SCIENTIFIC AMERICAN

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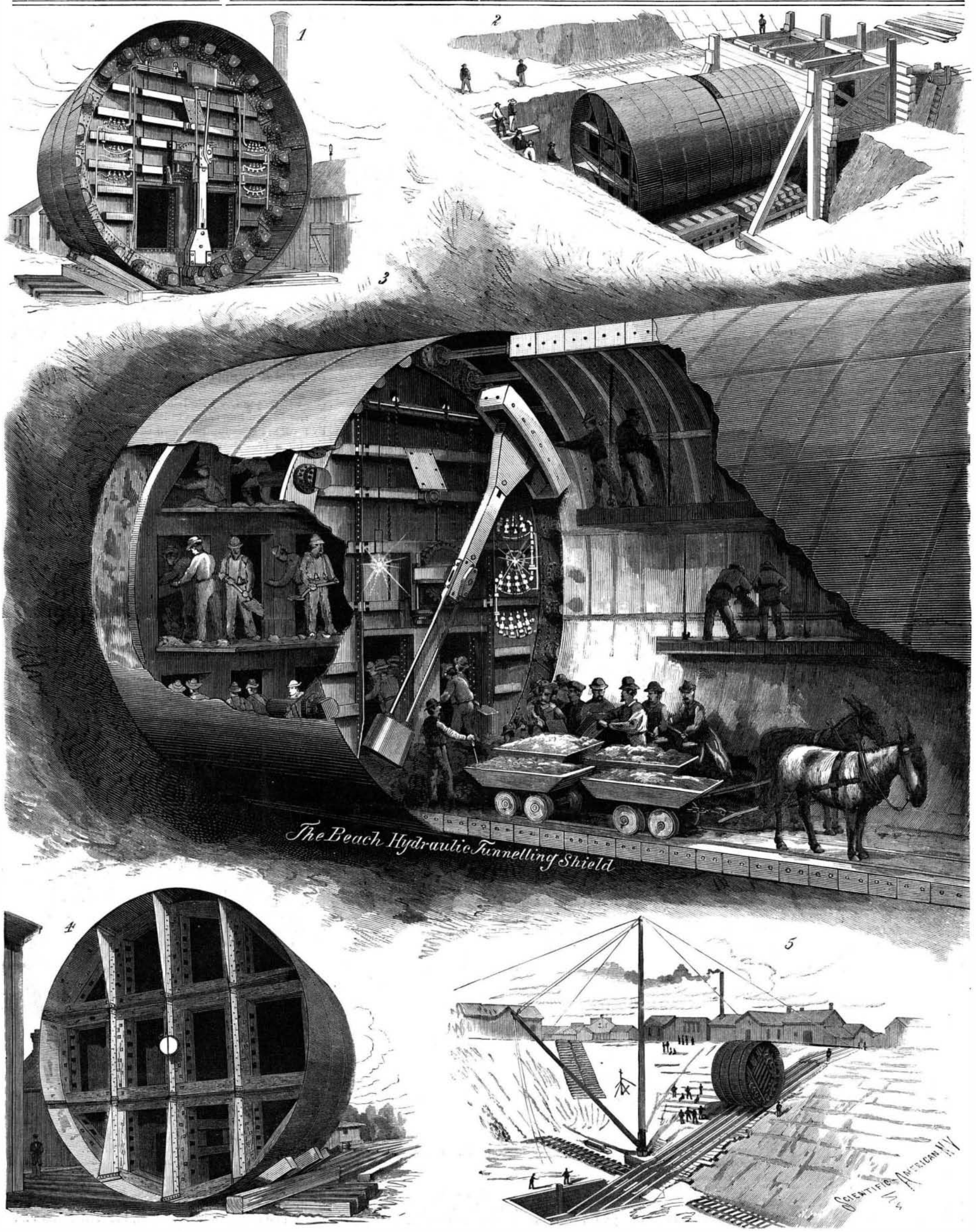

Fig. 1.—Rear view of the shield, showing hood and rams. Fig. 2.—The shield in place on grade. Fig. 3.—Interior view of shield and tunnel. Fig. 4.—Front view of shield. Fig. 5.—Lowering of the shield to the heading.

THE BEACH HYDRAULIC SHIELD AT WORK IN THE GREAT RAILWAY TUNNEL UNDER THE ST. CLAIR RIVER BETWEEN THE UNITED STATES AND CANADA.—[See page 87.]

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NEW YORK, SATURDAY, AUGUST 9, 1890.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 762.

For the Week Ending August 9, 1890.

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FIRE ISLAND.

The name Fire Island, which is used to designate a locality off the southern shore of Long Island and about forty miles from New York, has become well known for the following reasons: It is generally the first land sighted by vessels from European ports steering for New York; it is the location of one of the principal lighthouses of the country, as well as the marine observation station of the Western Union Telegraph Co. and government life-saving station, and has been the scene of a number of noted shipwrecks. This locality is really a part of the beach which extends from Fire Island Inlet, which is about two miles west of the lighthouse, and extends the entire length of the Atlantic coast of Long Island. The Great South Bay, of varying width, separates the beach from the Long Island shore. In the bay and about a mile from the northern shore of the beach is a group of five islands. It is claimed by some that this group was originally called Five Islands, that Fire Island is a corruption of this name which is now applied to the locality about the lighthouse, the correct appellation of which is Fire Island beach. Nearly on a line with the lighthouse and on the Long Island shore is the village of Babylon, which is ten miles distant.

The fast European steamers direct their course for Fire Island light, and it is part of a system which is so arranged that coasting vessels may keep in sight of one of the revolving or flashing lights. Many incoming European steamers first sight Montauk Point lighthouse, the light of which is a revolving one; then about thirty miles west Quogue light is seen, which is a steady one; then comes the revolving light at Fire Island, and finally the Navesink light on the Jersey coast. Excepting there be dense fogs, a vessel approaching the port of New York is never out of sight of one of these lights, and is thus safely guided to its destination. Montauk Point light is white varied by a white flash every two minutes, is 169½ feet above the sea level, and the light can be seen 19¼ miles. Quogue light is a fixed white, 160 feet above sea level, and can be seen 18¾ miles. Fire Island has a flashing white light every minute, is 168 feet above the sea level, and can be seen 19¼ miles, while the Navesink light is 248 feet above the ocean, and the light can be seen for 22¼ miles.

The old Fire Island lighthouse which preceded the present structure was erected in 1826. It was octagonal in shape, built of stone and whitewashed. It stood about a hundred yards from the present structure and immediately upon the shore of the inlet, which is now more than two miles to the westward, the intervening space having been filled in with sand by the action of the sea, thus making a considerable extension of the beach. The present structure was completed in 1858, and is built of brick, laid on solid stone foundations, and the principle of construction is the same as that upon which Smeaton built the famous Eddystone light. The focal plane is 158 feet high. The light is a Fresnel of the first order. This is a combination of prisms and lenses by which the brilliancy of effect is so increased that compared to a simple reflection it is five to one. The axes of the reflectors are all parallel, and the number of reflectors used depends upon the desired interval between the flashes. The framework of the apparatus is revolved by clockwork, and the light which is concentrated and flashed out in this manner has been found to be much stronger than a fixed one. It is necessary to keep curtains before the lenses during the day, because they concentrate the rays of the sun to such an extent as to ignite the wicks of the burner. The heat thus concentrated is so powerful that it is impossible to occupy the space within the lantern for cleansing or repairs unless the curtains are drawn.

The thick lenses of the lantern are seen to be cracked and chipped off in places, and the keeper of the lighthouse states that this has been caused by ducks and geese in their migrations flying through the glass which covers the outside of the lantern, and which is an eighth of an inch thick, and striking the heavy lenses with their bills. He says that he has frequently come up to the lantern and found one or more ducks or geese flying around, wounded from the broken glass and spattering the machinery, lenses and floor with their blood. The large metal ball which surmounts the structure has been bent and nearly twisted from its position by flocks of brant, which is a species of wild goose, coming in contact with it. Sixty dead ducks have been picked up on the ground about the base of the lighthouse on a single morning, and at other times over a hundred birds of various kinds have been found. A large proportion of the very interesting information published by the United States Agricultural Department on the migration of birds is made up of facts obtained from the keepers of the various lighthouses. This light consumes 2,350 gallons of mineral oil each year.

A short distance to the eastward of the lighthouse is the marine observation station of the Western Union Telegraph Co. It is a wooden building about forty feet high and stands back from the surf nearly two hundred feet. Four large wire cables strengthen the building against the winter gales, which are very severe at this point. The building is connected by telegraph with New York, and the arrivals of ocean steamers are reported about six hours before they get to their docks at New York. This gives people who have friends on board time to prepare for their reception, and enables those who live as far distant as Albany or Philadelphia to reach New York before the passengers are landed. Observations were formerly made from the cupola of the Surf Hotel, a noted summer resort near by, but five years ago the present building was erected, which is specially adapted to the work of marine observation. Mr. Peter Keegan is in charge of this station, having previously performed a similar service on the New Jersey coast. He has been eighteen years in the service of the company, ten of which has been passed at this point. During the summer season the vicinity is much frequented by pleasure seekers, but at other times Mr. Keegan and his family only have for neighbors the lighthouse keeper and his family and the crew of the life-saving station, while communication with the mainland, except by telegraph, is not frequent. A constant watch has to be kept for incoming steamers.

Many of the vessels are from fifteen to eighteen miles away, and some go by in the night and in fogs and cloudy weather. So skillful has Mr. Keegan become in the work of detecting them, that during the whole time that he has been at his post, he has only made one mistake, and that was owing to the substitution of another steamer for the regular one on the Bremen line. His acquaintance with steamers has been formed entirely by noting their peculiarities at long range. Only once has he read the name of a passing vessel, and that was about three years ago, when the Amerique came within three miles of the shore. Mr. Keegan keeps a careful record of the departure of all regular steamers, also reports of storms, adverse winds, icebergs, and everything which would be likely to cause delay; and from his knowledge of the steamer's average speed, he approximates her arrival, and decides when he must be on the lookout. At night all steamers, when opposite Fire Island, send up a signal. That of the Inman line is two blue and red lights followed by a rocket showing blue and red stars. The Cunarders burn two Roman candles showing six blue balls. These signals merely indicate the line to which the vessel belongs.

To make sure of the name of the steamer, careful observation must be made of the side and stern lights. It is often with the greatest difficulty that their signals can be distinguished at night, as they are not always displayed at exactly the same point, so that as soon as the steamer comes in sight, the observer must fix his gaze steadily upon one of the lights until the signal is given, which makes the work very tedious indeed. During the day the signals are given with different colored flags, but these have been found to be very deceptive, as the colors appear differently under different conditions of the atmosphere.

Yellow is the color which can be the most distinctly seen on the ocean, and a flag of three colors, one of which is yellow, will appear to be all of that color at a long distance. No signals of this kind can be seen at a greater distance than five miles. In consequence of this, Mr. Keegan has been compelled to rely upon noting and remembering the peculiarities of the several steamers, and in doing this he has gained great proficiency. These peculiarities consist in the general outline of the vessel, position of the smoke stack, cabins, lifeboats, nature of the smoke, etc., as well as the course of the vessel. The Cunard steamers generally pass the observation station in the evening, while those of the French line pass early in the morning. On one of the smoke stacks of the Servia is a square white mark, while on the others of the Cunard fleet the mark is oblong. Certain vessels carry their sails in a peculiar way, while one steamer has a derrick in a certain place, while there are a number of other peculiarities which assist in their identification. Vessels are often distinguished merely by the smoke.

On one line a certain kind of soft coal is burned, and the smoke is so peculiar that the approach of the vessel is known at Fire Island before the hulls are seen. The fast liners are steering farther and farther away from Fire Island in order to shorten their course, and the difficulty of reporting them is consequently increased.

Last December the life-saving stations from Coney Island to Montauk Point were connected by telephone, so that in case of disaster help can be quickly summoned from one or more of the adjoining stations. The observatory has been made the central station, and all news of disasters is telegraphed to New York, and thus the owners or consignees of vessels know of a disaster anywhere on the Long Island coast almost as quickly as if it had happened in New York harbor.

IT has hitherto been supposed that the maximum depth of the Mediterranean was 10,785 feet, between Sicily and Sardinia. Lieutenant Magnachi, of Italy, has found a depth of 13,550 feet, between Malta and Candia.—*Revue Geographique.*

Preserving Milk.

A. VASARHELYI AND J. JAMBOR, BUDAPEST, HUNGARY.

Fresh and sound milk not later than one hour after milking is placed in jars made of a suitable material.

The jars are made in three parts. The bottom part, in which eventually the milk is preserved, is first filled; the other two parts together form what is called the mediator. This is screwed into the bottom can and acts as a filler. For this purpose, even after the bottom can is filled, the top filler is kept three parts full.

When a number of cans and mediators have been fixed in a tray they are filled, and the whole lowered into water in a suitable boiler. The milk is heated up to 76°–77° R. (a little over 200° F.) As soon as the mediator and can are full, by the milk expanding, a tap at the top of the mediator is turned and the whole is thus hermetically closed. The water in the boiler is then raised "to an intense heat, and this will keep the milk for another 50 minutes at a somewhat high temperature." The jars are next deposited upside down in a cooler, and left in this position for 60–80 minutes. This insures the mixing of the milk, as it is in the nature of the milk that its fatty particles, and therefore the buttermilk, will rise to the surface. The cans are finally placed in an upright position. The vacuum above the milk in the mediator is caused by the contraction of the milk. The air-tight stopper between the can and mediator is now turned, and as the ordinary temperature is rather higher, the can will be full, and there is little chance of the fat coagulating should the cans be shaken. The mediator is opened, and the milk in it having been run off, it is taken off and the process is complete. The milk is said not to lose its freshness, pureness, and sweetness, even after eighteen months or two years in hot countries, and when opened tastes like new milk, fresh and sweet.—*F. W. T. K.*

To Obtain Beautiful Crystals.

In order to obtain beautiful crystallizations, Mr. H. N. Warren uses the alums. He dissolves 13 ounces of potassa alum in 1 quart of water and leaves the solution in a water bath at a temperature of 26°. At the end of an hour there deposit small but perfectly regular octahedrons. These are detached and put aside. The solution is afterward cooled to 15·5°, and there are then deposited group crystals, which are rejected, while the first crystals are put back into the solution. The lower part of the vessel is put into a refrigerant mixture composed of A_2O_3K and A_2H_4Cl, P. E. During this time, the upper layers remain at a temperature of 10°, and a feed tube charged with solid alum is introduced into them, so that the concentration shall remain constant. After this, the small crystals form so many centers of crystallization and progressively enlarge. Warren has thus obtained chrome alum in magnificent crystals, absolutely transparent ferrocyanide of potassium, etc.—*Moniteur Scientifique.*

Premiums for Inventors.

The Verein deutscher Eisenbahn-Verwaltungen has offered nine premiums, of a total value of 30,000 marks, for inventions and improvements relating to (1) the construction and mechanical arrangement of railways (three prizes of 7,500, 3,000, and 1,500 marks respectively); (2) rolling stock and its maintenance (three prizes of 7,500, 3,000, and 1,500 marks); (3) the administration and working of railway and railway statistics, as well as important works on railway (three prizes of 3,000, 1,500, and 1,500 marks). Without restricting the scope of the competition, and without binding the jury in its decisions, it is recommended that competitors should confine themselves to the following subjects: (1) Design and construction of a locomotive boiler which, without increasing its weight, affords safety against explosion, and reduces, at the same time, working expenses; (2) improvements in the construction of locomotives, especially the valve motion, whereby a better utilization of the steam may be obtained; (3) proposal and justification of a simpler means of calculating truck hire; (4) the construction of a durable and practical coupling for steam pipes or continuous brakes, without the use of India rubber; (5) the construction of a practical and cheap switch break. The competition is limited to inventions and improvements covering the period of eight years extending from July 16, 1883, to July 15, 1891, and works and drawings must be sent in between January 1 and January 15, 1891, to the Verwaltung des Vereins deutscher Eisenbahn-Verwaltungen, Bahnhofstrasse 3, Berlin, S. W., from which complete copies of the regulations governing the competition may be obtained.

THE following is given in the *Archiv fur Eisenbahnwesen* as the railway mileage at the beginning of 1889: Europe, 133,900; America, 190,000; Asia, 17,800; Africa, 5,200; Australia, 10,500; total, 357,400, as compared with 293,000 in 1884. Of the increase of 64,000 miles during the four years, 40,000 is in America and 30,000 in the United States alone; 11,000 miles were opened in 1885, 17,000 in 1886, 23,000 in 1887, and 13,000 in 1888; showing that the changes in rapidity of railway construction in this country have been closely followed in other parts of the world.

The Approaching Meeting of the Iron and Steel Institute.

An event of importance in the history of the Iron and Steel Institute of Great Britain will be the holding of its annual meeting this year in the United States.

The provisional programme of the meeting has been issued. While the meetings of the Institute do not begin until Wednesday, October 1, a cordial invitation is extended by the American Institute of Mining Engineers to attend its sessions, which will be held in New York, on Monday, September 29, and Tuesday, September 30. The meetings of the Iron and Steel Institute at New York will be held on Wednesday morning, October 1, Thursday morning, October 2, and Friday morning, October 3. These meetings will be held in Chickering Hall, Fifth Avenue and Eighteenth Street. During the meetings there will be an excursion, by steamer, on the Hudson River, to West Point and return, and other trips and entertainments are being arranged for. One afternoon will be set aside for the proceedings connected with the unveiling of a statue of the late Mr. Alexander L. Holley. The headquarters of the Institute at New York will probably be at the Park Avenue Hotel. Trips are intended as follows:

Oct. 4 and 5, to visit a number of manufacturing establishments and works in Philadelphia and its vicinity. Oct. 7, to Lebanon, to visit the famous Cornwall iron ore mines, and to inspect the plant, at Steelton, of the Pennsylvania Steel Company. Oct. 8, to Pittsburg, stopping at Altoona and at Johnstown, the former town famous for the shops of the Pennsylvania Railroad Company; passing through Johnstown—the scene of the great flood of 1889. Oct. 9, 10, 11 and 12, at Pittsburg. A number of excursions will be arranged during these days to iron and steel works, natural gas wells, and the Connellsville coke region. During the stay at Pittsburg, two international meetings will be held. Oct. 13 and 14 will be spent in Chicago. Excursions are being arranged to local iron and steel works and manufacturing establishments. Members will make choice of two alternative excursions from Chicago—the one to the iron and copper mines of the Lake Superior district (I.), and the other to the iron and coal regions of the Southern States (II.)

I. NORTHERN TRIP TO LAKE SUPERIOR, ETC.

Iron Mountain, Michigan, October 15. A visit will be paid to the air-compressing plant of Chapin Mining Company, at Quinnesec Falls, and subsequently to the Chapin mine, which this year will produce about 800,000 tons of Bessemer ore.

Oct. 16, visit the iron mines of the Gogebic Range, which, in 1889, produced 2,016,391 tons Bessemer ore. Oct. 17 and 18, visit the copper mines of Lake Superior, including the plant of Calumet and Hecla, the Tamarack Mines, and the stamp mills and smelting works on Torch Lake. Hotel accommodation is so inadequate in this region that the greater part of the members will have to remain in the sleeping cars. Oct. 20 and 21, visit to the iron mines of the Marquette district, the oldest of the Lake Superior ranges. Oct. 21, proceed to Sault Ste. Marie, viewing the large locks through which, in the last calendar year, a freight tonnage of 7,516,122 tons passed, thus affording an opportunity of seeing something of the commerce of the lakes. Oct. 22, leave Sault Ste. Marie for Niagara Falls. Oct. 24, leave Niagara, arriving at New York on Saturday morning, Oct. 25. Those of the party who desire it will be conveyed from New York in special trains to Washington and back. It is probable that a reception of the members will be given by the President of the United States.

II. SOUTHERN TRIP TO ALABAMA AND KENTUCKY.

Leave Chicago, Oct. 15, via Louisville and Nashville. Oct. 16 and 17 will be spent at Birmingham, Alabama, visiting the coal and iron mines, coke plants, blast furnaces, and rolling mills, thereby affording opportunities for studying this iron district, famous for its recent rapid development. Oct. 18, the typical brown ore deposits of Shelby and Anniston will be visited, and the charcoal and coke blast furnaces will be inspected. Oct. 19 will be spent on Lookout Mountain. Oct. 20, visits to the National Cemetery and to localities of historic interest. Oct. 21, inspect Middlesbrough, Kentucky, in the morning, and in the afternoon Knoxville, Tennessee. Oct. 22, visit the Pocahontas coal field and coke district, the most famous of the South. Oct. 23, visit Roanoke, Virginia, and its recently developed industries. Oct. 24, visit Luray Cave, discovered a few years since, and now lighted throughout with electric lights. Oct. 25 and 26, these days will be devoted to Washington. It is probable that the party will be received at the White House by the President of the United States. Oct. 27, the party will return to New York. Those of the party who so desire will, after their arrival at New York from the southern tour, be conveyed to Niagara Falls, returning to New York Oct. 29.

Provisional List of Papers for the Autumn Meeting of the Institute in New York.

1. "American Blast Furnace Yields." By Mr. James Gayley, Pittsburg, Pa.
2. "Testing Materials of Construction in the United States." By Messrs. Hunt & Clapp, Pittsburg.
3. "The Manufacture of Steel in the United States." By Mr. Henry M. Howe, Boston, Mass.
4. "The Thomson Electric Welding Process." By Prof. Thomson, New York.
5. "The Manufacture of Spirally Welded Steel Pipes in the United States." By Mr. J. C. Bayles, New York.
6. "The Development of the Iron Manufacture of Virginia." By Mr. E. C. Pechin, Cleveland, Ohio.
7. "The Use of Water Gas in the United States." By Mr. B. Loomis, Hartford, Conn.
8. "The Coke Industry of the United States." By Mr. J. D. Weeks, Pittsburg.
9. "Recent Progress in the Manufacture of War Material in the United States." By Mr. W. H. Jaques, Bethlehem, Pa.
10. "The Composition and Wearing Qualities of Steel Rails." By Dr. Chas. B. Dudley, Altoona, Pa.

Provisional List of Papers to be offered by the Iron and Steel Institute, at the proposed International Meeting in the United States, October 9 and 10.

1. "The Protection of Iron and Steel Ships against Foundering from Injury to their Shells, including the Use of Armor." By Sir N. Barnaby, K.C.B., London.
2. "The Recent Development of Marine Engineering." By Mr. A. E. Seaton, Hull.

Sir Lowthian Bell has also been asked to prepare a paper embodying his views on the present state of the iron manufacture.

The American Institute Fair.

The announcement of the annual fair of the American Institute of the City of New York is always a matter of interest to a great number of inventors and manufacturers, from the fact that, at these exhibitions, it is possible to bring their devices, their machinery, and their goods practically before so large a body of examiners and possible customers. The just completed returns of the last census show a population of about two and a half millions of people within the city limits of New York and Brooklyn, all of whom are thus within easy distance of the fair as an opportunity for an ordinary evening's entertainment. Besides this, New York is the headquarters of capital itself, while also taking the lead in various lines of industry. It is not strange, therefore, that these fairs are always well attended, and that they present a great variety of exhibits calculated to instruct and interest all classes. The next exhibition will open October 1, and remain open for two months. Intending exhibitors should be prompt in applying for space.

Creosoting of Wood.

The practice of the Eastern Railway Company, of France, in creosoting sleepers is described in a recent issue of *Revue Generale des Chemins de Fer.* Sleepers as delivered are stacked and seasoned in the open air. They are then adzed and bored by a special machine, loaded on trucks, and run into a drying oven, where they remain twenty-four hours or more. After drying at a temperature of about 176° Fah., they are run into a metal cylinder, 6 feet 3 inches in diameter and 36 feet long, which is hermetically closed. The air is then exhausted, and a partial vacuum is maintained for about half an hour. Communication is then opened with reservoirs of dead oil, which is allowed to flow in at a temperature of 176° Fah., under pressure. When the oil ceases to flow under moderate pressure, it is forced in by a pump up to a pressure of 83 pounds per square inch, and this pressure is maintained for an hour or an hour and a quarter. Communication with the oil reservoirs is then opened again, and the excess of oil not absorbed by the timber flows back into the reservoir. The cylinders hold 168 sleepers each. The quantity of oil absorbed is measured by determining the difference in volume of the oil before and after operation. The wood used is principally oak and beech. The oak sleepers, absorb from 2·4 to 2·7 quarts per cubic foot; beech sleepers, from 8·7 to 10 quarts per cubic foot. The whole operation takes about four hours. This method of treatment has been practiced by the company since 1865, with, it is stated, very good results. After fifteen years of service the sleepers taken out have been 15 per cent for creosoted oak and 50 per cent for creosoted beech.

Marriage with Drunkards.

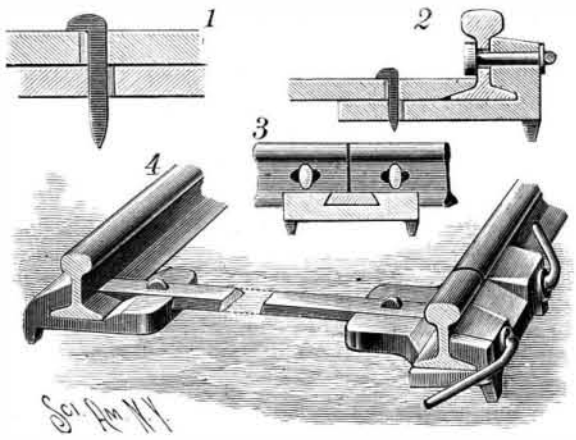
The efforts to raise the poor and degenerate inebriate and his family are practically of no value as long as marriage with inebriates is permitted. Recently the legislature of the state of Victoria, in Australia, has passed a law which gives a wife the right of divorce if the husband is found to be an habitual drunkard. If after marriage she discovers that he is an inebriate, she can also get a divorce. The husband can do the same with a wife if she is proved to be an inebriate. This is a clear anticipation of the higher sentiment which demands relief from the barbarous law which would hold marriage with an inebriate as fixed and permanent.—*Jour. of Inebriety.*

NEW METALLIC RAILWAY TIE.

A new railroad tie which is especially constructed for tracks which are frequently laid and removed, as in the case of mines, excavations, etc., is shown in the annexed engraving.

In the cut, Fig. 1 is a sectional view, showing the manner of drawing the parts together by means of a spike, Fig. 2 is a transverse section of the chair and tie as used at the rail joint, Fig. 3 is a side elevation of the rail ends, showing the relation of the chair, the tie, and the rails, and Fig. 4 is a perspective view showing the application of the improvement to a joint and to the middle portion of an improved tie.

The chair which supports the rail is undercut to receive one-half of the rail flange, and in the inner end of



DAINTY'S IMPROVED RAILWAY TIE.

the chair is formed a dovetail slot for receiving the iron bar which connects the chairs to opposite sides of the track. The end of the tie adjoining the rail is beveled so as to conform to the shape of the rail flange, and the chair and the tie are apertured in such a manner as to cause a spike, when driven through the bolt, to draw them together upon the foot of the rail, and thus clamp it securely.

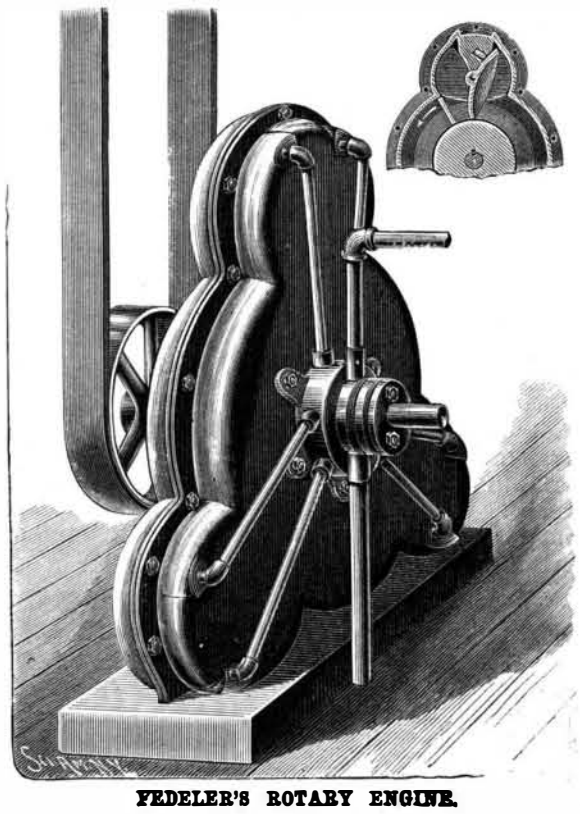
Where the improvement is applied to the rail ends, as shown at the right in the engraving, the chair is somewhat modified to receive two bent bolts having elliptical T-heads adapted to pass through holes of corresponding form in the web of the rail. After insertion in the holes of the rail, the bent ends of the bolts are turned down so as to bring the bolt heads into the position shown in Fig. 3, the heads being arranged at right angles to the elliptical apertures in the rail web. To facilitate turning the bolts, they are provided with washers which bear upon the outer surface of the chair.

With a railroad tie of this construction, the track may be readily laid and as easily taken up. Skilled labor is not required in the construction of a track where these improved ties are employed, as the rails are properly spaced and securely held in the position of use.

This invention has been patented by Mr. Elijah Dainty, of Coal Bluff, Pa.

AN IMPROVED STEAM MOTOR.

The illustration represents a rotary engine in which direct steam is applied to two or more parts of the



FEDELER'S ROTARY ENGINE.

periphery of the piston at the same time, whereby its expansive force is designed to be more fully utilized, and make an economical engine. It has been patented by Mr. John H. Fedeler, of No. 485 West Twenty-second Street, New York City. Inclosed within the casing is the body of the motor, which consists of a piston having two wings, and keyed to the shaft, which extends through, and has a bearing in a box screwed into the side of the steam chest. The wings of the piston are on its opposite sides, and fit steam tight in the casing, so that the whole force of the steam will be directed against them. At the top and on each side of the casing, and arranged at equal distances around it, are six chambers, arranged in three pairs, a live steam pipe extending to one chamber of a pair and an exhaust pipe to the other, these pipes radiating from the steam chest on the outside of the casing. Between each pair of chambers is a movable abutment, pivoted to a projection on the inside of the casing, as shown in the sectional view, and adapted to direct the steam against the wings of the piston. The abutments are backed by a spiral spring to prevent them from sticking, and the abutments and the spaces between are respectively one-sixth of the circumference of the cylinder. Keyed to the shaft within the steam chest is a rotary valve, with grooves and openings connecting with the radiating pipes, the direct steam pipes never carrying exhaust steam, but the exhaust pipes alternately carrying direct steam to operate the abutments. The arrangement is such that the live steam, on entering, forces down the abutment behind it, and exerts its full pressure upon a wing of the piston, but before the latter reaches the next abutment this abutment has been closed by live steam admitted through the exhaust, so that the live steam will continue to expand to force the wing of the piston further, the abutments alternately opening and closing as the wings of the piston travel around. In practice the steam enters two steam pipes at the same time, exerting its force simultaneously on both wings of the piston.

FIRE EXTINGUISHING APPARATUS.

The annexed engraving represents a compact arrangement of fire hose and fire extinguishing apparatus, which may be placed in any hall or apartment and is always ready for instant use.

The casing is provided with a glass cover which protects the contents, while allowing them to always remain prominently in view. A water pipe leads into the casing, and a short section of pipe is connected with the main water pipe by a swivel joint, which also forms a valve. With this short pipe is connected the hose, which is folded compactly in the case and which carries at its free end a fire nozzle of the usual description. The case is provided with an ax, and it may contain other tools useful in case of fire. In the present case the inventor has provided the casing with a number of hooks for hats and clothing, but this is not an essential part of the invention; it simply serves to partly disguise the real nature of the apparatus. The hose nozzle may also be made to hold fire extinguishing chemicals.

In case of a fire, the door is opened, and the nozzle is grasped and carried to the vicinity of the fire. The act of stretching the hose turns the short swiveled pipe, thus opening the valve and allowing the water to flow. This automatic action of the apparatus is an important feature, as the device may be set in operation by one person.

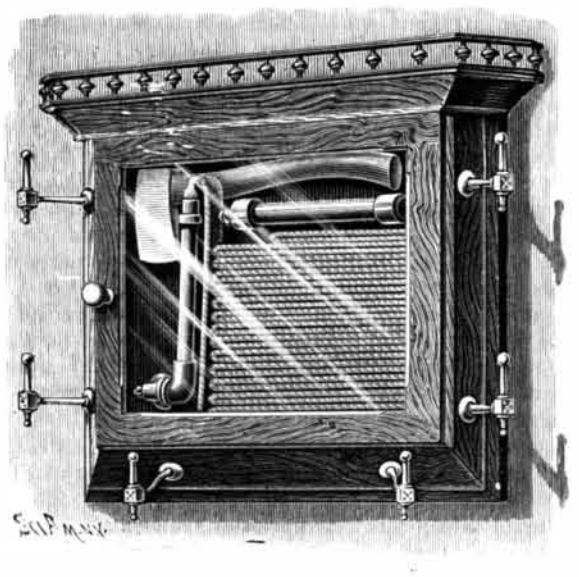
This useful invention has been patented by Mr. John H. Scholding, of No. 9 Archer Street, Yonkers, N. Y.

Photographs in Natural Colors.

At a recent meeting of the Berlin Physical Society, Professor Vogel spoke on photography in natural colors as attempted at first by Seebeck, then in succession by Becquerel, Niepce, St. Victor, Poitevin, Zenker, and most recently by a Hungarian named Verres. He exhibited a series of photographs in colors obtained by Verres, which, however, showed conclusively that he has not solved the problem, since, although the reds appear as red in the photographs, so also do the yellows and greens appear as red, and the blues as an undeterminate color. These photographs, on the other hand, mark a distinct advance in color photography, since they are fixed, while those of Zenke, although more strikingly colored, were not fixed. The speaker criticised Zenker's views on the mode of formation of a colored photograph, and expressed his disbelief in the possibility of any one substance being so changed by rays of different wave length as to emit, from various parts of itself, rays of exactly corresponding wave length.

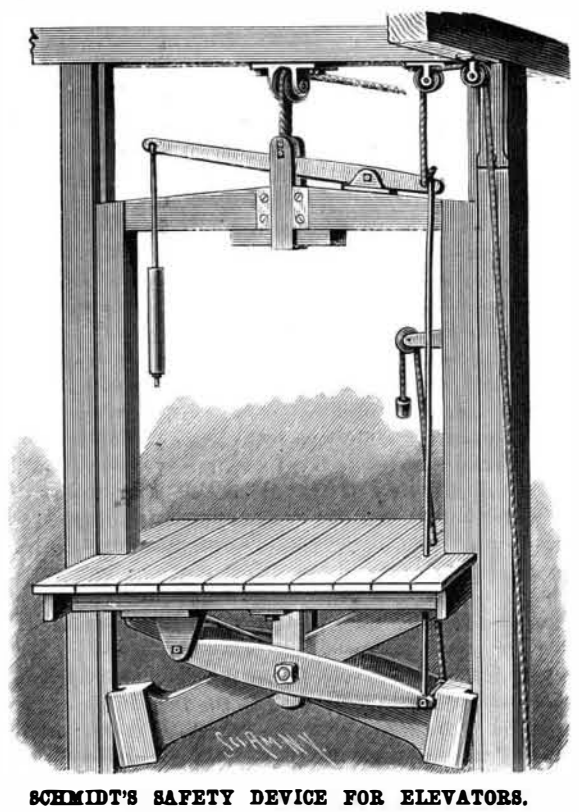
AN IMPROVED SAFETY DEVICE FOR ELEVATORS.

This is a device to automatically lock the elevator cage instantly if the hoisting rope or chain breaks, and also furnish means for controlling the ascent or descent of the cage from within or without. It has been patented by Mr. Philipp Schmidt, of No. 414 South Ninth Street, La Crosse, Wis. Projecting tongues on the upright timbers of the well hole frames retain the platform or cage in sliding contact therewith. Upon the transverse beam at the top of the cage a heavy weight is suspended by vertical opposite limbs connected to the block at their lower ends, the limbs loosely embracing the sides of the beam, and their upper ends being connected by parallel cross bolts. To the top bolt a wire rope is attached which extends over a pulley and thence downward to an elevator drum or other similar device actuated by hand or power. Beneath the center of the platform is a strong bracket frame having two spaced limbs, to receive the lapped bodies of locking arms and permit them to vibrate freely. The hole for the bolt on which the locking arms are journaled is elongated, that the bolt may have a small vertical motion, and the arms have a



SCHOLDING'S FIRE EXTINGUISHING APPARATUS.

short bend near their lower ends, which are grooved to loosely embrace the tongues of the frame timbers, the arms when in locked position being designed to abut squarely against the main faces of these timbers. To afford means for automatically spreading the arms, and thus locking the platform, two parallel bars are pivoted by one end to depending hangers secured to the platform timbers. At their longitudinal center these bars have oblong holes through which passes the bolt on which the locking arms are journaled. On one side of the beam at the top of the cage is a low bracket stand upon which is pivoted a tripping lever, to the short arm of which is loosely jointed the upper end of a connecting rod, the lower end of which is connected to a transverse spacing bolt uniting the outer ends of the parallel bars below the platform, there being also attached to this bolt a short lanyard. The upper portion of the lanyard passes through a bracketed pulley, and has a weighted handle block on its end. A weight is suspended from the long arm of the tripping lever at the top, and from its short arm a cord extends upwardly over pulleys and thence downwardly through the building. Normally the lower ends of the locking bars drop sufficiently by their weight to remove their bearing faces from contact with the side timbers, but if the main rope is suddenly broken, the dropping of the block suspended from the top cross bar of the cage operates the tripping lever and the parallel bars to spread the crossed locking bars and bring them in firm contact with the side timbers. In ordinary use the platform can be stopped at any point by pulling on the weight handle suspended

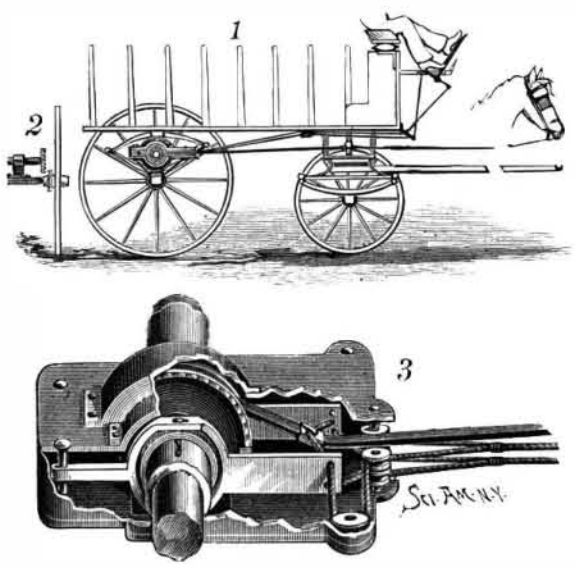


SCHMIDT'S SAFETY DEVICE FOR ELEVATORS.

from the tripping lever, or the handle block on the lanyard, either of which will raise the free ends of the parallel bars and spread the locking arms. This brake is designed to be readily attached to any elevator.

A DEVICE TO STOP RUNAWAY HORSES.

The illustration represents a device, applicable to any kind of a vehicle, for stopping runaway horses, or speedily arresting vicious or frightened animals that are uncontrollable by the ordinary appliances. A revoluble sleeve is mounted in bearings on the rear axle, with which the sleeve is in alignment, and centrally on the axle is mounted a sheet metal casing, a view of which, partly broken away, is shown in Fig. 3. The sleeve is extended through the side walls of the casing, and a pulley is centrally secured thereon, with radial flanges having ratchet teeth on their edges. Within the sleeve two shafts are made to fit revolubly, their inner ends nearly touching each other, while the outer end of each has a gear wheel with laterally projecting teeth, held near to but not in connection with a similar toothed wheel on the inner end of each hub of the axle, as shown in Fig. 2. In connection with a hub on each sleeve on either side of the central pulley is placed a laterally apertured lever, these levers having a rocking engagement with standing bolts near the rear end of the casing, and being connected at their forward ends with cords leading to a rocking lever pivotally supported on the foot board, as shown in Fig. 1. These side levers within the casing are so arranged, in connection with the sleeve and the two shafts within it, that the vibrations of the lever on the foot board by the driver will throw the gear wheels on the outer end of each shaft into connection with the similar wheels on the wheel hubs, and also cause the central pulley to revolve rearwardly. A substantial band, preferably of leather, is secured around the central pulley, and extends forwardly, its extremity having lateral straps attached to it and also to the bits of the horses, so that the revolution of the pulley in a direction away from the horses will shorten the band and pull the heads of the horses downward and rearward in a forcible manner, throwing the horses upon their haunches and



ZALUD'S HORSE ARRESTER.

quickly arresting their forward movement. Provision is also made for automatically locking the central pulley, so that the tension on the horses will not be removed if they back up, when it is desired to retain a team of fractious horses with their heads trammeled, this pressure being readily removed by the driver pressing with his foot on the treadle. The device is applicable to one-horse as well as two-horse vehicles.

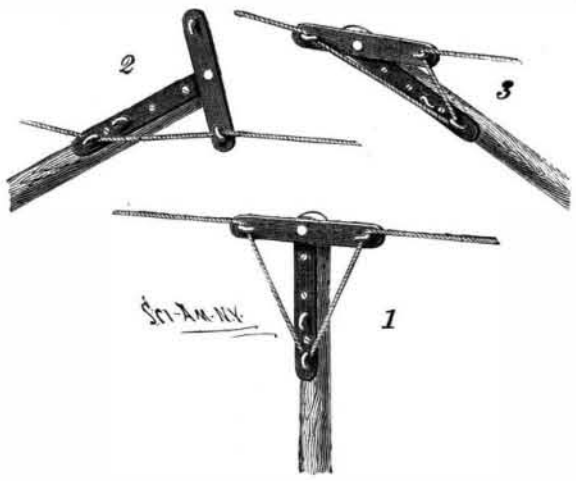
This invention has been patented by Mr. Albert Zalud, No. 150 Bunker Street, Chicago, Ill.

Ancient Egyptian Glue and Veneering.

Among the many occupations of the carpenter, that of veneering is noticed in the sculptures of Thebes, as early as the time of the third Thothmes, whom I suppose to be the Pharaoh of the Exodus, and the application of a piece of rare wood of a red color to a yellow plank of sycamore, or other ordinary kind, is clearly pointed out. And in order to show that the yellow wood is of inferior quality, the workman is represented to have fixed his adz carelessly in a block of the same color while engaged in applying them together. Near him are some of his tools, with a box or small chest, made of inlaid and veneered wood, of various hues, and in the same part of the shop are two other men, one of whom is employed in grinding something with a stone on a slab, and the other in spreading glue with a brush. It might, perhaps, be conjectured that varnish was intended to be here represented, but the appearance of the pot on the fire, the piece of glue with its concave fracture, and the workman before mentioned applying the two pieces of wood together, satisfactorily decide the question, and attest the invention of glue 3,300 years ago.—*J. G. Wilkinson.*

NOVEL CLOTHES LINE SUPPORT.

A very simple and effective device for supporting and tightening a clothes line is shown in three positions in the engraving. Fig. 1 shows the prop and stretcher in engagement with the line. Fig. 2 shows the first step



McCLAUGHRY'S CLOTHES LINE PROP AND STRETCHER.

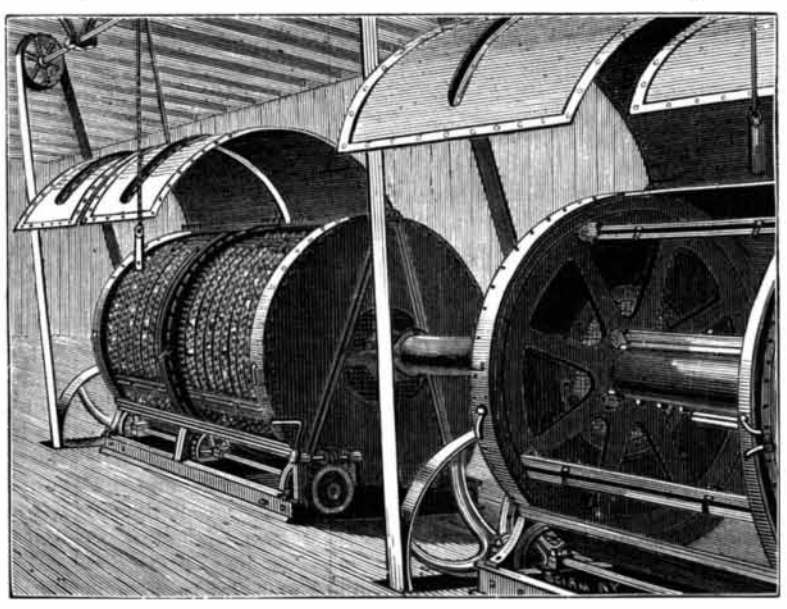
in the application of the device to the line, and Fig. 3 illustrates the second step in the operation.

To the prop pole at one end is attached an oblong metallic plate furnished with one or two hooks curved toward the opposite end of the pole. To the outer extremity of the plate is pivoted a bar having at opposite ends curved hooks which project inwardly toward the center of the bar.

The manner of applying the prop to the line is illustrated by Fig. 3. One of the hooks on the fixed plate is brought into engagement with the line, then one of the hooks on the pivoted bar is passed under the line as shown. Then the other hook on the pivoted bar is brought into engagement with the line as shown in Fig. 3. Finally the pole is straightened up, giving the line the desired amount of tension, at the same time supporting it so as to prevent undue sagging. A patent for this invention was recently granted to Mr. C. C. McClaughry, of Joliet, Ill.

A DRYING APPARATUS FOR FISH, ETC.

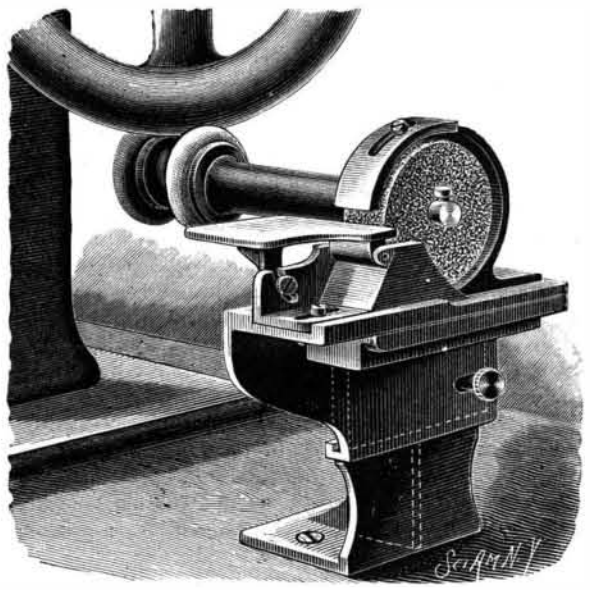
Our illustration represents a drying apparatus in which a blast of heated air in employed in connection with revolving reticulated wire frames or baskets carrying the material to be dried, the particular construction shown being used in drying fish, but the apparatus being also adapted for drying tea, wool, fruit, etc. It is a patented invention of Mr. Edward Robinson, of St. Johns, Newfoundland. The material to be dried is operated upon within a stationary cylinder or cylinder casing, in which is a central tube, through which heated air is forced by a pressure blower or fan, the tube having downwardly opening nozzles, through which the heated air passes to the interior of the cylinder. The fish are held in a series of wire net wheels or disks, arranged parallel with one another throughout the length of the cylinder, each of these disks being constructed to form a hollow wire-work box or basket. As shown in the engraving, radial divisions are made in these disks, each division occupying one-fourth of the transverse area of the cylinder. These divisions or sections are attached to longitudinal T-irons extending the whole length of the cylinder, the baskets in sets of four, thus making a species of wheels, any number of which, at suitable distances apart, are arranged in the cylinder. These wheels are connected by the T-irons with circular open-work frames or heads, one being in the middle of the series and another at each end, and together constituting a revolving frame. Doors or lids are provided for the insertion and removal of the reticulated boxes or baskets from the cylinders, our illustration showing the lids of these cylinders raised as for the purpose of filling and discharging fish, one of the cylinders being filled with fish frames ready for work. Instead of being stationary, the cylinder itself may, if desired, be made to revolve and rotate the basket-like disks. The frame of circular heads and T-irons, which is the carrier of the disks or receptacles, may be supported on rollers beneath the circular heads, or in any other suitable manner, rotary motion being then imparted by any convenient arrangement of gearing. For the drying of tea the skeleton frames require to be of finer texture or mesh, with means for maintaining the tea in motion, while for drying wool the frames should be of large capacity, with various other modifications in detail for different articles.



ROBINSON'S APPARATUS FOR DRYING FISH AND OTHER ARTICLES.

AN IMPROVED GRINDING DEVICE.

The illustration represents a convenient attachment which may be readily placed to receive motion and power from a sewing machine for the sharpening of scissors, sewing machine needles, and similar light articles. It has been patented by Mr. John S. Pyper, of Au Sable Chasm, N. Y. The attachment as shown is secured on the sewing machine table, but with a slight variation, that is provided for in the patent, may be clamped on the hand or balance wheel guard plate. The upright portion of the bracket stand screwed to the table has a horizontal flanged guide plate integral with its upper outer face, the flanges of this guide plate interlocking with hooked flanges on a sliding bed plate with an integral platen, carrying the grinding mechanism. The bed plate is adjustably secured to the guide plate by a set screw bolt, whereby the relative position of the parts on it may be adjusted with regard to the rim of a sewing machine balance wheel. Upon the bed plate is a wheel case, one side of which is open, and from the other side an integral sleeve projects horizontally, the bore of the sleeve being adapted to afford revoluble support to a shaft, on one end of which,



PYPER'S GRINDING ATTACHMENT FOR SEWING MACHINES.

within the wheel case, is a grinding wheel, while on its other end are friction wheels. The friction wheels are duplicate, being integral radial enlargements on a hub, and having their peripheral edges grooved for the reception of elastic bands, whereby they will readily engage the peripheral surface of a balance wheel rim. Upon the upper surface of the platen are parallel guide ribs, between which a dust guard and rest plate support is adjustably located, the plate being slotted to permit the frame to be moved toward or from the wheel face and adjustably secured where desired by a screw bolt. The platen is also apertured below the forward face of the grinding wheel for the escape of dust into a drawer supported in position to slide on the under side of the platen, there being also a dust guard above to direct the products of attrition to the drawer. Upon an upright longitudinal bracket flange is supported the rest or rocking table, whereon the scissor blades are held and brought into contact with the revolving face of the wheel. This table may be given any desired degree of inclination, so that the blades may have their edges properly beveled when supported on the table and brought into contact with the moving face of the grinding wheel. To shield the hands of the operator from accidental contact with the face of the revolving grinding wheel, an adjustable guard plate is attached to the rim of the wheel case, whereby only a small portion of the surface of the grinding wheel need be exposed.

JAPAN'S literary welfare is looked after by 475 newspapers, magazines, etc. Tokio alone boasts of sixteen daily newspapers. It is imperative that each officer of the government should subscribe to the government organ "Kwampo."

The Holley Memorial.

The memorial to be erected in this city in honor of Alexander Lyman Holley is so far advanced as to assure its completion before the time appointed for its public dedication, which is to take place early in October, during the New York meeting of the British Iron and Steel Institute. The site fixed for the memorial by the park commissioners is an admirable one, in Washington Square, and there, of course, the ceremony of unveiling the bust will take place; but the commemorative address of the occasion will be delivered before the open air ceremony, in Chickering Hall, which has been engaged by the Institute of Mining Engineers for all the sessions of both societies in this city. This is a wise arrangement. The delivery of an address out of doors is, under all circumstances, an unsatisfactory business for the audience as well as the orator. In the daytime, and in the midst of the traffic and bustle of a metropolis, it would be more than usually laborious and ineffective.

The joint committee of the civil, mechanical, and mining engineers having this matter in charge has invited Mr. James Dredge, editor of London *Engineering*, to deliver the address, and it is understood that he has accepted the appointment. A better choice certainly could not have been made. Mr. Dredge will bring to this congenial task a thorough acquaintance with the history of progress in those branches of engineering science which Holley so greatly advanced and so brilliantly adorned. It has been his business as a technical journalist to note the successive steps of their wonderful advance, and to measure the achievements of the individual leaders as well as the conquests of the armies they have directed and inspired. The theme is a grand one, for it so happens that the period and the sphere of Holley's professional career present developments unequaled for far-reaching effects by any other quarter of a century or any other departments of human industry since civilization began.

It was in this period, and in the domain of mechanical engineering (in its widest sense), that all the great inventions of the preceding century suddenly came to full harvest. Railways, stationary and marine steam engines, high explosives and heavy artillery and armor, and above all the manufacture of steel on a vast scale as a structural material, all burst into bloom and fruit, revolutionizing the conditions of commerce, industry, and war, and inaugurating a new era, in which for the first time, whatever pessimists or agitators may say, the dominant tendencies are for peace, the rewards of labor are steadily increasing, and the world, which had previously produced little more than would feed and clothe its inhabitants, is making all civilized nations rich.

But besides the ability to grasp this great subject, and the critical perception of its relations to the individual career which he is called more particularly to characterize, Mr. Dredge possesses a qualification which renders him a welcome as well as competent orator for this occasion. No one who knew Holley could fail to know that James Dredge was one of his most loyal and well-beloved friends. It was at the house of Mr. Dredge that he was nursed back to life from the first attack of the disease which after another year proved fatal.

The occasion is an international one. The memorial itself is a testimony from engineers of both hemispheres. Its dedication will be graced with the presence of hundreds of guests from beyond sea. We Americans have had other opportunities to express our appreciation of the character and career of our great countryman. What voice could now be more fitly heard than that of an Englishman, who is a distinguished engineer, a critic of authority, and who was Holley's friend?—*R. W. R., Engineering and Mining Journal.*

Japanese Vegetable Paper.

This paper is manufactured largely in Japan from the bast fibers of *Wickstrœmia canescens*, a shrub which grows widely over the middle and southern parts of the country, and belongs to the family Thymelaeaceæ. This bast paper—used in the home country for a great number of purposes, such as bandages, etc.—possesses an astonishing tenacity and flexibility, combining the softness of silk paper with the cohesion of a woven fabric; it is so thin that the finest writing can be read through it, yet it is torn only with great difficulty.

Commercially the paper is known in Japan as usego; as put upon the market it has a uniform yellowish-white color and a silky luster. It is made in pieces 20 inches long by 14 wide, weighing about 30 grains, and yielding when burned about 1 per cent of an ash containing alumina, oxides of iron and calcium. Examined under the microscope it is seen to consist of a thick network of cross and transverse thread-like bast fiber cells with extraordinarily thin walls.

The attention of Dr. Hoffmann was first drawn to the use of the paper in medicine by a traveled patient, who during the recent influenza epidemic was accustomed to take powders wrapped up in the paper; he had himself thought of the method, and had long adopted it. The author says (*Therap. Monats.*), "This method appeared to me to have so many and so considerable advantages over the now customary enveloping (of powders) in wafers and capsules, that I took occasion to invite its trial and initiation in wider circles."

The wrapping up of a powder is simple enough; it is placed on a piece of the paper, say of four square inches surface, and shaken or moved into the center. The four corners are now taken up, brought together over the powder, and twisted between the first finger and thumb into a little cord, care being taken to avoid direct pressure of the little packet, as well as all unnecessary crumpling of the paper. In this way a paper packet is obtained similar in form to the toy known as a "banger." With a pair of scissors the "cord" is now cut up as close as possible to the packet, leaving of course as much of the twisted column as is sufficient to keep the paper together. By the compression of the scissors in cutting, the latter is the more tightly held together.

If, for the sake of experiment, the packet thus prepared is unfolded, it will be found that for wrapping a powder of say 8 grains, a piece of paper about as large as a crown and weighing about ¼ of a grain is used. In the process the powder is also much compressed, so that, for example, an antipyrin powder of 8 grains occupies a volume scarcely exceeding that of a pea.

The powder thus simply enveloped is quite ready to be taken; it is laid on the tongue and swallowed with a mouthful of water. Arrived in the stomach it unfolds immediately, the medicament is set free and readily absorbed.

That this does occur may be simply shown as follows: If a powder thus wrapped is thrown into water, the twisted end untwists in a few seconds, the packet opens like a bud, and the contents are taken up by the water. The same conclusion was also reached by physiological experiment, benzoic acid taken into the stomach enveloped in Japan paper being distinctly traceable half an hour after in the urine as hippuric acid. By this means it was proved that the vehicle did not delay the absorption of the remedy.

Sympathetic Inks.

In answer to frequent inquiries, we give herewith the modes of preparation of a number of sympathetic inks:

INKS THAT APPEAR THROUGH HEAT.

1. Write with a concentrated solution of caustic potash. The writing will appear when the paper is submitted to strong heat.

2. Write with a solution of hydrochlorate of ammonia, in the proportion of 15 parts to 100. The writing will appear when the paper is heated by holding it over a stove, or by passing a hot smoothing iron over it.

3. A weak solution of nitrate of copper gives an invisible writing, which becomes red through heat.

4. A very dilute solution of perchloride of copper gives invisible characters that become yellow through heat.

5. A slightly alcoholic solution of bromide of copper gives perfectly invisible characters which are made apparent by a gentle heat, and which disappear again through cold.

6. Write upon rose colored paper with a solution of chloride of cobalt. The invisible writing will become blue through heat and will disappear on cooling.

7. Write with a solution of sulphuric acid. The characters will appear in black through heat. This ink has the disadvantage of destroying the paper.

8. Write with lemon, onion, leek, cabbage, or artichoke juice. Characters written with these juices become very visible when the paper is heated.

INKS THAT APPEAR UNDER THE INFLUENCE OF LIGHT.

9. Chloride of gold serves for forming characters that appear only as long as the paper is exposed to daylight, say for an hour at least.

10. Write with a solution made by dissolving one part of nitrate of silver in 1,000 parts of distilled water. When submitted to daylight, the writing appears of a slate color or tawny brown.

INKS APPEARING THROUGH REAGENTS.

11. If writing be done with a solution of acetate of lead in distilled water, the characters will appear in black upon passing a solution of an alkaline sulphuret over the paper.

12. Characters written with a very weak solution of chloride of gold will become dark brown upon passing a solution of perchloride of tin over them.

13. Characters written with a solution of gallic acid in water will become black through a solution of sulphate of iron, and brown through the alkalies.

14. Upon writing on paper that contains but little sizing with a very clear solution of starch, and submitting the dry characters to the vapor of iodine, or passing over them a weak solution of iodide of potassium, the writing becomes blue, and disappears under the action of a solution of hyposulphite of soda in the proportions of 1 to 1,000.

15. Characters written with a ten per cent solution of nitrate of protoxide of mercury become black when the paper is moistened with liquid ammonia, orange red with a solution of, and gray through heat.

16. Characters written with a weak solution of the soluble chloride of platinum or iridium become black when the paper is submitted to mercurial vapor. This ink may be used for marking linen. It is indelible.—*Les Inventions Nouvelles.*

A New Expedition to the North Pole.

The London *Times* gives some details of the new expedition to the North Pole, for which the Norwegian National Assembly voted 200,000 kroner on June 30, and which will be under the charge of M. Nansen. Hitherto, with one possible exception, all attempts to reach the North Pole have been made in defiance of the obstacles of nature. It has been an open campaign between the endurance of man and the icy barrier of the Arctic Seas, in which nature has always been triumphant. On this occasion a systematic and well organized attempt will be made to ascertain if nature herself has not supplied a means of solving the difficulty, and if there is not, after all, a possibility of reaching the North Pole by utilizing certain natural facilities in these frozen seas of which all earlier explorers were ignorant. The circumstances on which these new hopes are founded may be thus summarized. The Jeannette expedition of 1879–81 and the loss of that vessel seemed to sound the knell of all expeditions to reach the Pole by Behring Straits; but in the end the results of that effort are shown to have been more satisfactory and auspicious than any of the officers of the Jeannette could have hoped for when, with extreme difficulty, they succeeded in reaching Siberia across the ice from their wrecked vessel. In June, 1884, exactly three years after the Jeannette sank, there were found near Julianshaab, in Greenland, several articles which had belonged to the Jeannette and been abandoned at the time of its wreck by the crew, and which had been carried to the coast of Greenland, from the opposite side of the Polar Sea, on a piece of ice. This fact at once aroused curiosity as to how it accomplished the journey across the Arctic Ocean, and as to what unknown current had borne the message from Behring Straits to Greenland. However these objects reached Julianshaab, they could not have come in an eastern direction, through Smith's Sound, for the only current which reaches Julianshaab is that from the eastern coast of Greenland *via* Cape Farewell and the north. Nor is there much probability that they were borne in a western direction from the place where the Jeannette sank, for all the currents round Nova Zembla, Franz Josef Land, and Spitzbergen are known, and it seems impossible for the ice bearing the relics of the unfortunate Jeannette to have traversed the intervening distance in the space of three years, even if it were possible at all. There remains only the alternative that there is a comparatively short and direct route across the Arctic Ocean by way of the North Pole, and that nature herself has supplied a means of communication, however uncertain, across it. Increased significance to the discovery of the Jeannette relics in 1884 was given by the identification in 1886 of bows found on the coast of Greenland with those by the Eskimo in the vicinity of Behring Straits, at Port Clarence, Norton Sound, and the mouth of the Yukon River. M. Nansen's expedition will endeavor to realize these hopes of a direct route across the apex of the Arctic Ocean. A specially constructed boat of 170 tons will be built, and provisions and fuel taken for five years, although it is hoped that two will suffice. The expedition will consist of ten or twelve men, and M. Nansen proposes to leave Norway in February, 1892.

Valuable Points by a Plumber.

"If you want a point or two about cleaning waste pipes without sending for a plumber," said a retired member of the fraternity to a New York *Telegram* reporter, who was complaining of the trials of house ownership, "just listen to me. If I were still in the business I would not give away what I am going to tell you now, but as I am out of it I do not see why I may not help a friend. One of the most frequent and trying annoyances," he continued, "is the obstruction to the free, quick outlet of the waste water of the wash basin, the bath tub, and kitchen sink. This is caused by a gradual accumulation of small bits of refuse material, paper, rags, meat bone, or grease, which check and finally entirely stop the outflow of the waste, and then the plumber is called to remove the stoppage with his force pump. Sometimes this is accomplished, but often the pipe bits to be cut, and there is great inconvenience and expense. Just before retiring at night, pour into the clogged pipe enough liquid soda lye to fill the 'trap,' as it is called—or the bent part of the pipe just below the outlet. Be sure that no water runs into it until the next morning. During the night the lye will convert all the offal into soft soap, and the first current of water in the morning will wash it away and leave the pipe as clean as new. See? This is practical chemistry, yet few chemists would ever think of it."

Photographing in Colors.

Experiments with a view to photographing in permanent colors were made by Herschel in 1840, by Becquerel from 1847 to 1855, and by N. de St. Victor from 1851 to 1866; but without a coating of varnish the colors thus obtained faded within a couple of days at the longest. Now, Herr Franz Veress, of Klausenburg, Transylvania, has discovered a process to produce very brilliant colors that, according to *Iron*, have so far stood the test of a three weeks' exposure to ordinary daylight without suffering any change. The photographs were exhibited during a lecture delivered before the Society for the Propagation of Natural Sciences, as well as in the Photographic Institute of Vienna, but not yet exposed to the direct sunlight. The photographs are upon glass and upon paper. The former are diapositives, and, if looked through, show for the most part a ruby red ground color, with a picture in bright, sometimes brilliant, colors, from the deepest hue of ruby red—far deeper than the ground color—to light orange, with several shades of red and yellow, and from violet to aniline blue and the intensest, most brilliant blue. The same colors prevail also on the paper positives, which have all a grayish brown ground color, upon which the red inclines more to purple than ruby, and the violet is especially brilliant. Green is missing on all positives. Examination through a magnifying glass fails to detect any impurities in the pigment of the colors or vagueness in the contours of the pictures, and each color stands out from the other with striking distinctness. It is not known whether the colors are a real pigment or the effect of thin layers. The sensitive preparation is a silver chloride emulsion in collodion or in gelatine, and the solution, the preparation of which is the inventor's secret, is poured upon the glass or the paper, where it soon takes a brownish red color. The plate is put into a copying frame, and exposed to the rays from a transparent colored drawing, of which the negative picture is soon visible. The exposure has to last in the case of glass negatives two or three hours, and in case of paper at least three days, as the colors come out very slowly, but the picture having been fixed in an alkaline bath, the colors become brighter and more intense. The process in the camera would require an exposure lasting several weeks, but the latest improvements have greatly lessened the time of this kind of exposure only, especially for the paper negatives. The invention is believed to rest on a modification of the process described by H. Carey Lea some two years ago, of applying the photo chlorides of silver in the form of an emulsion.

The Tricentenary of the Microscope.

The magnifying power of lenses is a discovery whose origin is lost in the darkness of ages. Layard found a convex lens in the ruins of Nimrod's palace, and there would seem to be no doubt that the very delicate work of the ancient lapidaries owed its remarkable perfection to optical arrangements of greater or less simplicity that permitted of magnifying the apparent size of the objects worked.

Roger Bacon made known the magnifying power of segments of spherical glass, and a short time afterward appeared the double opera glass, the invention of which is attributed to an Italian optician. But it was not till 1590 that the idea of combining lenses and of constructing a microscope, properly so called, was realized for the first time. This invention is due to Hans Zansz or Jansen and his son Zacharias, both manufacturers of double opera glasses at Middelburg, Holland.

The year 1890 therefore corresponds to the tricentenary of this important invention, and the population of Anvers has decided to celebrate this historic date by organizing an international microscopical exhibition in which will figure the ancient apparatus, those of intermediate epochs, and the most improved modern ones. This is a project of great scientific interest, and we can only express the sincerest wishes for its realization and success.—*La Nature.*

PAINT spots may be removed from wood by covering them with a thick coating of lime and soda. Wash off after twenty-four hours.

A MACHINE TO SUPERSEDE TYPESETTING.

In the SCIENTIFIC AMERICAN of March 9, 1889, appeared an illustration and description of a machine then being successfully operated in the New York *Tribune* office, and which superseded all typesetting in the ordinary way, as heretofore done by hand. The accompanying engraving represents the same machine, but with important improvements and modifications which have since then been made. The machine is constructed after the patents of Ottmar Mergenthaler, now controlled by the Mergenthaler Printing Company, of New York City, and is styled the linotype machine, because it casts lines or type blocks, as shown in the small view herewith, to be used instead of individual

A LINOTYPE, OR TYPE BLOCK OF ONE LINE.

types set up and "spaced" to make the required measure. To form these lines a matrix is necessary for each letter or character, these matrices being assembled in the proper order by operating a series of finger keys like those of the typewriter.

In the improved machine the matrices, instead of being held, as formerly, in vertical tubes just above the keyboard, one tube for each different letter or character, are contained in the channels of a magazine formed of properly grooved top and bottom plates, set at a little distance above the keyboard, and inclined toward it at an angle of about forty-five degrees.

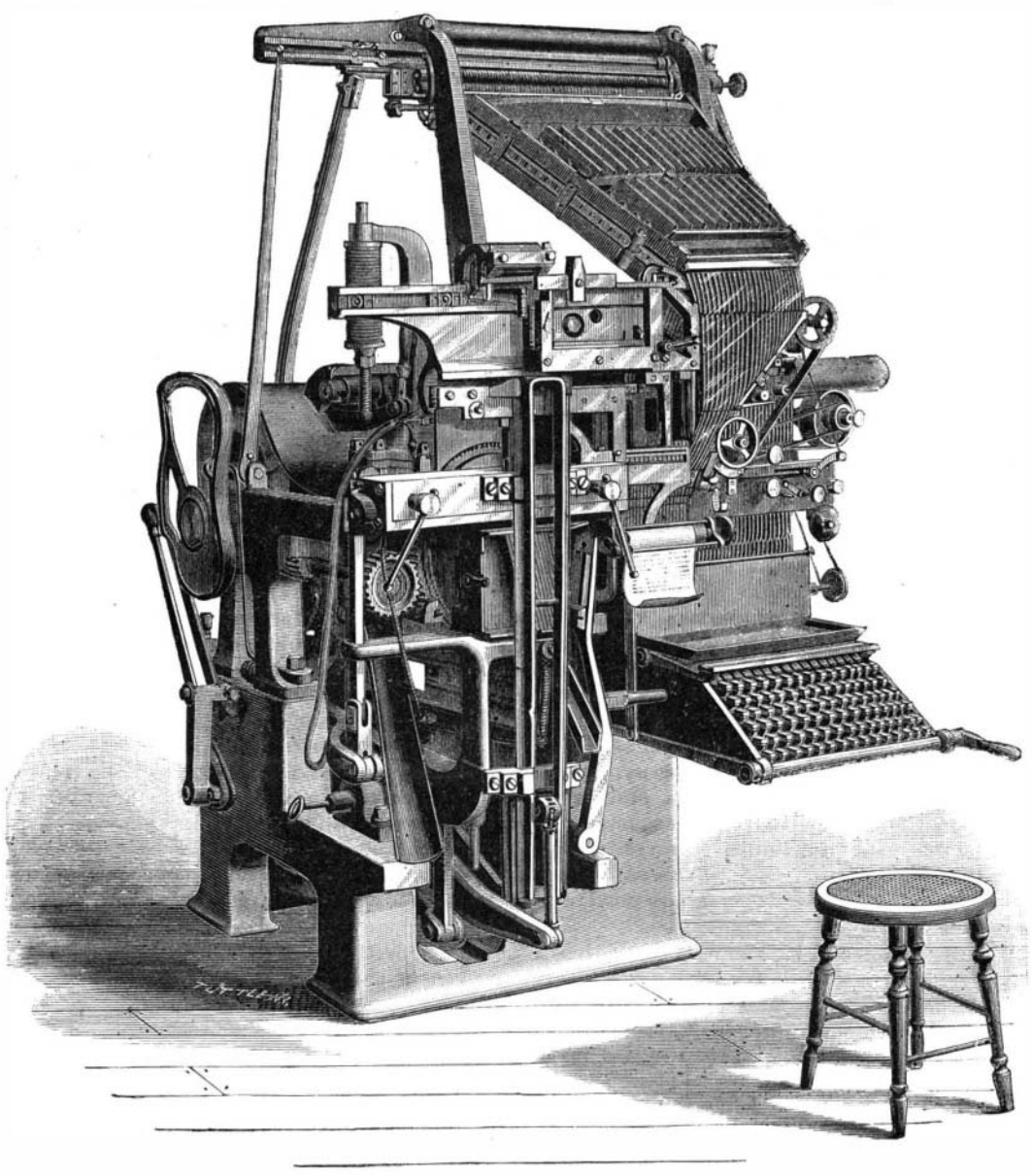
The matrices are flat pieces of brass, on the edge of which is the female die for forming its proper letter, and for each touch on one of the keys a single matrix drops from its inclined magazine down a vertical or nearly vertical chute to the point of assembling. The arrangement is such that no air blast is needed, as in the former machine, to bring the matrix quickly to its proper place in the formation of the line. To increase the speed of the matrices that are not in direct line vertically with the place of assembling, the vertical chutes at one side are made of gradually diminished length, the bottoms of the chutes of the chute section thus forming a sharp incline, just below which, and at a corresponding inclination, is a fast-running belt. In this way the matrices the farthest off come into position as quickly as those which are nearest, and there is no danger of transposition of the letters when the machine is worked at its highest speed. There is also a great advantage in the arrangement of the magazine with the grooved plates, instead of separate tubes, as heretofore, for, by making proportionate flanges on the sides of the matrices, one set of magazine plates can be used for matrices representing several different sizes of type, and the work of changing the machine from one size to another is but slight.

The work of "spacing" is essentially unchanged. The spaces are simply long, tapering wedges, dropped in their proper places by the operator in the same manner as a letter would be in the formation of a line, and, when it is seen that the line will take no more of the text, a simple touch of a lever pushes all the wedges simultaneously enough further in to make a perfect "justification," in which there is no possibility of uneven spacing. Thence the line of matrices, properly clamped, is taken automatically to a pot of metal automatically kept at the proper temperature, substantially as heretofore described, the type block is cast and deposited in proper order with its predecessors, and the matrices themselves taken to a distributing device at the top of the magazine, to the proper places in which they are returned, the whole work being done automatically. A great improvement in the direction of simplicity and positiveness of action has been effected in the distributing device, and the whole machine is much less complicated than formerly. To a person of sufficient intelligence it must be as easy to "learn to set type" with this machine as to acquire facility in operating a typewriter.

Much as printers generally are inclined to be skeptical as to the practicability of any typesetting machine in actual work, it is hardly possible to observe the operation of this machine without being convinced that, for ordinary composition, it is a remarkable success. A compositor will ordinarily compose or "set up" 1,000 to 1,200 ems an hour, and it requires one-third of his time in addition thereto to "distribute" his type, or put them back in the case. This machine performs both operations simultaneously, and at a speed equal to that of a typewriter. One but ordinarily expert in typewriting can readily write from thirty to forty words a minute, and, to illustrate the amount of composition accomplished at different rates of speed, a table has been prepared by an expert printer, from which it appears that

20	words a minute	equals	3,158	ems an	hour.
25	"	"	"	3,947	"	"
30	"	"	"	4,737	"	"
35	"	"	"	5,526	"	"
40	"	"	"	6,316	"	"
45	"	"	"	7,105	"	"
50	"	"	"	7,894	"	"
55	"	"	"	8,784	"	"
60	"	"	"	9,474	"	"

It is said that the machine can be run at the rate of 10,000 ems an hour, if the operator can work the keys fast enough, although from 5,000 to 6,000 ems an hour has been found to be about the highest practical speed thus far. The work is cleaner and much less tiresome than typesetting by hand, and to learn it is but the task of only a few hours. The machine in its old form has been for a considerable time in successful use in several large daily newspaper offices, in different sections of the country, and its importance has been recognized and is appreciated by the International Typographical Union, which directs practical printers to run the machines in all offices within its jurisdiction where they are used. The President of the New York Typographical Union, after witnessing recently a trial of the new machine, writes: "I conclude that the acme of perfection in a typesetting machine has been reached."



THE LINOTYPE MACHINE, TO SUPERSEDE TYPESETTING.

A New Gas Detector.

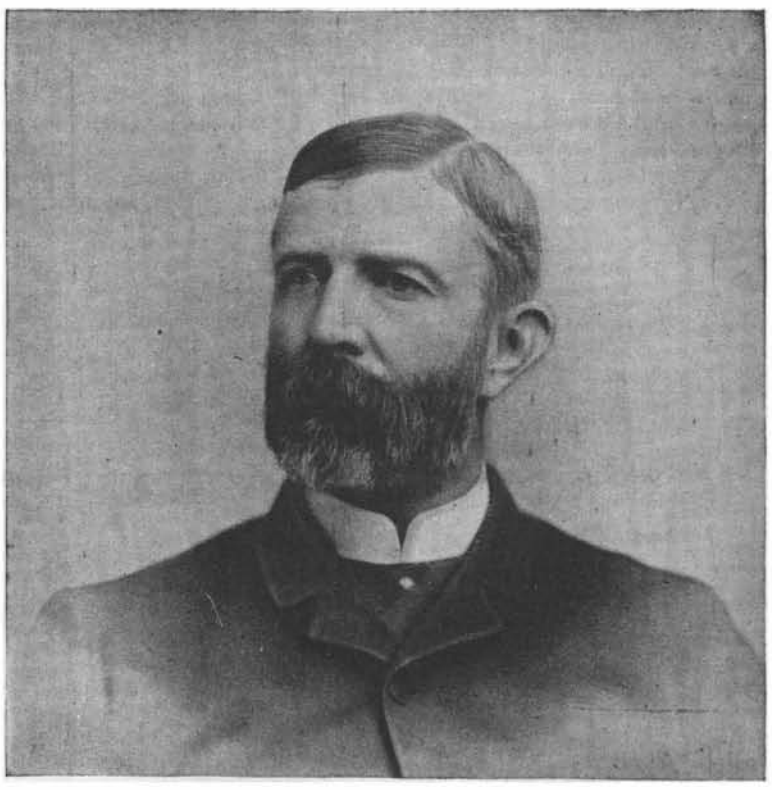
Spongy platinum, as is well known, glows in a mixture of combustible gas and air; but hitherto no convenient arrangement has been devised for utilizing this reaction. H. N. Warren proposes to saturate asbestos yarn with a saturated solution of platinum oxalate, and then ignite it in a platinum crucible. This prepared yarn when heated to 80° F. becomes incandescent in an atmosphere containing 0·5 per cent of coal gas by volume, and by arranging it by the side of the wick of an ordinary spirit lamp, it is easy, by lighting for a short time, to raise the temperature of the yarn to the requisite temperature, so that when the lamp is blown out it will become incandescent if there is any escape of coal gas in the neighborhood.

GEORGE LINCOLN GOODALE.

The American Association for the Advancement of Science celebrates this year the fiftieth anniversary of the organization of the Association of Geologists and Naturalists, from which it has descended. Last August, under the presidency of Thomas C. Mendenhall, the superintendent of the United States Coast and Geodetic Survey, it met in Toronto, but this year it returns to its native soil and gathers its members in Indianapolis for a second time, having previously, in 1871, convened there. The office of president rotates from the physical sciences to the natural sciences, and the able representative of the former class gives place this year to a distinguished botanist.

Professor Goodale was born in Saco, York County, Me., on August 3, 1839. Early in life he seems to have had distinct leanings toward science, for after completing his academic studies he took a practical course in pharmacy. He then entered Amherst College, and was graduated there in 1860. During a portion of the subsequent year he remained at college as assistant in chemistry and botany, pursuing private studies in the latter subject, under the direction of Professor Edward Tuckerman, the most distinguished lichenologist this country has ever seen. He then studied at the Harvard Medical School, whence, in 1863, he received the degree of M.D., and also in the same year received a similar degree from the Medical School of Maine, a department of Bowdoin College. Settling in Portland, Me., he there began the practice of his profession, and at the same time served as instructor of anatomy, materia medica, and surgery in the Portland School for Medical Instruction, receiving also, in 1864, the appointment of State Assayer of Maine. His health having become impaired, he made a sea voyage, in 1866, to Panama for its recovery, and returned by way of California, Nevada, Oregon, Washington, Idaho, Utah, and Colorado. In 1868 he was appointed professor of applied chemistry in Bowdoin College, and later instructor of materia medica in its medical school. Professor Goodale was transferred, in the following year, to the Josiah Little professorship of natural science, and also became a member of the State Board of Agriculture.

These various connections he resigned in 1872 to accept the place of instructor in botany at Harvard College, where he also became University lecturer on vegetable physiology. Since then he has been connected with the botanical work of this university. In 1873 he was made assistant professor of vegetable physiology, and five years later professor of botany. On the death of Asa Gray in 1888, he was chosen to succeed that distinguished scientist as Fisher professor of natural history, which chair he still fills. He has also been director of the Botanic Garden since 1879, and since 1881 he has been a member of the faculty of the Museum of Comparative Zoology of Harvard University. Besides these many duties he is a member of the council of the Harvard University library.



GEORGE LINCOLN GOODALE.

Professor Goodale's publications have been physiological and botanical. Soon after his appointment at Harvard he delivered a lecture on "Hybrids and Hybridization in Plants," and one on "Recent Researches in Regard to Seeds and their Germination," which were published in the "Annual Reports of the Massachusetts Board of Agriculture." He contributed the articles on "Vegetable Histology" and "Vegetable Physiology" to "Johnson's New Universal Cyclopedia," and in 1879 published his "Concerning a Few Common Plants." The text of the "Wild Flowers of North America," a quarto published in parts, with beautiful plates by Isaac Sprague, was written by him. He is also the author of "Practical Exercises in Histology and Vegetable Physiology" (New York, 1885) and of "Vegetable Histology" (1885) and "Vegetable Physiology" (1885). The two last named, with additional matter, have been combined under the title of "Physiological Botany," to form the second volume of Asa Gray's "Botanical Text Book" (1885). At present he is occupied with the preparation of an extensive treatise on "Economic Botany," illustrations of the useful products of plants in the Harvard University museum. A compedium of this work will be published in the series to which his "Physiological Botany" belongs. Professor Goodale is also associate editor of the *American Journal of Science*, the duties of which came to him on the death of Dr. Gray.

Of honors he has a fair share. The degree of A.M. has been conferred on him by Amherst and Bowdoin colleges, while the former at its recent commencement again honored him by conferring the degree of LL.D. upon him. He is a member of the Deutschen Botanischen-Gesellschaft in Berlin, also of the American Society of Physiologists and the American Society of Anatomists, while he has recently held the presidency of the Society of American Naturalists. Besides honorary or corresponding relationship to the Philadelphia Academy of Natural Science and the New York Academy of Sciences, he is one of the seven fellows in botany of the American Academy of Arts and Sciences. At the spring meeting held this year of the National Academy of Sciences, he was one of the four new members admitted to that distinguished body.

Professor Goodale joined the American Association for the Advancement of Science at the Salem meeting, held in 1869. He was advanced to the grade of fellow in 1875, and in 1888 was elected vice-president over the section on biology. At the Toronto meeting last year he delivered his address entitled "Protoplasm of Living Matter," in which he discussed the investigations made upon cellular tissue from the year 1667 down to the present time. At the close of the meeting he was chosen president of the association, and will preside at the forthcoming gathering.

White Lead by Electrolysis.

The new electrolytic process for the production of white lead is now in practical operation, and there appears to be no doubt of its commercial success. Estimating its production in expenditure of horse power, 152 pounds per day per horse power, or 27½ tons per year, is the result. The process may be briefly described as follows, employing technicalities as little as possible:

A solution is first prepared by dissolving sodium nitrate and ammonium nitrate in water in the proportion of 1 gallon of water to ⅛ pound of each of the nitrates. This solution must be saturated with carbon dioxide, which is best obtained by burning limestone, washing the gas thus produced, and supplying this gas directly to the solution while in the tank and subjected to the electrolytic action. After the solution has been placed in the tank, electrodes of metallic lead are immersed in it, and an electric current from a generating dynamo passed between them through the solution, and pure white lead is rapidly precipitated by the action. From time to time the white lead is removed, washed and dried, and may then be mixed with a suitable article to form paint. The supply of carbon dioxide must be maintained throughout the operation.

The white lead thus formed by electrolytic action, besides being produced more cheaply than heretofore, is found to have greater covering properties and to go further in actual use. Moreover, not the least valuable feature of this invention is that it substitutes an innocuous process for the very injurious operation of dissolving lead in acetic acid in the presence of carbonic acid. Thus electricity has added another boon to mankind. The discoverer of the process is Mr. Turner D. Bottome, of Hoosick, N. Y., U. S. A.

What is Invention?

The late Judge Hall, of the Circuit Court of the United States, says: "An invention, in the sense of the patent law, means the finding out, the contriving, the creating of something which did not exist and was not known before, and which can be made useful and advantageous in the pursuits of life, or which can add to the enjoyment of mankind. In other words, the thing patented must be new; and it must be useful to an appreciable extent, though the measure of that usefulness is not material. Any degree of utility appreciable by a jury is sufficient, upon the question of utility to sustain a patent."

Steam Engine Economy, Thurston's Process.

Among recent inventions which we have had opportunity to promote, we note one which has for its object the further improvement of the steam engine by the reduction of those internal and once mysterious wastes which are now known to constitute the most important part of the avoidable losses of heat and of steam in the engine, and which, unlike the thermodynamic wastes, are due to defects of the machine itself, and not of the process of heat and power conversion, defects of the cycle which must be adopted in its operation. In a paper recently read before the American Society of Civil Engineers, by Professor Thurston,* we find an account of the experiments made under his direction in the laboratories of the Sibley College of Cornell University to determine the efficiency of his process of treatment of the interior of the engine, with a view to securing less conductivity and heat-storing power, and thus of reducing the wastes and of increasing the efficiency of the machine.

The process is described at length in a patent which our readers have seen recorded already, among our notes of recent inventions, and consists of the following simple operations: The interior surfaces, such as are not acted upon by rubbing parts, the heads of the cylinder and the sides of the piston, and where practicable the ports of the engine, are first subjected to prolonged action of very dilute acid, like foundry "pickle" for example. This, if sufficiently dilute and if the treatment be sufficiently prolonged, has the effect, familiar to those of our readers who are familiar with the operation of condensing engines, as sometimes observed in the channel ways and other parts exposed to the wash of the warm water discharged from the condenser through air pump and hot well, that process which is sometimes, though improperly, described as "conversion into plumbago." The material so produced as surface covering is really, as shown by analyses made by Dr. Thurston many years ago, and at the time reported in the SCIENTIFIC AMERICAN, a mass of fine sponge of mixed iron oxide and metallic iron, of which the pores are filled by the graphite originally present as a constituent of the iron now dissolved out by the acid. Such a sponge will take up a certain portion of any fluid, and the sponge thus saturated becomes a comparatively good non-conductor for heat and a very poor storehouse for caloric. A surface thus protected can no longer act efficiently in receiving and storing heat, and it thus becomes impossible for the interior of the engine, where thus treated, to take up heat from the entering steam in as large quantities as before, and the waste is thus reduced, just in proportion as the conductivity and heat-storing power are by this method diminished.

The treatment with acid alone reduces the wastes considerably; but the addition of the coating of resin produced by the application of a drying oil is found by the inventor to be a very important gain. It was found that even a single application of the oil, with but twenty-four hours' drying, reduced the waste about *forty per cent.* Since the wastes in the ordinary engine seldom fall under one-fourth the total amount of steam supplied, and frequently are enormously greater, it is obvious that, should this, or an equivalent, process prove practically successful, the gain is likely to prove of serious importance.

Other experiments are in progress, and other researches are planned, looking toward a more complete investigation of the subject. We have also in our hands the papers exhibiting the details of other and what are anticipated to be still more perfect methods, devised by the same inventor, for securing these economies; and it is thought very possible that, in time, advances in the economy of the steam engine, through the use of these or other processes, may be chronicled which will give the steam engine another lease of that life which has been threatened by the advocates of the other motors. An extensive laboratory investigation will give, in time, a scientific basis for computation; and the experience of the builders of engines about to be thus constructed and treated will give a practical test of the real value of the invention.

Palpitation of the Heart.

Dr. Nebo (in *Journal de la Sante*) says that an excessive palpitation of the heart can always be arrested by bending double, with the head downward and the hands pendent, so as to produce a temporary congestion of the upper part of the body. In almost all cases of nervous or anemic palpitation, the heart immediately resumes its natural function. If the respiratory movements be suspended during this action, the effect is only the more rapid.

*Cresson meeting, June, 1890.

THE GREAT RAILWAY TUNNEL UNDER THE ST. CLAIR RIVER, BETWEEN THE UNITED STATES AND CANADA.

Owing to the steady increase of traffic over the Grand Trunk Railroad, of Canada, and the Chicago and Grand Trunk, Detroit, Grand Haven and Milwaukee, and the Toledo, Saginaw, and Muskegon railroads of the United States (practically one company) during the last few years, it became obvious that some other means of transit than the steam car ferry now in operation would be necessary, as that method is a great annual expense, and is also very unreliable, especially so in the winter, when the ice in Lake Huron becomes loose and is carried down the St. Clair River, often catching the ferry boat and carrying it down the river with it, with its cargo of passengers or freight. This necessitates the maintenance of a powerful tug, always in steam, and ready to go at a moment's notice to aid the ferry and break the ice if necessary.

In view of the extreme flatness of the country, and the low-lying ground in that part of the country, it was found impracticable to build a bridge, in consequence of the great height to which it would have to be carried, to allow of free navigation, as the traffic at this point is very great, and the current very swift, viz., eight miles an hour. So the construction of a tunnel was decided upon, to extend between Port Huron, Mich., on the American side, and Sarnia, on the Canadian side. The St. Clair Tunnel Co. was formed in the year 1886.

In the following year test shafts and tunnels on both sides of the river were completed, and attempts were then made to begin the work of the large tunnels by sinking large shafts; but the efforts failed, and after much loss of time and money, it was decided to open horizontal cuttings to the required depth on each side of the river, and in the headings thus formed carry the tunnel through on the proper grades by means of the Beach hydraulic shields. Work upon the great cuttings was begun in January, 1889.

The walls of the tunnel are constructed of cast iron segments, thirteen of which and a key form the circle. The dimensions of the cast iron segments are: Length, 4 feet 10 inches; width, 18 inches; thickness, 2 inches, with flanges inside 6 inches deep and 1¾ inches in thickness. These segments are cast with 32 holes in them, viz., 12 in each side flange, and 4 in each end; they are secured in their places with bolts ⅞ inch in diameter. The outside diameter of the tunnel is 21 feet, and 20 feet inside. The circle, taken by the bolts in the flanges, is 20 feet 5 inches.

The tunneling is being carried on by means of a pair of Beach hydraulic shields, one of which is employed in each heading. At this point a brief history of this device may not be uninteresting.

It is the invention of Mr. Alfred E. Beach, of the SCIENTIFIC AMERICAN, and was designed by him and tried in 1868 (patented 1869) for the purpose of excavating under the streets of New York, with a view to an underground railway. At that early period the need of rapid city transit for passengers was strongly felt, but there was great opposition on the part of property owners along the line of the proposed railway, through fear that the buildings would be injured if a tunnel were carried on a lower level than the foundations; added to which would be serious loss of business by the closing and tearing up of the streets during the construction of the work. Mr. Beach determined to show the fallacy of both of these objections by excavating a short piece of tunnel under the most crowded part of Broadway, at a lower depth than the adjacent buildings, and without interrupting business or traffic. He accordingly constructed the hydraulic shield or underground boring machine, which he set to work, and with it constructed a tunnel extending under Broadway from Warren Street to Park Place, large enough to receive a small street railway car, the length of the tunnel being between three hundred and four hundred feet. This tunnel was 9 ft. 4 in. in exterior diameter. It was started at the head of Warren Street, from which it turned underground on a radius of about 50 ft. into Broadway. The curved portion of the tunnel was walled with cast iron plates, put up in segments and united by means of screw bolts; the straight portion was walled with brick masonry. The object of the shield was to protect the workmen while excavating the earth and building the tunnel.

The shield consists of a strong cylinder somewhat resembling a huge barrel with both heads removed. The front end of the cylinder is sharpened, so as to have a cutting edge to enter the earth. The rear end of the cylinder, for a length of two feet or so, is made quite thin, and is called the hood. Arranged around the main walls of the cylinder and longitudinal therewith are a series of hydraulic jacks, all operated from a common pump, each jack having cocks, whereby it may be cut off from the pump whenever desired.

Within the shield are vertical and horizontal braces and shelves. When at work, the iron plates or the masonry, of which the tunnel is composed, are first built up within the thin hood of the shield, the hydraulic jacks are then made to press against the end of the tunnel plates or masonry, which has the effect to push the shield ahead into the earth for a distance equal to the length of the pistons of the jacks, say two feet, or not quite the length of the hood, and as the shield advances, men employed in the front of the shield dig out and carry back the earth through the shield. By the advance of the shield, the hood, within which the iron or masonry tunnel is built, is drawn partly off from and ahead of the constructed tunnel, thus leaving the hood empty. The pistons of the hydraulic jacks are then shoved back into their cylinders, and a new section of tunnel is built up within the hood as before described. The shield is then pushed ahead, and so on. The extreme end of the tunnel is always within and covered and protected by the hood. In this manner the earth is rapidly excavated or bored out, and the tunnel built, without disturbing the surface of the ground.

The floor of the Broadway tunnel above mentioned was 21½ feet below the pavement. It was carried under sewers and beneath the Croton water mains. The work was executed while the street was thronged with omnibuses and heavy teams, and few persons, except those directly interested, had any knowledge that a tunnel was in progress until after it was completed. It was then opened to the public, and many thousands of people enjoyed the privilege of riding in the car, which was worked back and forth in the tunnel by the pneumatic or air pressure system.

By means of the system of hydraulic jacks capable of either combined or separate action, Mr. Beach was enabled to govern the direction of his tunneling shield with the utmost precision, making it to ascend or descend in the earth, according to grade required, or travel on a curve of any desired radius. The first machine attracted much attention on the part of engineers. It was illustrated and described in the SCIENTIFIC AMERICAN of March 5, 1870, also in the *Manufacturer and Builder* of the following year, and in various other publications.

Since the construction of the Broadway tunnel the Beach hydraulic shield has been employed on a number of important engineering works, with much success, and it is now generally recognized as an important adjunct in the execution of various classes of underground tunnels. At Buffalo it was used to carry a large sewer under a main street and under a canal. At Chicago it was used in the construction of one of the lake tunnels. In London, 1886-89, it was employed in the construction of the City and Southwark Subways, recently completed, and soon to be opened for public traffic as the underground electric railways. These two tunnels extend from the Monument, London, and pass under the Thames River, Great Dover Street, Kennington Park road, and other thoroughfares to Clapham, a distance of about three miles. The exterior diameter of each of these tunnels is 11 ft. 6 in.

The Beach hydraulic shield has also been brought into use recently in the railway tunnels now in process of construction under the Hudson River, between New York and Jersey City, N. J. The shields here used have an external diameter of 19 ft. 11 in.

As before stated, the tunneling of the St. Clair River is being carried on by means of the Beach hydraulic shields, which precede the diggers. This remarkable machine is illustrated on our first page. Each shield is circular, 21 feet 7 inches in diameter, 16 feet long, and is built of plate steel one inch thick. It is divided into twelve compartments by means of two horizontal and three vertical stays, which are built up to a thickness of two inches. These stays have a knife edge in front and extend back ten feet, leaving six feet of clear cylinder, into which the end of the tunnel extends. Ten of the compartments are permanently closed and bracings of angle iron placed across them. The other two are provided with heavy iron doors, which can be closed at once in case of accident or danger. These doors are situated at the bottom in the center, and through them is passed all the excavated matter. Flush with this heading (with their cylinders extending forward into the compartments) are twenty-four hydraulic rams at equal distances around the shield. These rams are eight inches in diameter and have a stroke of 24 inches. By their means the shield is forced forward enough to admit of another section of castings, viz., 18 inches. Each of these rams can be worked separately, as may be seen by the sketch of the back view of the shield.

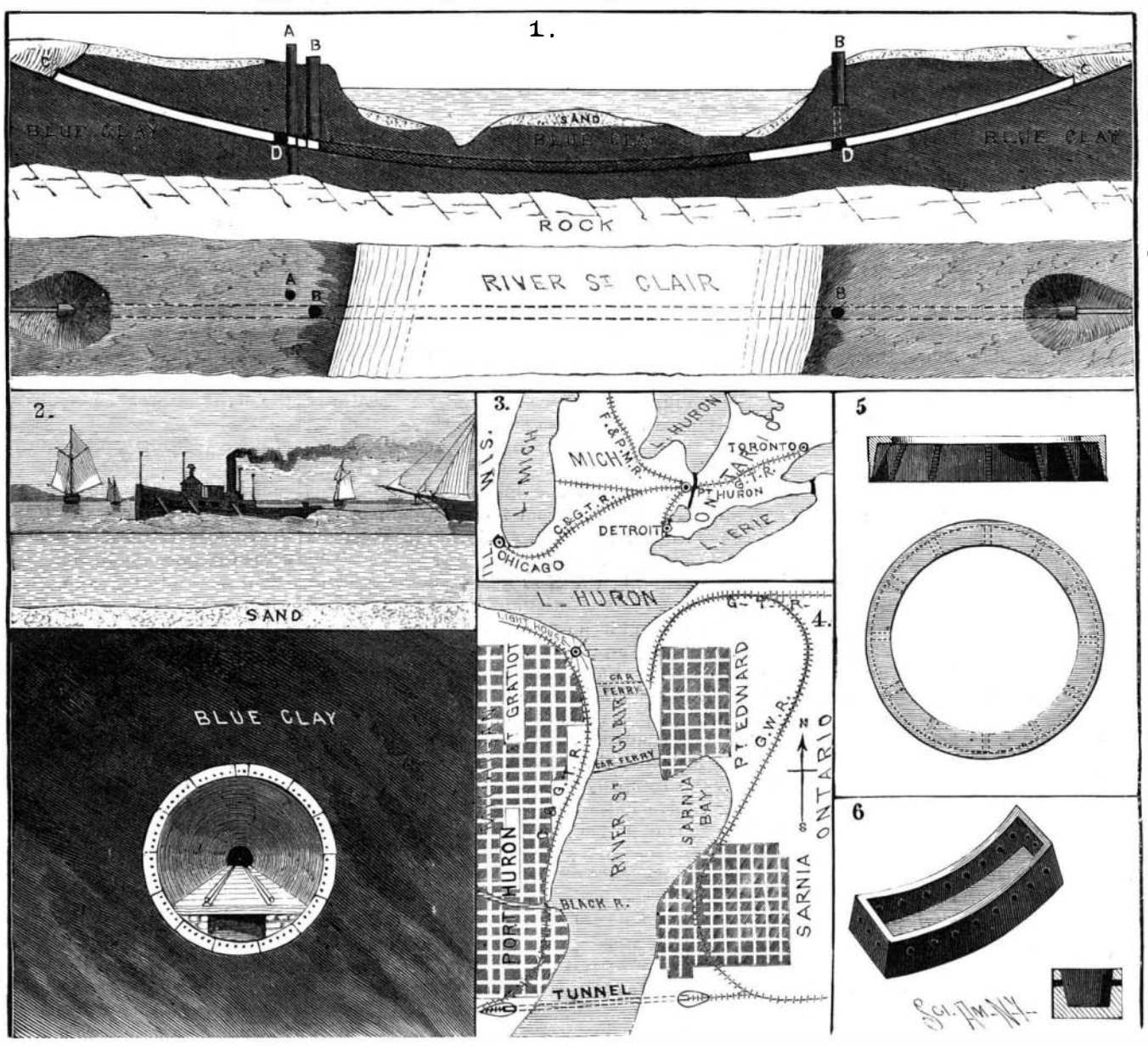


Fig. 1.—Sectional elevation and plan of tunnel; A, pump shaft, B, brick air shafts, C, cuttings, DD, bulkheads. Fig. 2.—Cross section of tunnel and river. Fig. 3.—Map showing location. Fig. 4.—Plan of Pt. Huron and Sarnia, showing position of tunnel. Fig. 5.—Section and plan of iron shoe of shaft. Fig. 6.—Segment of cast iron of which the tunnel is composed.

The power is supplied by a Worthington pump, which is capable of producing a pressure of 5,000 pounds per square inch, which will amount to 125 tons per ram, or 3,000 tons on the 24 rams. The greatest pressure as yet used is 1,700 pounds per square inch, which is 40 tons per ram, and 1,060 tons on the shield. These shields weigh eighty tons each, and were built by the Tool Manufacturing Company, of Hamilton, Canada. They were brought to their destination in pieces, and erected on the tops of the great cuttings, on the north side in both cases, at which side are also the machine and work shops which have been erected. This immense machine, when completed, was rolled down the side of the cutting on a wooden track composed of four rails of wood, each one foot square and placed about four feet apart. It was restrained in its downward course by means of six large ropes, which were passed around it, fixed at one end to the upper end of the wooden track and coiled around piles, with a number of men to lower out when the order was given. From the time at which the machine first moved to the time it was resting on the cradle of wood (which was prepared for it) at the bottom was only one hour and twenty minutes. A better idea can be obtained by referring to the engraving (Fig. 5), which is taken from a photograph, and which shows them in the act of lowering the shield on the Canadian side. When in position a backing of timbers one foot square was erected against the dead clay, and to this backing the first section of the tunnel was bolted, and others were added by means of the derrick, which is shown in the engraving of the cutting on the American side. (See Fig. 2.) A similar backing was used on the Canadian side, with the exception that instead of having a solid back of clay as a support, it had a number of shores.

The erection of the castings composing the tunnel is accomplished by means of a circular crane, which revolves on a spindle in the center of the shield (see Figs. 1 and 3), and is provided with a vise at one end, with which to grip the casting, and a counterbalance weight at the other. When a casting has been made secure, the arm of the crane rises about nine inches, thereby shortening the vise arm and lengthening the counterbalance arm. This gives the cast iron segment a clearance to travel around to the desired point, where it can be placed in position by reversing the sliding motion.

The machinery plant necessary for this great undertaking is as follows: One boiler house, containing three boilers, two of which are kept in steam at a time; one machine shop, containing one planing machine, one drilling machine, and one bolt screwing machine. The planing machine is provided with an extra bed at each end, distant from the working bed about 2 feet. It is also supplied with an extra table. By this means the plane is kept almost incessantly at work, as while one table load is being planed the other table is being unloaded and loaded again. When one lot is finished the table is run on to one of the extra beds and the newly laden table on the other bed is placed on the plane. There is one carpenter's shop, one smith shop, one electric light room, containing two dynamos and engines, a room containing blower engine and blower, a hoisting engine in another apartment, and a pump in the pit to pump out loose water. This plant is precisely similar on both sides of the river.

The tunnel when completed will be 6,050 feet in length from cutting to cutting, and is divided as follows: From the American cutting to the river edge, 1,800 feet; from the Canadian cutting to the river edge, 1,950 feet; and distance across the St. Clair River, 2,300. Of this 6,050 feet, 4,150 feet has already been constructed, viz., 2,215 feet on the American side and 1,935 on the Canadian.

The tunnel proper was commenced in August of 1889, and the expedition with which it has been completed so far (for its manner of construction renders it complete as the shield proceeds) has beaten all previous records of tunnel construction, and has so far proved a success beyond expectations, inasmuch as it shows a fewer number of accidents than other types of tunnel, the most serious accident up to date being a broken leg. The idea of building this tunnel of cast iron segment originated with Mr. Joseph Hobson, of Hamilton, Ontario, who is chief engineer of the St. Clair Tunnel Company, and also chief engineer of the Great Western division of the G. T. R. of Canada. The fact that no less than 4,550 feet out of the 6,050 has been constructed speaks volumes for Mr. Hobson's skill in tunnel construction. At a meeting of directors a short time since, Sir Joseph Hickson is reported to have expressed his belief that the tunnel would be completed for traffic within 18 months. Mr. Thomas Murphy, of New York, who is superintendent of excavation, is thoroughly sanguine about its healthy state. Mr. Murphy is a man well versed in these matters, and is thoroughly competent, having been connected with the construction of several tunnels of note throughout the United States.

The tunnel will drain itself into the pump shaft, A, Fig. 1, on the Canadian side. This shaft is 18 feet in diameter and 112 feet in depth, being carried to the rock which lies at that depth.

The cost of this tunnel was estimated at $3,000,000, but it is now thought that (notwithstanding the immense amount of money expended on the test and brick shafts) it will not reach that figure. Should another tunnel be put through, which we shall not be at all surprised to see in the near future, we shall have a much fairer chance to compare the certain and marked advantages that the cast iron tunnel possesses over the old style brick and cement tunnels.

The tunnel proper is 6,050 feet in length and 21 feet outside diameter, the Beach hydraulic shield being 21 feet 6 inches in diameter. The amount of soil excavated for this portion of the work amounts to 2,196,400 cubic feet, and will require 55,962,500 pounds of cast iron lining, secured together with 859,242 bolts seven-eighths inch in diameter. The success attained by Mr. Hobson, in the face of so many obstacles and the difficult nature of the soil to be gone through, indicates his complete mastery of the subject, and reflects high credit upon his skill as an engineer. The tunnel construction furnishes employment for 700 hands.

REFERENCES TO THE ENGRAVING ON FIRST PAGE.

Fig. 1.—Rear view of the Beach hydraulic shield, showing the hood within which the tunnel is built and the heads of 24 hydraulic rams by which the shield is pushed ahead. Also showing the swinging crane for placing the cast iron segments.

Fig. 2.—The shield in place, on grade, and ready to enter the heading. The cutting edges of the shield are seen in front. At the rear of shield is seen a portion of the constructed iron tunnel pushed up against the temporary timber backing.

Fig. 3.—Interior view showing the Beach hydraulic shield as worked in the heading. The cast iron segments composing the tunnel are built up within the thin rear part or hood of the tunnel. The hydraulic rams are then made to press against the end of the tunnel, as shown, which forces the shield ahead and leaves the constructed tunnel behind in the earth. The swinging crane assists in placing the cast iron segments. As the shield advances, the men in the front part dig and throw back the earth.

Fig. 4.—The front of the shield, showing its cutting edges, its cross shelves and vertical supports.

Fig. 5.—The great shield as it appeared when being lowered by cables to its place at the heading.

American Industry in Cuba.

The rich iron ore deposits near the coast in the southeastern portion of Cuba are now in a fair way to be developed on a very extensive scale, by American enterprise, to help supply the demand for Bessemer ores in the United States. The Juragua Iron Co., established in 1883, was the first in this field. This company, whose office is in Philadelphia, has been extending its operations each year. In 1889 it shipped 256,278 gross tons of iron ore to this country from its Cuban mines, and it expects to ship over 300,000 tons during 1890. It was announced some time ago that a number of Cleveland capitalists, including the Hon Geo. H. Ely, president of the Western Ore Association, had secured control of an extensive tract of iron ore land in the vicinity of the Juragua Company's property. We are advised that these gentlemen are now making preparations to open up their portion of this iron ore region.

A third company is now in this field, called the Sigua Iron Co. This company was organized last spring, and represents Philadelphia capital. The property controlled by the company comprises about 34,000 acres, extending twelve miles along the coast and inland to the mines, the ore property, which includes about 2,000 acres, being about seven miles from Sigua Bay. This extent of territory gives the company ample room for mining towns, shops, harbor facilities, etc. The Sigua mines are about eight miles east of the Juragua mines. The Sigua River runs by the mines into Sigua Bay. The company is already preparing to build a railroad from the mines along the river to the bay and to provide suitable docks for shipping the ore.

The quality of the Sigua ore, which is red specular in character, is fairly shown by two analyses. The first analysis represents an average of all ore exposed on the surface of the ground, and is as follows: Iron, 58·10 per cent; silica, 15·50 per cent; phosphorus, 0·034 per cent; sulphur, 0·046 per cent. The second analysis was more carefully sorted, and was taken by knocking off three hundred small pieces. It resulted as follows: Iron, 64·20 per cent; silica, 5·10 per cent; phosphorus, 0·023 per cent; sulphur, 0·042 per cent. No traces were found of titanium or other substances which would render iron made from this ore poor in quality.

The estimated cost of delivering the ore from the Sigua mines to the docks at Philadelphia, including a royalty of 25 cents and the duty of 75 cents per ton, is $4.40.

The committee which examined the property included men thoroughly familiar with all the details of determining the quality of ore and of mining, transporting, selling, and smelting it. This committee was composed of Messrs. S. H. Chauvenet, David Thompson, Clarence M. Clark, E. V. D'Invillers, and Edmund D. Smith. Mr. Chauvenet was for nine years chief engineer of the Pennsylvania Steel Co., and later was manager of the Robesonia furnace, at Robesonia, Pa. Mr. Thomas is manager of the Thomas Iron Co., at Hokendauqua, Pa. Mr. Clark is first vice-president of the Virginia Development Co., which is opening up the mineral regions of Virginia. Mr. D'Invillers is an iron ore expert, and has been a member of the State Geological Survey of Pennsylvania. Mr. Smith has been actively engaged for twelve years in the handling and transportation of foreign and domestic iron ores. The committee also obtained the services of Mr. W. J. Rattle, the well known iron ore expert of the firm of Rattle & Nye, of Cleveland, to make a careful and conservative report upon the Sigua property. The reports made by Mr. Rattle and the committee were most favorable in all respects.

As at present constituted, the officers of the Sigua Iron Co. are as follows: President, S. H. Chauvenet; Vice-President, Thomas H. Graham; Secretary and Treasurer, George F. Baker; Chief Engineer, Captain D. B. Greene, the well known harbor expert. Included in the directory of the company are Edmund D. Smith and David Thomas. With such eminently practical men controlling its affairs, the success of the company is assured.—*Bulletin of the American Iron and Steel Association.*

Captain Ericsson.

John Ericsson, by virtue of his appointment as Knight Commander of the Royal Order of Isabella the Catholic, was a Spanish nobleman, and his position as Knight Commander, First Class, Danish Order of Dannebrog, gave him the title of "Excellency," with rank next to that of field marshal and admiral, and entitled him to the military honors due to a lieutenant-general. The army regulations provide, paragraphs 427, 449, that officers of foreign services shall be received and saluted according to their rank. It says nothing concerning funeral honors to be paid them, but the regulations provide that on the occasion of the burial of a lieutenant-general a salute of fifteen guns shall be fired and a funeral escort be provided, under the command of a lieutenant-general or an officer nearest to that grade in rank, to consist of a regiment of infantry, a battalion of cavalry and a battery of artillery (paragraphs 445, 467, 474, 475). As Ericsson ranked next after an admiral, or with a vice-admiral, under the Danish law, this fixes his status under the navy regulations governing the matter of funeral ceremonies. Aside altogether from the question of merit, the honors bestowed upon Ericsson while living may serve as a guide in the arrangement of the function attending the transfer of his remains to Sweden. Besides the decorations referred to, he received those of a knight of the Swedish Order of Vasa, a knight commander of the Norwegian Order of Saint Olof, and a knight commander with the Grand Cross of the Swedish Order of the Polar Star. He received by formal vote the thanks of the American Congress, of the Legislature of the State of New York and of the Swedish Diet. He never made any display of these honors, and when he was once asked what titles should accompany his name in the dedication of "Haswell's Engineering Handbook," he answered "Captain and LL.D." He was proud of the title of captain, received in his youth from the Swedish government, and of the degree bestowed as a recognition of his contributions to science. We have by no means given a catalogue of Ericsson's honors. They include the bestowal in 1862 of the Rumford Medal, which had up to that date been awarded but once before in this country, during a period of nearly three-quarters of a century since the establishment of this fund by Count Rumford.—*Army and Navy Journal.*

Lead in Lace.

Ph. De Clarmont gives an account, in *Le Moniteur de la Teinture*, of a white satin dress totally ruined by its trimming with English lace. The dress had been worn but once, had then been packed into a trunk which was deposited in a damp place and exposed to emanations of hydrosulphuric acid from gas. When taken out, it was found that the pattern of the lace, particularly of its tulle ground, had been printed in indelible black upon the white satin. The accident was not difficult to explain. English lace is habitually charged with sulphate of lead, which in this case had absorbed hydrogen and hydrosulphuric acid from the atmosphere, forming sulphide of lead, which had been imprinted and fixed upon the white satin, which naturally had also absorbed hydrogen and hydrosulphuric acid. The seller of the lace showed that charging English lace with white lead (sulphate of lead) was commercial usage, and thereby escaped paying the damage. An objectionable usage it is at any rate, as the absorption of lead through the skin from such lace may become dangerous to health.

The Cost of Firing a 110 Ton Gun.

According to a calculation made by the *Economiste Belge*, the cost of firing a 110 ton gun is, in round numbers, $832, divided as follows:

900 lb. of powder	$380
1,980 lb. projectile	435
Silk for cartridge	17
	$832

But this is not all. The 110 ton gun, it appears, can be fired but 95 times, and after that becomes incapable of being used, and requires repairs. Now, the cost of the piece being $82,400, it is necessary to estimate the cost of wear at about $868 for each shot, thus raising the cost of each charge to $1,700.

Correspondence.

To the Editor of the Scientific American:

I have made the simple electric motor and it works splendidly. I have it running two sewing machines in our show window. I have also made a smaller motor and car, and have it running on a track in show window. I supply the current through the rails. It makes a fine show. D. O. THAYER.

Sioux Falls, South Dakota, July 23, 1890.

To the Editor of the Scientific American:

I see in SCIENTIFIC AMERICAN of July 19 that you would like to know what we amateur electrical workers are doing: Well, first of all, I made "The Simple Electric Motor," described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641. Made it "plump up" to instructions. It works splendidly. I use it to run my No. 1½ Whitcomb lathe, and it does the work. I use the current from the Edison electric light wires. I then made German silver rheostat described in SCIENTIFIC AMERICAN, September 14, 1889. I use this in connection with the motor. With the rheostat I can regulate the motor for doing heavy or light work. I followed the directions in making, except I used another coil instead of straight wire to go back to the top. I also tried my hand on the "Watch Demagnetizer" described in SCIENTIFIC AMERICAN, October 2, 1886. With it I can magnetize or demagnetize a piece of steel at will. I then made a galvanometer; it has been used, in connection with a battery, to hunt broken electric light wires, and has proved a success. Have made electric bells from instructions given in SCIENTIFIC AMERICAN, and they have always worked all right. Have made other articles besides electrical, and with as good success. I have found, if you want to make anything that is described in the SCIENTIFIC AMERICAN, *read carefully* the instructions, and follow them closely, and you will have no trouble.

G. H. SPANGLE.

Chetopa, Kan., July 23, 1890.

Smokeless Powder.

Mr. A. Jaksch has had an opportunity of examining a new kind of powder sold by an English house under the name of "smokeless sporting powder." This powder is in grains that are nearly white and resemble semoule. It was found that it was a mixture of wood nitrocellulose with 4 per cent of nitrate of barytes. It burns with very little smoke and does not produce so strong a detonation as ordinary sporting powder does. An identical composition has been obtained by operating as follows:

Purified wood cellulose is gradually introduced into a very cold mixture of one part of fuming nitric acid and two parts of concentrated sulphuric acid until a thick pulp is formed. After six hours' contact, the pulp is washed, first with cold and then with warm and slightly ammoniacal water. The washed product is boiled in a concentrated solution of nitrate of baryta, gently compressed, and dried at 40° C. In order to granulate it (an operation that is not indispensable), machines devised for the purpose are necessary.

It is probable that this smokeless powder is the same that was offered two years ago, by an English house, to the Austrian and German governments, and refused after an examination.—*Le Moniteur Scientifique.*

Nickel Steel.

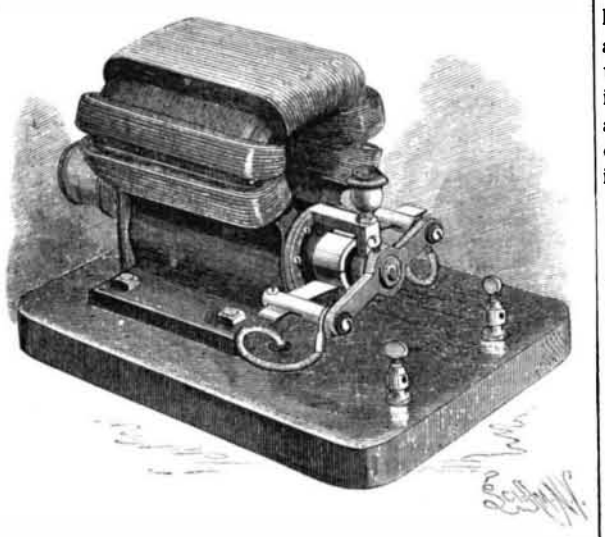
From experiments on samples of wire drawn from nickel steel containing 25 per cent of nickel and 74 per per cent iron, by the Steel Company of Scotland, the author finds that nickel steel can exist in two states, magnetic and non-magnetic, over a range of temperature from below freezing to 580° C. The wire becomes non-magnetizable after heating to redness, whether cooled slowly or by being plunged into water, but when cooled by solid carbonic acid it resumes its magnetizable state. The electric resistance is very different in the two states, and the change in resistance effected by cooling with solid carbonic acid is almost as remarkable as the change in magnetic properties.

Of five non-magnetizable samples, the highest breaking stress was 50·52 tons per square inch, the lowest 48·75; the greatest extension 33·3 per cent, the lowest 30. Of five magnetizable samples, the highest breaking stress was 88·12 tons, the lowest 85·76; highest extension 8·33 per cent, lowest 6·70. The broken fragments of both were magnetizable.—*J. Hopkinson.*

AMONG recent arrivals in New York came one of England's fastest amateur safety riders, Mr. H. E. Laurie. Mr. Laurie is but nineteen years of age, stands 5 feet 8½ inches in his stockings, and weighs 163 pounds. In appearance Mr. Laurie is the picture of health and vitality. His racing career began five years ago on a tricycle, and he has ridden the safety bicycle three years, on which machine he has been scratch man in all handicap events for the past two years, and has won 174 prizes. When seventeen years of age he rode 21 miles 125 yards inside the hour, which is still the English record

NEW VICTOR No. 0 ELECTROPLATING DYNAMO.

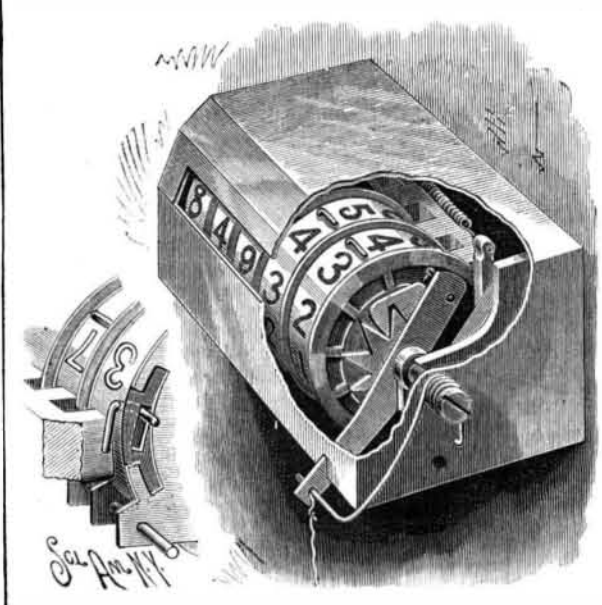
We illustrate herewith a new electroplating dynamo, which has just been brought out by Mr. Thomas Hall, of No. 19 Bromfield Street, Boston, Mass., and is furnished at a low price. He styles it the Victor No. 0. It is furnished with a switch board, and is a complete dynamo for electroplaters' use. It gives a current of 10 volts, and is suited for either gold, silver, or nickel plating. It is an excellent working machine, and will be found useful to manufacturers who wish to do their own plating, or others who wish a small dynamo for small work. These machines have many advantages over batteries: they are clean, require little attention, there is no unpleasant odor, as from acids used in batteries, and they are always ready to work. Mr. Hall has several sizes of dynamos for electroplaters and nickelplaters, but the No. 0 has been designed especially for beginners, or those who wish to use it on a small scale. A fully illustrated catalogue will be sent to those interested on application.



HALL'S ELECTROPLATING DYNAMO.

AN IMPROVED REGISTER OR COUNTER.

The device shown in the illustration has its counting or numbering wheels actuated by direct mechanical movement, without the use or aid of springs. It has been patented by Mr. Rudolph Ruhlman, of No. 167 Cooper Street, Trenton, N. J. In a suitable casing, having a longitudinal opening through which the numbers may be read, the numbering wheels are mounted to turn loosely on a fixed shaft held in brackets fastened to the back of the casing. On the end of the shaft next to the units wheel is a loosely swinging lever, the lower end of which extends through a transverse slot in the casing, where it is connected by a rope or other suitable device with the machine whose revolutions are to be counted, while its upper end carries a double-toothed pawl, to firmly grasp one of the teeth



RUHLMAN'S REGISTER FOR ENGINES OR MACHINES.

of a ratchet wheel on the outer face of the units wheel. This wheel has ten teeth, and ten strokes of the lever cause it to make one complete revolution. Ordinarily the machine imparts motion to the lever in only one direction, the return motion being made by a spring, but this movement may also be made directly by the machine, or by counterbalancing the lever. The pawl is a gravity pawl, and there is a pin on the lever to limit the outwardly swinging motion of the pawl when it moves backward over the teeth on the return stroke, while a friction brake is provided to prevent the units wheel from being moved too far by the motion of the pawl, this brake being spring-pressed against the outer face of the wheel. Each of the numbering wheels is provided with a lever, shown in the small view, composed of an arm extending normally longitudinally across the face of the wheel, a radially extending part which turns in the periphery of the wheel on its left side, and, on the inner end of this radial part, an arm standing at right angles to the arm first named, and free to turn in a recess within the wheel, so that when the outer arm is given one-quarter turn the inner arm will be thrown outward into engagement with the next numbering wheel. Fixed disks are arranged between each two adjacent numbering wheels, each disk having a segmental slot through which the inner arm of the lever is adapted to move. and on the right side of all the numbering wheels are flanges, each provided with ten radial arms. A fixed lug or projection, as shown in the small view, is arranged in the rear of each numbering wheel, adapted to engage its lever, extending longitudinally across the face of the wheel. With this arrangement, as the units wheel completes one revolution, the lug engages the outer arm of the lever, throwing its inner arm into longitudinal position, to engage a radial arm on the next wheel and move that wheel a distance of one tooth, the lever being turned back to its normal position by the fixed slotted disk between the wheels on the next forward stroke of the pawl. In this way, at every tenth revolution of the units wheel two wheels are moved, at every one hundredth three wheels, at every one thousandth four wheels, and at every ten thousandth five wheels, the movement being always positive and the several parts not liable to get out of order.

Effect of Lightning upon Trees.

It is a well known fact that the oak is very often struck by lightning, but it is not so well known that the beech is but very rarely struck.

From the standpoint of atmospheric electricity, the degree of danger attending the taking of shelter under a tree during a storm depends upon the height of the tree, the greater or less conductivity given it by its more or less abundant sap, and the degree of electric tension that may accumulate in it.

Mr. Werckert, of Bischofsheim, Alsace, has made some very simple experiments that seem to prove that the nature of the leaves is very important from the standpoint of electric action.

While the leaves of the common oak (*Quercus pedunculata?*) are entirely smooth, those of the beech (*Fagus sylvatica*) are very villous. Placed upon a glass plate electric machine, the branches of the beech, owing to the innumerable points that they possess, dissipate the electricity so well that but half the tension can be obtained that we reach when the branches of the beech are replaced by those of the oak.

It has likewise been remarked that a beech leaf placed upon a conductor charged with electricity dissipates the charge much more rapidly than an oak leaf does.

These experiments prove that the nature of the leaves has a great influence upon the danger that different trees present as objects of shelter, and that villous leaves, like those of the beech, appear to prevent the accumulation of electricity, while, on the contrary, they favor the slow neutralization of the fluid through the action of the innumerable small points with which they are provided.—*Annales Industrielles.*

American Built Cars for Europe.

The Jackson & Sharp Works, at Wilmington, Del., are building passenger cars for the railways in France, Spain and Austria. Mr. William Voss, writing about the cars after a visit to the works, says: They are a curious mixture of European and American practice, and are built according to complete sets of drawings sent over. Of course it is sectional work, like that sent to South America. These cars are about 50 feet long, some of them day coaches and others of the Mann boudoir style of sleeper. They have combination wood and iron sills, bogie trucks, the old country drawhook and buffers, etc. All the heater and water pipes are of copper, windows run in brass guides (a very good but expensive thing). There is a vestibule at each end, but they do not touch like ours, being about four feet apart when coupled, and iron aprons and railings form the bridge. The entrance is through the vestibule and steps like ours, but different. The exterior is mahogany, natural wood finish. Roof much like ours, and is covered with canvas and sheet copper on ends and eaves. Some of the cars have been shipped, six or twelve more are almost done, and a lot of six is just being erected.—*National Car and Locomotive Builder.*

Ocean Timber Rafts.

The steam schooner Noyo, from Noyo, lately arrived at San Francisco with a raft of 500 and odd piles in tow. They were consigned to the Southern Pacific Railroad Company, and are intended for the repair and construction of bridges on its lines.

This is the fifth or sixth trip with rafts of the Noyo, and each of its voyages has turned out successfully, so says the *Pacific Lumberman.* The rafts are constructed one deep. They are made of lots of thirty piles each. The piles are bored through, and a chain passed around the lot. Each lot in its turn is attached to the main chain by which they are towed.

RECENTLY PATENTED INVENTIONS.

Electrical.

RHEOSTAT. — Thomas J. Parrish, Nevada, Mo. The base plate of this device is preferably made of hard rubber, brass or wood, with binding postsat one end and at the other end an upright supporting a helical coil with hollow central chamber, where a slide is arranged to move into or out of the coil, an external spring being adapted to bear upon different portions of the exterior of the coil to transmit the current through more or less of the coil, as desired.

PHONOGRAPH. — James . P. Magenis, North Adams, Mass. This is a device in which, combined with the record cylinders, is a mouthpiece furnished with diaphragms having tracing points, a track to support the mouthpiece in the position of use, and other novel features, forming a phonograph in which a record may be made on two cylinders simultaneously, so that one may be retained as a file, or a message may be repeated from one cylinder to another.

SUPPORT FOR TELEPHONE RECEIVERS. —Simon Lebenberg, Berlin, Germany. This is a device to enable the receiver to be held and adjusted for use to leave the hand at liberty for writing, etc., and consists of a horizontal jointed bracket in vertical bearings, a vertically movable upright in the outer member of the bracket, with a horizontal arm having at its outer end vertical spring clamps and connected by a universal joint to the upright.

DRILL HOLE MAGNET. — Charles S. Porter, Ivanhoe Furnace, Va. This is a magnet for lifting particles of iron and steel, broken bits, etc., from drill holes, being a permanent bar maguet flattened at one end and perforated to receive the link of a chain, while the keeper is formed of a bar of soft iron with its ends curved over toward each other and fitted to tightly clamp the ends of the permanent magnet, to preserve its strength when not in use.

Mechanical.

SANDPAPERING MACHINE. — Axel K. Hatteberg, Marshfield, Wis. This is a machine which provides for the holding of the work in yielding contact with the sandpapering cylinders, for a reciprocation of these cylinders in a line parallel with the shaft axes, and for the adjustment of the machine so that it can be readily used with material of different thicknesses.

SPINNING AND TWISTING. — Johann Boelsterli, Fussen, Bavaria, Germany. This is flier and drag device for spinning and twisting machines in which the flier is independent of the bobbin spindle and terminates in a tubular spindle which rotates on a fixed bearing, the fibrous substance passing through this spindle or its bearing, over one arm of the flier, and downward and around half of the periphery of a ring connecting the ends of the flier arms, and thence to the spool, making a stronger spindle and giving easier access to it.

MOTIVE POWER FOR JIGGERS.—James Nicholas, Benton, Wis. The upper ends of the pitmen of two oppositely placed balance wheels are secured to the outer ends of the tongues of one or more jigging machines, a large central drive cog wheel, rotated by a crank handle, communicating rapid motion to the balance wheels through side shafts and pinions, whereby the work will be lightened and its amount greatly increased, the device being also applicable to a variety of other uses.

VISE.—Charles Wies, Faulkton, South Dakota. This is an improvement in that class of vises whose sliding jaw is operated by a cam lever pivoted on the fixed jaw, and having a pendent lip or flange engaging shoulders or teeth on the shank of the sliding jaw, the novel feature being the means for pivoting and detachably holding the cam lever on the fixed jaw.

Miscellaneous.

MAP CASE. — Charles M. Terrell and Hiram M. Chittenden, Omaha, Neb. This case has a transparent front, and two rollers are revolubly mounted in the case at proper distances apart, a web of flexible material being wrapped on the rollers and adapted by simple mechanism to be transferred from roller to roller reciprocally, thereby exposing any map, design, engraving, or like article to view, as it is drawn before the transparent face of the case.

TIME AND DATE CALCULATOR. — William R. Will, Baltimore, Md. This is a device more especially for use in banks and offices for mechanically determining the number of days between two dates, and consists of two stationary concentric scales oppositely numbered from 1 to 365, combined with a similarly numbered rotary adjustable circular scale, with other novel features.

AERIAL MACHINE. — Stewart Cairncross, Grafton, North Dakota. The gas bag of this machine is held to a suitable frame by netting, and on the lower face of the frame is a shaft carrying a propeller wheel to be operated by gearing devices from the cage below, the machine being normally adjusted to counterbalance the weight of the operator, so that it will only rise as he operates the propeller wheel, but the adjustment being such as to permit guiding the machine in any direction.

MIDDLINGS PURIFIER. — Robert L. Hottel, Cedarville, Cal. This is a machine designed to be simple and durable in construction and very effective in operation, the invention covering various novel parts and details and their combinations.

FRACTURE APPARATUS. — Thomas M. Miller, Medford, Wis. This invention provides a device whereby a fractured limb may be held in position for bandaging or the application of plaster of Paris with the least inconvenience to the patient, while affording great facility for the operator, and whereby also the limb may be stretched or raised and lowered as desired, with rests for the limb capable of lateral adjustment.

COAL ELEVATOR.—Angus H. McLean, Saginaw, Mich. This elevator is designed especially for loading coal from a bin into the tender of an engine, and provides means whereby the bucket will be raised by the engine, and at the proper moment, as the tender is brought in front of the bucket, the latter will be dumped to deliver the coal into the tender.

BOX CLAMP.—Robert H. Blair, Kansas City, Mo. This is a clamp especially adapted for use on boxes containing nursery stock, where there is considerable spring to the sides of the box, the clamp consisting essentially of two upright side pieces adapted to fit against the sides of the box, each piece having an angular lower end to fit beneath the box, and having notches near the top, a cross bar with a slot in one end fitting upon the side pieces, provided with a swinging lever adapted to engage the notches.

VEHICLE SPRING. — Phaon J. Kern, Frankfort, Ind. This invention relates more particularly to springs for road carts, providing what is designed to be a simple, cheap, and effective arrangement of springs, the invention consisting in the novel arrangement and peculiar combination of parts.

DESK AND ITS SUPPORTS.—William A. Roos, New York City. This invention is more particularly designed for a window desk, or for desks to be used in doorways, and other places, and provides novel combinations of parts for supporting the desk, adjusting its top to various angles, shutting or closing it when not needed, and its ready attachment and detachment.

STEAM FOOD COOKER. — Olive C. Christin, Bodie, Cal. This cooker has several sections, the lower one being a boiler and the upper sections divided into compartments with through and through passages for the steam, whereby several different kinds of edibles may be cooked at once, with economy of time, space, labor and fuel, and without giving one the flavor of the other.

DOOR CHECK.—Charles W. Fishel and Frank S. Hotchkiss, Carbondale, Col. This is a door holder whose main feature is a spring catch adapted to receive and firmly clasp a knob or projection attached to the door, the spring catch being inclosed in and protected by a detachable barrel or tube applied to the part having a screw for attaching it to the wall.

Business and Personal.

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

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(2363) E. W. H. asks: What kind of material is generally used for balloons? A. Muslin varnished with linseed oil varnish is often used. For an excellent article on the subject we refer you to our SUPPLEMENT, No. 726. Silk is often recommended, but is too expensive, and probably more liable to heating while stowed away.

(2364) C. A. asks: 1. What is the mode of cleaning a meerschaum pipe? Please give process fully. A. Cork up the stem aperture, moisten the interior of the bowl with a little alcohol, and light it. When burned out, scrape the charcoal out with a knife. A button of meerschaum should be kept in the bottom of the bowl to prevent the point of the knife penetrating the base and spoiling the pipe. 2. What is mode of connections on the old style frictional plate electric machine, and what materials should rubbers be made of? A. Either the rubbers or prime conductor must be insulated, and the one that is not insulated should be connected to the ground. The rubbers may be made of felt rubbed with a very little grease and an amalgam of tin and mercury. 3. A good recipe for ginger beer. A. Crush sixteen ounces of the best ginger, and put it in a large tub, boil ten gallons of water and pour thereon, add six pounds best white sugar, one ounce cream of tartar, and ounce tartaric acid, stir the whole up with a stick till the sugar is dissolved, allow it to stand till sufficiently cooled, then add one pint brewer's yeast; stir this in, let it stand for twelve hours or until a scum forms on the top, then drain it off, add one ounce of soluble essence of lemon, clarify, bottle, and tie down.

(2365) J. P. asks how he can plate a silver ring with gold and not use an electric current. A. You must apply amalgam gilding. The article is "quicked" by dipping into a solution of nitrate of mercury. It is then rubbed with an amalgam of gold 1 part, mercury 3 parts. A brush is used for the rubbing. It is then gradually heated until the mercury is all expelled, which requires less than a red heat, and is rubbed up and polished. This is an extinct art practically, as battery plating has displaced it.

(2366) L. W. asks how to detect tinctura cantharidis in coffee. A. Extract the coffee with ether or chloroform and evaporate to dryness. By volatilization, pure cantharidin mixed with caffeine can be obtained. Weak alkali will dissolve the cantharidin. Precipitate with acid, filter, and test by second volatilization and examine under the microscope, comparing it with a sample of known cantharidin.

(2367) H. V. asks where he can purchase a book of designs used for papier mache decorations and terra cotta workings, designs that would answer for interior and exterior work on houses. A. We can supply you with Interior Decoration, by Brunner & Tryon, $3. 2. Would you also inform me what is the composition of the plaster work on the outside of frame houses? A. Use a cement mortar, 1 part Portland or even Rosendale cement to 1½ or 2 parts sand. The only rule to apply in working rapidly setting cement or plaster of Paris is to mix the ingredients dry, then moisten and mix, and only mix small quantities.

(2368) J. H. J. asks how to blacken brass and German silver. A. A very simple process consists in dipping the metal in solution of nitrate of copper and heating over a flame or clear fire. This must be repeated until a black is produced. Or proceed thus: Polish with tripoli or other agent, then wash with a solution of 1 part nitrate of tin and 2 parts chloride of gold; after 12 or 15 minutes wipe off. If the solution is acid, the color will be darkened.

(2369) F. P. asks (1) for the best preparation to use of soda and tartaric acid for aerated water. A. Use 4 parts bicarbonate of soda to 3½ parts tartaric acid. A slight excess of acid may be used to give pleasant acidity. 2. Is there anything better or cheaper that can be used without a special apparatus? A. No.

(2370) M. H. asks: 1. Is there such a thing as liquid vaseline? A. No. Kerosene and heavy paraffine oils may be taken as the nearest approach to it. 2. What is the most practical formula for determining the flow of water from an artesian well? A. Determine the head of water or pressure at the mouth, and apply the formula

$$\cdot 82\, a \sqrt{2gh}$$

in which a=area of pipe in square feet, and h head in feet, and g=32·5. 3. What is the formula for determining the number of gallons of water discharged per minute by a mountain stream? A. Determine its profile and the current velocity, and calculate the flow from these data. 4. For determining the number of gallons of water discharged per minute by a river. A. Determine its profile and the current velocity at different depths, and from these calculate the amount of water. 5. Can the magnetic variation be found by means of an ordinary compass, Jacob mounting, or ball and socket movement? A. Not very accurately. Works on surveying tell how to determine the true meridian, with which you can compare your compass. We can supply you with "A Practical Treatise on Surveying," by Gillespie, price $3.50. 6. What is the best method to preserve poplar trees from being worm-eaten, and what is the scientific name of the worm that destroys them? A. Spray with Paris green and water. For publications and information on subject, address the Department of Agriculture, Washington, D. C.

(2371) J. H. J. writes: 1. Where are phonographic dolls to be purchased, and what is the price? A. For phonograph dolls, address the North American Phonograph Company, New York, N. Y. 2. Professor Steele, in his Series in the Natural Sciences, gives two experiments with sodium sulphate (Na_2SO_4, $10H_2O$); one is given in his "Fourteen Weeks in Chemistry," page 133, bottom of page, the other in his "Popular Physics," page 251, bottom of the page. I have tried both of these, and do not succeed. Can you suggest what the difficulty is? A. Sometimes these experiments in crystallization fail unaccountably. By using fresh soda sulphate each time you have a better chance of success. 3. In catalogues of "weights of precision" I have seen "riders" spoken of in connection with some sets. What are they and what is their use? A. A "rider" is a weight made of wire that is used like a steelyard weight upon the arm of the balance which must be graduated, generally in twelfths. Thus a twelve milligramme rider gives one milligramme for each division. 4. In a great number of receipts paraffine is used. What is paraffine? Druggists in Shanghai tell me it is an extra refined kerosene oil. Is this right? A. Paraffine wax is meant—the substance from which paraffine candles are made. It is a white solid substance, a product of distillation of coal. It is not an oil in your case, although it is a common name for refined petroleum.

(2372) G. W. writes: In the process of rendering fat and bone boiling from the refuse of markets, a very strong and disagreeable odor is engendered. By the most recent machinery this odor is directed from the vat through a pipe to a furnace fire. The pressure forcing the odor in steam form through the coal bed in the furnace from six to eight inches thick. Now the question is, does this odor become odorless from this furnace heat, or is it brought back through the chimney in a warm form with the same smell to foul the air? Would the smell be greater some distance from the factory, say a mile to a mile and a half, than near to it? A. The process described we should judge could be made perfectly effectual, and would quite destroy the odors if properly conducted. The odoriferous compounds would be oxidized and decomposed, not merely disseminated. No smell should be found near to or far from the factory.

(2373) P. I. W. M. Co. asks: Can you give process for recovering metals? We melt antimony, lead, and tin together. We have a quantity of the ash or dross. We wish to separate the metal from waste. A. The dross undoubtedly consists of the oxides of the metals. By melting in crucibles with powdered charcoal at a high heat, some could be recovered, but probably not enough to pay. By proper precautions the waste could be kept low. We would suggest keeping melted salt upon the metal in the crucibles, or even a layer of charcoal in coarse powder, and also keeping the crucibles covered.

(2374) C. C. W. writes: I have some pieces of serpentine rock which I wish to polish highly on one surface. Can you tell me how to do this? A. This has to be done by rubbing with proper polishing agent. A piece of moist sandstone may be used to produce the flat surface, or a plate of iron with sand and water will answer. This is followed by pumice stone ground to a flat face, and then a compact linen cushion is used with fine emery. Finally apply to the washed surface putty powder and water with a linen cushion. In Workshop Receipts, 1st series, $2, there is quite an article on the subject under "Marble Working."

(2375) W. H. H. asks why it is that the manufacturers of best grades of barometers, both mercurial and aneroid, place the words *stormy* at about 28, *rain* at 29, *dry* at about 31°, when the instrument has no such range. Is it not misleading and erroneous? A. It is misleading, and the custom should be abandoned. The variations of the barometer in conjunction with other meteorological observations may be used to foretell the weather. In any case and under the best conditions there is much uncertainty.

(2376) S. L. asks: What kind of red powder is used in the manufacture of the metal polishing paste used for polishing all kinds of metal? A. Red oxide of iron, colcothar or jeweler's rouge may be used for this purpose in the proportion of 25 parts to 20 parts of rotten stone. Both enter into the formula.

(2377) G. F. C. asks how to make a good rosewood stain. A. Boil ½ pound of logwood chips in 3 pints of water until very dark, then add ½ ounce salts of tartar. Stain wood with boiling hot mixture. When nearly dry, repeat. Two or three coats can be given. Streaks can be made on it with black stain applied with a graining brush. The black stain is made by boiling 1 pound logwood chips in 4 quarts of water and adding a double handful of walnut husks. After boiling, stain. Good ink may be used for the black streaks.

(2378) U. L. H. asks: 1. What is the best method to clean sea shells and prepare them for the cabinet? A. If in good natural condition, no cleaning is needed. If encrusted with parasitic calcareous matter, it can be removed with an engraver's tool or other similar instrument. A very weak mixture of hydrochloric acid and water may be used as a last resort. They should be soaked in cold water, dried well, oiled, and polished by rubbing. 2. How are star fish and sea weeds best preserved? A. Immerse in fresh water for some hours, extended and pinned down upon a plank and dried. Thrust the pins into the wood by the side of the rays, not through them. Dry in the shade. The flesh should be cut out of the larger specimens and a preservative applied before drying. 3. How are shells polished in the quickest manner? A. Place in cold water with quick lime and boil for some hours, cool slowly, apply strong acid to the epidermis, which will peel off. Polish with rotten stone and oil. 4. What is the best illustrated work on conchology? A. We recommend and can supply Structural and Systematic Conchology, by Tyron, 1 vol., cloth, $12. 5. Where can I get a work on polishing shells, and a guide for lapidaries? A. We can supply you with a Handbook for Artisians, Mechanics, and Engineers, by Byrne, price $5, which contains a chapter on lapidary work. 6. Is the process of embalming birds of any value? A. No. 7. How are fine shells shipped, also star fish? A. Pack as you would glass or china. 8. How long will specimens keep in alcohol? A. Indefinitely.

(2379) H. W. S. asks the meaning of the words "present" or "addressed," used in sending a letter to a person not far off. A. "Present" should mean left by writer, but is used often when a letter is sent by hand. "Addressed" seems to have no special meaning in this connection.

(2380) J. J. C. writes: I have a small barrel which held orange wine, and I wish to make root beer in it. How can I clean the cask? There is a sort of a mould in it. A. Fill one-quarter of the cask with water, burn sulphur in it, and shake repeatedly, removing the sulphur if necessary while shaking. This will destroy the mould if done well and effectually.

Replies to Enquiries.

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

W. T. M., in query 2348, in July 26 issue of the SCIENTIFIC AMERICAN, asks how to cut a large glass bottle. The method you recommend him you acknowledge to be a dubious one. If your correspondent will use a sharp triangular file kept wet with turpentine, he can file the glass with ease. It takes patience, but it will be successful.

Answer to query 2353, to keep milk or butter cool in warm weather. Take tin vessel, say 10 or 12 inches diameter and 4 or 5 inches deep. The cover should be conical, the center being raised 3 or 4 inches. On this place a linen cloth, large enough to hang over the side of the vessel. Take about a dozen strands of woolen yarn, slightly twist them together a portion of their length. From the cone of the cover spread the single strands of yarn over the linen. Immerse the twisted portion in a bucket of water near the can. One bucket of water will suffice for several cans. They should be placed on a bench under the shade of a tree. By this method milk may be kept sweet in the hottest weather.—J. M. C., Independence, Mo.

NEW BOOKS AND PUBLICATIONS.

THE DISPOSAL OF HOUSEHOLD WASTES. A discussion of the best methods of treatment of the sewage of farm houses, isolated country houses, suburban dwellings, houses in villages and smaller towns, and of larger institutions, such as hospitals, asylums, hotels, prisons, colleges, etc., and of the disposal of garbage, ashes and other solid house refuse. By WM. Paul Gerhard, C.E. New York: D. Van Nostrand Company. 1890. Pp. 193. Price 50c.

This little work has as the best evidence of its usefulness the author's name. Mr. Gerhard's authorship gives it the proper stamp. We can confidently recommend it to all interested in sanitary engineering as an excellent exposition of country and suburban practice.

PRACTICAL ENGINEERING FOR ELECTRIC LIGHT ARTISANS AND STUDENTS. By W. Slingo and A. Brooker. London and New York: Longmans, Green & Co. 1890. Pp. vi, 631. Price $3.50.

Although overshadowed by the influence of the City and Guilds Technical Institute of London, a valuable contribution is found in the present work to the science of engineering. It purports to be for electric light artisans and students and to embrace branches prescribed in the syllabus of the institute just mentioned. As this syllabus happens to be a very exhaustive one, the work is also comparatively complete. It will be found of value for students and readers in general. We presume it is well adapted for its end, facilitating the work of passing the examinations of the London examining bodies.

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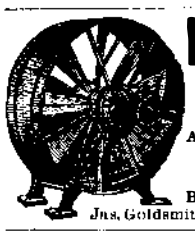

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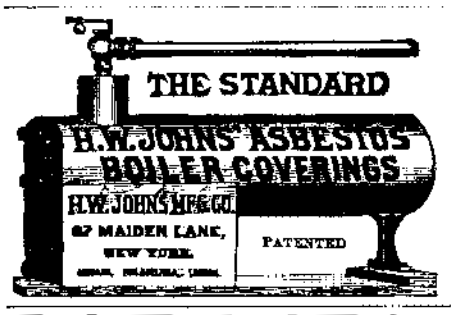

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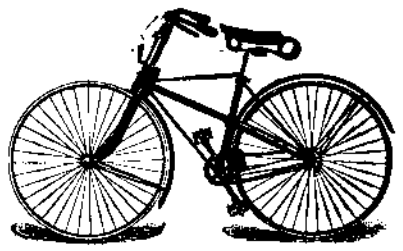

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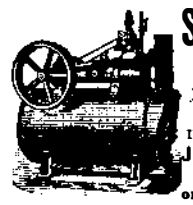

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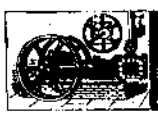

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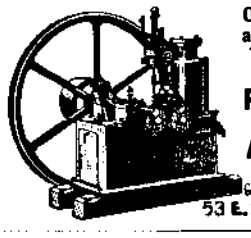

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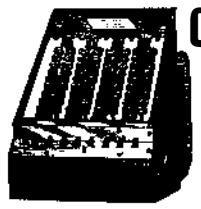

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