on the metal being deposited. 4. What is the resistance of German silver wire, No. 26 A. W. G., per foot? Would above size carry 110 volts without heating? A. About 542 ohms per 1,000 feet. The voltage required to melt it depends on its length. 5. Do you know of any work on buffing and polishing? If so, where can it be obtained? A. We recommend and can supply Langbein's "Electro-Deposition of Metals," which contains information on buffing and polishing. Price $4.

(5779) W. K. asks: 1. Is it necessary to strip the nickel from old work in order to replate it, and if so how can it be done? A. Stripping is absolutely essential. A bath of two volumes of sulphuric acid to one of nitric acid in one volume of water may be used. Use cold, and remove the article the instant the nickel is gone. This may be in a second or two. Or an old nickel bath may be used, making the article the anode. Remove quickly as the nickel disappears. 2. In the nickel solution which I have, when I added ammonia, a yellow, powder-like substance settled on the bottom of the tank. Will you please let me know what caused that; or is, perhaps, the solution out of order? A. Possibly your bath contained some impurities, such as iron. The bath should be neutral, or a shade acid.

(5780) J. L. L. asks: Can you please tell me how many Fuller cells are required to run a motor, and also what candle power lamp can be run by 5 Fuller batteries? A. Allow two watts utilizable energy for each cell. Thus 5 cells should run a 3 or 4 candle power lamp. For battery required for special motors, address the dealers or agents for same.

(5781) C. K. asks: 1. Which of the following will produce the strongest current: A pile (No. 1) constructed by placing upon a disk of copper a disk of cloth, moistened with acid, and upon this a disk of zinc, and upon this a disk of cloth moistened with acid, repeating this order indefinitely; or a pile (No. 2) where copper and zinc plates are placed together in pairs and cloth, moistened with acid, is put between each pair of plates. I would like to know particularly whether, in this pile, the zinc may be amalgamated on that side which lies directly upon the copper without interference to the current? A. The second method is the proper one. You may amalgamate the zinc plates on both sides. The zinc and copper plates may be soldered or sweated together. 2. What kind of a fluid is best for the cloth disks? A. Dilute sulphuric acid, 1 acid to 10 of water, may be used. The cloth disks should be a little less in diameter than the metal plates, and must have just enough acid. If too much, it will squeeze out and run down the outside of the pile.

(5782) J. R. S. asks: 1. Have you plainly described in any SUPPLEMENT the manufacturing of a dynamo suitable to run three 16 candle power electric lights? A dynamo that I could make from the instructions given, and if so, at what cost could it be made? A water motor, developing three horse power under a pressure of 70 pounds, after the pattern of a revolving lawn sprinkler. I would like to build a dynamo to be run by this motor to light three 16 candle power electric lights. What would the same cost, and what difference in cost between one capable to run three and one to run six of these lights? A. In our SUPPLEMENT, No. 844, a five light dynamo is described. For three lights it should be 92-100 of the size. The cost you can easily calculate from the very full description given. 2. What is the probable amount of water used per hour by this motor? A. This class of motor will require 18,000 gallons per hour for three horse power, at the pressure named. 3. How does a 16 candle power electric light compare with an ordinary kerosene light, with single wick 1¼ inches wide? A. The oil lamp in good condition should give 25 per cent more light.

(5783) L. D. W. asks how far a transmitter will work having a permanent magnet 6 inches long by ¾ inch in diameter, encircled at one end by a bobbin of wire having 75 ohms resistance, and using a regular iron diaphragm. A. It depends on the resistance and other electric qualities of the circuit. It should operate on a metallic circuit ten miles or more in length.

(5784) J. C. S. asks: 1. How could I make an electric motor capable of running a sewing machine? A. For electric motors of simple construction see our SUPPLEMENT, Nos. 641, 759, 761, 767. 2. How many Leclanche or Grove cells would be necessary to furnish sufficient current? A. Leclanche cells are not suited for the work. Grove cells emit gas. Use a plunge battery, such as described in our SUPPLEMENT, No. 792.

(5785) W. H. McC. writes: 1. Would No. 28 thread be fine enough for winding the No. 36 wire on the induction coil in "Experimental Science"? A. No. 36 wire is $\frac{5}{1000}$ inch in diameter; so your thread would be very coarse for the purpose. 2. I am also building the SCIENTIFIC AMERICAN dynamo, and have fifty-two feet No. 18 double cotton-covered wire (to use on field) instead of the single-covered. Will it not do as well? Will I have to put on more than the twelve layers to make up for the extra insulation? If so, how many more layers? A. Use the same weight of wire as given, or a little more. It is all a question of close winding. 3. Cannot the armature be wound the same as the eight-light machine and give good results? A. We advise you not to depart from the instructions.

(5786) J. J. R. asks: 1. How do opticians produce the beautiful different colors on their brass works of microscopes and other instruments, especially the shining gold color? A. For lacquering and coloring metals, we refer you to the "Scientific American Cyclopedia of Receipts, Notes and Queries," which contains many receipts for the same and directions for applying. Price $5. 2. Is the brass heated when lacquered, and if so, to what heat? A. Yes. The heat is about that of boiling water, and the piece must be absolutely clean. A finger touch before lacquering will injure it. 3. Is it possible to make cables containing 80 to 100 insulated copper wires? How heavy would the cable have to be to secure satisfactory insulation for every wire? A. Yes. Telephone cables about 1⅛ inches outside diameter are examples. The size of the cable depends on the size of the wires and on the thickness of their insulation.

(5787) V. H. T. asks: 1. How far away could you get effects from an alternating current actuated by about 1,000 volts potential? A. Several miles, if the conditions are good. In this way it is possible to telegraph without wires. Preece, in England, has done some interesting work in this line. See SUPPLEMENT, 926; for other valuable papers on the subject see Nos. 790, 861, and 925, also SCIENTIFIC AMERICAN, No. 3, vol. 66. Voltage has no direct connection with it. The amperage is the operative factor, and this depends on voltage and resistance. 2. What proportion of such current would you get by induction in a circuit 50 feet away? A. A very small portion. You might approximate it by dividing the length of a circle of 50 feet radius by the diameter of the receiving device.

(5788) J. F. D. asks: How much will a steel tape of 500 feet leugth expand or contract from the change of 1° temperature (Fahrenheit scale at 60°), and how much from the change of 1° temperature (Fahrenheit at 170°)? A. For 1° Fah. at either temperature allow an expansion of $\frac{1}{140000}$ of its length. This will not be accurate, as different samples vary widely. For 500 feet this gives $\frac{6}{140}$ inch.

(5789) T. H. P. asks: 1. Would a gravity battery be the best style for a current to be used to energize an electro-magnet for periods of one second, each at intervals of one second, this interrupted action to be continuous? A. The battery would be excellent as regards its constancy; not so much so as regards strength of current. 2. Can you refer me to some work, article or articles on clocks actuated by electricity (not merely regulated)? A. For information on electric clocks we refer you to "Domestic Electricity for Amateurs," price $2.50 mailed. 3. What is the origin and date of origin of the so-called Hero's fountain? Has any striking example of it been exhibited in modern times? A. It is attributed to Hero of Alexandria, a philosopher who lived in the third century B.C. No very striking example can be cited. See SUPPLEMENT, No. 404.

(5790) W. V. G. asks (1) the address of a storage battery manufactory. Can storage battery be recharged from an Edison-Lalande battery, four cells, both batteries being 300 ampere hours, the storage being 2·5 volts? If so, how long will it take? A. Allowing 0·667 volt for a single cell of Edison-Lalande battery, it would require $\frac{2.5}{0.667} \times 1\frac{1}{8}$ or about 5 such cells. You do not correctly specify the Lalande cell. The five would give a charging of about 4 amperes requiring about 80 hours to charge one storage cell. 2. What is the best battery to run a phonograph? A. The Edison-Lalande battery type S or the special storage battery supplied for it. 3. What book could you recommend on the subject of storage batteries and small motors? A. "Electric Light Installations and the Management of Accumulators," by Solomon, price $2; Bottone's "Electro Motors," 75 cents. 4. How many common Crowfoot 6×8 batteries would it require to recharge a 300 ampere storage 2·5 volts? A. A prohibitive number. At least three in series and almost any number in parallel; three hundred would not be too many altogether.

(5791) S. H. says: Will you kindly give me a formula for sticky fly paper? A. Cobalt fly paper. —Vomacka gives the following:

Quassia chips	150	parts.
Chloride of cobalt	10	"
Tartar emetic	2	"
Tincture of long pepper (1 to 4 of proof spirit)	80	"
Water	400	"

2. Powdered black pepper is mixed with sirup to a thick paste, which is spread by means of a broad brush upon coarse blotting paper. Common brown sirup will answer, but sirup made from sugar is preferable, as it dries quicker. For use a piece of this paper is laid upon a plate and dampened with water. The paper may also be made directly at the mill by adding sugar to the pulp and afterward ¼ to ⅛ of powdered black pepper and rapidly working it into a porous absorbent paper.

(5792) C. E. B. says: I have a 4½ bore and 9 inch stroke engine. My neighbor has two 3½ bore×4 stroke, working on quarter centers. He wants to trade with me. Will I get more power out of his two than my one? Please give me the exact horse power of both rigs with 60 pounds pressure steam, and the rule for calculating the horse power of any engine? A. Assuming that both engines cut off at ½ stroke and make 100 revolutions per minute, the 4½×9 inch engine will indicate $3\frac{6}{10}$ horse power and the two engines 3½×4 will indicate $1\frac{1}{10}$ horse power, and in proportion for other pressures and speeds. The rule is to multiply the area of the piston by the mean engine pressure due to cut-off, and this product by the travel of the piston in feet per minute. Divide the last product by 33,000 for the horse power.

(5793) G. E. asks: 1. What would be the expense to have an electric light (incandescent) connection running in my rooms, incandescent lamps (116 volts) being used about three buildings away? Could not wires be laid from there to my rooms, and what would be the expense to have this done? A. The expense depends on the number of lamps you require and on the drop in potential allowable. Consult the electrician of the concern supplying the light. 2. Is there any chemical fluid (not injurious) which when blown upon by bellows or mouth ignites the gas which is formed by the air blowing over the chemical and passing off? A. No. The "fire eaters" of the museums use gasoline for their performances. They dip a lump of cotton or lamp wick in it, place it in their mouths secretly, and, on blowing, enough gasoline vapor is carried with the breath to ignite. Great care is required in these experiments.

(5794) W. W. P. writes: I have an Edison-Lalande battery; please give the voltage, and current of same. A. The voltage varies. The mean working E. M. F. is given as 0·667 volt. The amperage for type B & X is 1 ampere; for type J, 2 amperes; for type Q, 3 amperes; for type R, 4 amperes; for type S, 6 amperes; for type W, 7 amperes. These are continuous currents; the maximum is from ⅓ to nearly 5 times as great. 2. Can I use the solution of the above battery for any purpose (experimental) after the battery has been exhausted? A. No. 3. Is there any book published that gives the instructions for the amount of iron and wire, etc., for a certain number of watts or output of dynamos and motors? A. See Sloane's "Arithmetic of Electricity," $1 by mail, for dynamo calculations.

(5795) C. S. writes: An engineer claims that if the steam pipe from the boiler to engine is higher at a point near the engine than it is at the boiler, any water that may be carried with the steam will drain back to the boiler. I claim it will not. Who is right? A. You are right. The velocity of the steam in the pipe will carry any water of condensation or priming directly to the cylinder. Even a vertical pipe will not always return water to the boiler.

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January 30, 1894,

AND EACH BEARING THAT DATE.

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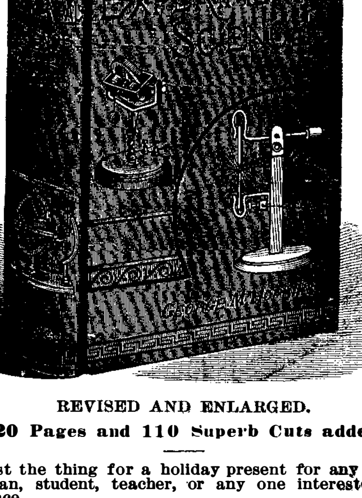

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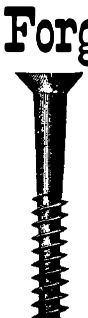

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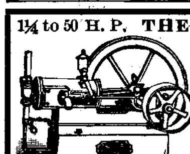

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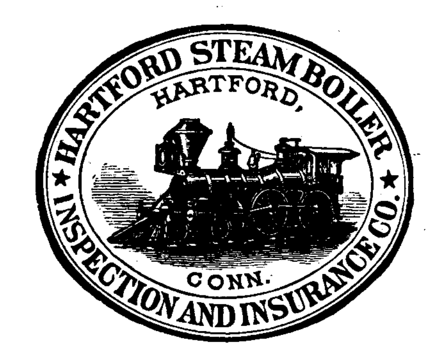

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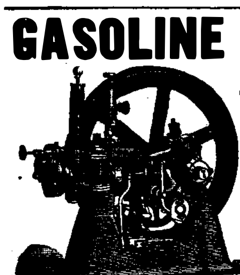

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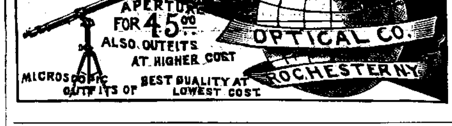

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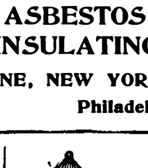

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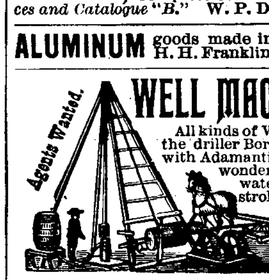

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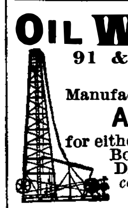

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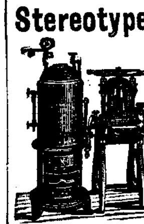

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