SCIENTIFIC AMERICAN

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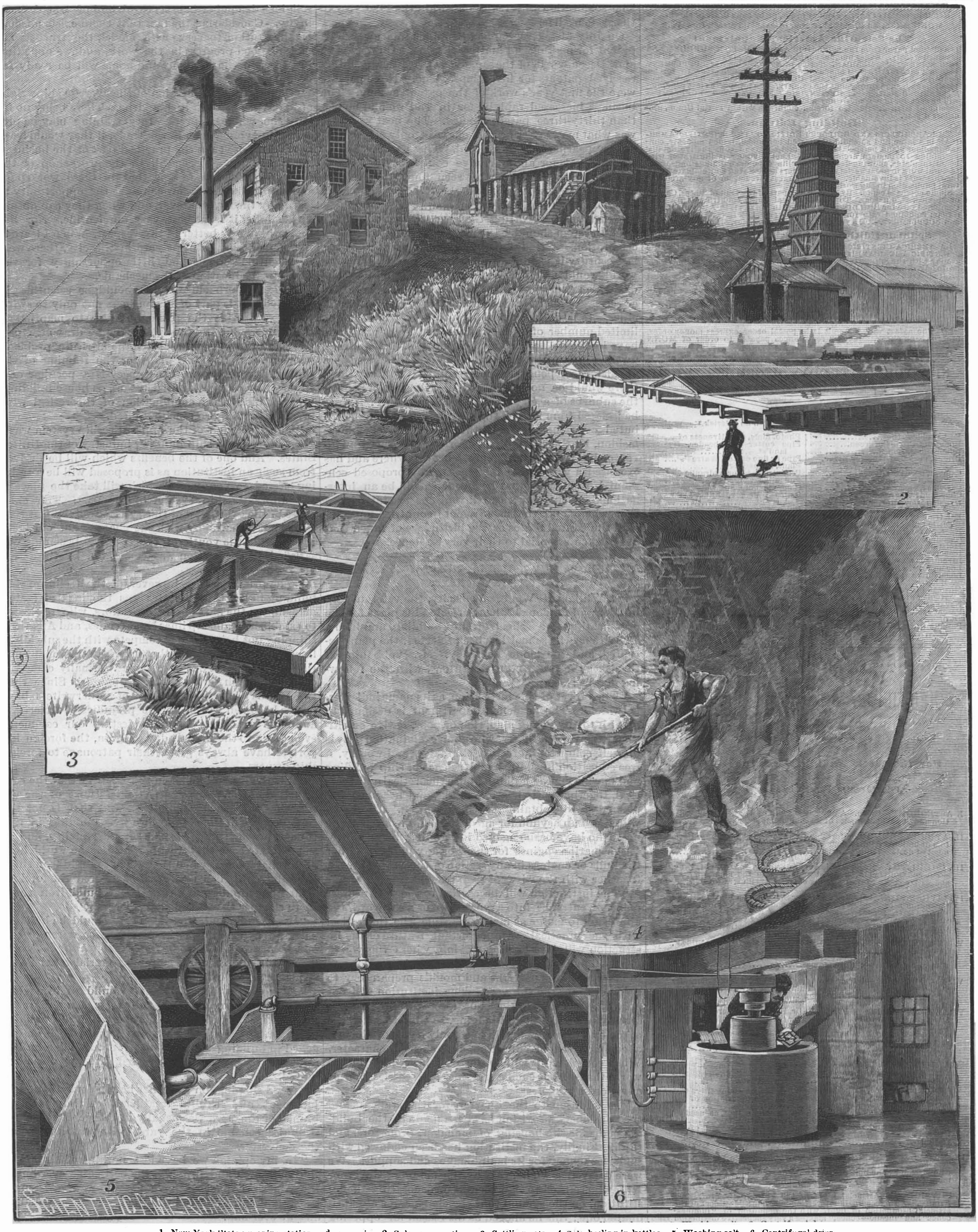

1. New York State pumping station and reservoir. 2. Solar evaporation. 3. Settling vats. 4. Salt boiling in kettles. 5. Washing salt. 6. Centrifugal drier.

THE SALT INDUSTRY OF ONONDAGA COUNTY, N. Y.—[See page 373.]

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 780.

For the Week Ending December 13, 1890.

Price 10 cents. For sale by all newsdealers.

THE CENTENNIAL OF THE UNITED STATES PATENT SYSTEM.

The wealth and economic prosperity of our country are so largely due to the system of patents, by which our inventors have been encouraged to pursue their unselfish labors, that among the many centennials which have been and are to be commemorated, the one hundredth anniversary of our patent system should not be overlooked. It is proposed to celebrate it at Washington, D. C., in April, 1891. A large and influential meeting in furtherance of the idea has been recently held in Washington. Although a year will have elapsed since the true centennial, it is not too late to fittingly commemorate America's industrial progress. The celebration will really be within the 101st year of the system's life.

On July 31st, 1790, Samuel Hopkins was awarded a patent for making pot and pearl ashes. On August 6 and December 18 of the same year two other inventors received patents for inventions. Those three patents were the first year's work of the patent system. The business increased rapidly, for in 1791 we find no less than thirty-three patents issued. The next year 1792 was what may be termed an off year, only eleven patents appearing on the record. These early records afford a basis for an impressive contrast. In a single week at the present time between four and five hundred patents are issued, and the roll of patentees is approaching a half million.

It is, therefore, fitting that the centennial of the patent system should be made the occasion of proper celebration. Without the mechanical progress of the last century it is hard to say where America and the world would stand. The increase of population has demanded enormous supplies of food and general necessaries. Modern life has tended to concentration in cities. It is only by the inventor's efforts that the limited number of farmers and other direct producers have been able to feed and clothe the multitudes of dwellers in the great centers. The whole modern system of existence depends on the inventors. Without them there would be no centralized distribution of people, the suburbs of a city would for all practical purposes be isolated from it, and the populace would be distributed over the surface of the land and live, Chinese fashion, by their own direct efforts. The American inventor has made his influence felt everywhere and has exercised a world-wide influence. The proposed centennial, in view of what he has done, will be an international epoch. American inventions are introduced everywhere, and the most remote countries must regard the United States as the birthplace of much that has become essential to their very existence.

A SCHOOL OF SHIP BUILDING—THE OBJECTS AND IDEAS OF ITS FOUNDER.

Mr. William H. Webb, of this city, the veteran ship builder and millionaire, has perfected his plans for the organization of a school of ship building, and home. The site for the school has been selected, the plans accepted, and the money is ready. Mr. Webb himself furnishes the SCIENTIFIC AMERICAN with the following details:

"The object of this institution, as its name indicates, is twofold. The academic department is designed to furnish to any young man, rich or poor, native or citizen of the United States, who upon examination proves himself competent, of good character, and worthy, a free education in the art and science of ship building and marine engine building, both theoretical and practical, together with board, lodging, and necessary implements while obtaining such education. The home will afford an asylum for aged, invalid, or unfortunate men who have been engaged in building hulls of vessels or marine engines for such, or any parts of either the hulls or engines in any section of the United States, together with the wives of such persons.

"The instruction will be carried to the very nearest point of entrance into a workshop or a shipyard, the aim being to merge as far as possible the theoretical with the practical. An important feature of the instruction will be a 'laying-off' loft, where the young men will be instructed in 'laying down' a vessel and in making all the patterns and moulds preparatory to going out into the shipyard. The institution will not only furnish free tuition, but also will provide the students with board and lodging, so that to enter the academy a young man will need only a suit of clothes, a common school education, and a good character. When completed it will be the only institution in the world that affords such a training and carries it to so advanced a stage.

"In addition to the quarters for the students and the pensioners, provision has been made in the building plans for the housing of manager, professors, and tutors. Finally, the institution has been endowed with sufficient money for its maintenance and supplies. We were delayed a whole year by the action of Governor Hill, who refused to sign the bill incorporating the institution, on the ground that the charter was an antiquated one; this he alleged as his reason for opposing the charter. We finally accommodated the provisions of the charter with his views, and the institution is thereby limited as to the value of the property it will be allowed to hold, two million dollars being now fixed as the limit.

"The trustees of the institution are the president of the Chamber of Commerce of the State of New York, a member of the General Society of Mechanics and Tradesmen of the City of New York, to be designated by the society, Prof. Trowbridge, of Columbia College, the president of the New York Hospital Society, Richard Poillon, Henry Steers, Andrew Reed, Charles H. Cramp, William Henry Webb, Thomas F. Rowland, and Stevenson Taylor.

"The academy and home will be strictly non-sectarian, but the chapel will be open to services by such religious denominations as the board of trustees may invite. Considering the fact that there exists no similar institution to serve as a model, the trustees are making good progress in the work, and we hope that in two years the academy and home will be ready for occupation.

"The technical education of the average shipwright of to-day is not what it should be. There being no institution where a preparatory training may be procured, the young men in the trade, if they would learn anything more than the practical part of the business, must pick it up, piecemeal, in the workshop or the shipyard. But the fact is that in these workshops and shipyards only a few can have the opportunity to learn any theory whatever, and when they can obtain this training it is, at best, very unscientific. Nor has it ever been any better in this respect. When I learned the trade in my father's yard in this city, there were no scientific schools and little opportunity for the theoretical education of the mechanic.

"The modern shipwright should be scientifically educated. It is part of his business not only to swing the ax and drive the plane, but also to manipulate the needle point and triangle, to make drawings, patterns and moulds, and to solve the intricate problems which arise in making plans for the framing of the ship. His vocation in this respect is a peculiar one. In no other of the kindred trades, as house building, bridge building, is a combination of theoretical with practical training so much required.

"The extinction of the apprenticeship system was a great blow to the ship building industry of the United States. And one of the benefits which will be derived from such an institution as is proposed will be a training offered to young men which will take the place of the apprenticeship system of the past. The chief cause of the overthrow of this system was the fact that it was not in harmony with the character of our institutions, and the youth of the country becoming dissatisfied, its destruction was completed by the action of the trades unions.

"The primary cause, however, of the decline of ship building in the United States was the lack of statesmanship on the part of our legislators, who neglected to establish steamship lines by subsidies, and American shipping not being able to compete with the subsidized lines of other countries, the American merchant marine passed almost out of existence. Finally came the civil war, which put a clincher upon it. Since then the Lloyds (English) company of underwriters have favored English vessels to the prejudice of American, and have thus done much to destroy our commerce even down to the present day. Again, the foreign importers have always given their patronage to foreign ship owners.

"It is the general belief in this country that the construction of iron ships was the chief cause of the decline of American ship building. But such is not the case, because in the old days we were building in this country wooden ships of such superior quality, and at so moderate cost, that we brought all the world here as purchasers. But when they came to build iron ships abroad, the English underwriters favored the foreign-built iron ship, because they could build iron ships there cheaper than wooden ones.

"In my judgment, if wooden ships could be built in England as cheaply as in America, *we never would have heard of the introduction of iron hulls*, as wood is undoubtedly the more suitable material for the construction of a ship.

"Moreover, it is much easier to build an iron ship than a wooden one. It requires far less judgment and less mechanical skill. This every iron ship builder will admit, as nearly all have at some time been engaged in building wooden hulls. In building a hull of iron, the raw material is fashioned into any form required.

"Wood shaping, on the other hand, demands much judgment and skillful treatment. This particular branch of the work was usually in charge of the most skillful mechanic in the yard, who was known as the converter.

"In my opinion we have lost nothing of the art of ship building; and although the best ships ever built, the American packets, have passed out of existence, the freight ships now built in the East are the equal of any we ever had.

"But I have not yet mentioned one of the greatest causes of the decline of ship building in the United

States. I mean the opportunities for the more profitable investment of money, the railroads for instance, the railroads and manufactures, which have developed to so great an extent since the war.

"But the renaissance of American ship building is near at hand. Our government is now building a navy, and it is found that through the lack of a merchant marine there are no sailors to man the government ships. If for no other reason, then, than this, it is my opinion that America will soon see her way clear to the establishing of a shipping and ship building industry which shall be worthy of her favorable geographical location and of her position among the nations of the the earth."

The U. S. Naval Establishment.

An intelligent writer in the New York *Times* gives reasons and excuses why our new war ships are so deficient in speed. The most essential reason given is that the ships have an insufficient coal capacity. They can only run fast for a short distance before their coal gives out. Next the crew are not kept trained up to the duties required in fast running.

A first-class passenger ship maintains at all times, throughout the longest voyages, nearly the original speed developed on her trial trip, to wit, from 15 to 20 knots or more per hour. These are common speeds for Atlantic steamers and for those of the Australian and other lines. Witness the history of such boats as the City of Paris, 560 ft. length, 63 ft. beam, 10,500 tons, 20,000 h. p., 21½ knots voyage speed; City of New York, same dimensions and power, 20½ knots voyage speed; Etruria, 501½ ft. length, 57·2 beam, 7,718 tons, 14,321 h. p., 19½ knots voyage speed; Umbria, same dimensions, same power, same voyage speed; Teutonic, 582 ft. length, 57½ ft. beam, 9,685 tons, 17,000 h. p., speed 21 knots; Majestic, same size and power, speed 20 knots; Augusta Victoria, 460 ft. length, 56 ft. beam, 10,000 tons, 12,500 h. p., 20 knots speed; Columbia, same size, power and speed; Spree, 485 ft. length, 52 ft. beam, 9,000 tons, 13,000 h. p., 19½ knots mean speed; Normannia, 520 ft. length, 60 ft. beam, 8,500 tons, 14,000 h. p., 20½ knots voyage speed.

The steamer Australian makes the voyage between South Australia and Marseilles in 27 days, a distance of over 13,000 miles, the mean speed being 15·7 knots or a little more than 18 miles per hour for the entire run. Boats like these maintain their high speed year in and year out.

The names of other ships might be added, all capable of maintaining high speeds throughout long voyages; and furthermore they are kept in readiness at all times for immediate, active service, as commerce destroyers, in case of sudden hostilities. The United States government is not in possession of a single vessel that could compete with any of those we have mentioned, on an ocean voyage. With all our brags about our new and fast vessels, the stubborn fact remains that for trips of any considerable length they are dull tubs. The new war ship Baltimore, out of which the contractors squeezed 20 knots on her trial trip, was barely able to steam 8 knots on her recent voyage to Sweden. It took her 19 days to do what one of the boats we have named would have done in 8 days. Our new war vessel Charleston, credited with between 18 and 19 knots on her trial trip, averaged only 7 knots between Honolulu and San Francisco. By dint of straining the boilers of these ships to the utmost, a respectably quick speed was developed for a few miles, on the trial runs, but that was the last of their fast movements.

Probably the only way whereby we can acquire a fleet of fast war ships is to build boats that can be utilized in carrying the mails. First, the ships should be capable of steaming throughout long voyages at as high a velocity as anything afloat. Second, the vessels should be kept in active service in transporting the mails between this country and Europe, the West Indies, South America, China, and Japan. This duty would be of the highest value in training and accustoming both officers and men to high-speed running, while it would help to develop and keep alive all the other active exercises and duties required on war ships. What the American people want is a navy composed of vessels that are capable of doing something. The present ships are veritable do-nothings. They cannot keep pace with a three-masted schooner in a fair wind, much less overtake or capture a merchant steamer.

According to the report of the Secretary of the Navy, our new naval establishment consists of 36 vessels, of which nine are now in commission, and the remainder in various stages of completion. Most of the above are of the cruiser class, and lacking in the important quality of speed.

The Secretary points out the pressing need of a fleet of strong battle ships of the Puritan type, for coast defense. These are to carry 20 inches of steel armor, and guns of the most powerful kind; to be capable of standing up to a square fight w th anything an enemy might bring against them. They are to be floating forts, as nearly impregnable as science can make them. The need of such vessels for harbor defense is strongly urged by the Secretary. He thinks it is within the power of a hostile fleet to pass through the Narrows of New York Bay, or to take position near Randall's Island within the city, despite the resistance of well constructed and well armed forts. It is pointed out that we are entirely unprovided with torpedoes, neither have we the means nor plant necessary for their construction. Even if torpedoes were laid, war ships could spring or fire them without danger to themselves.

Once a war ship took position in the Hudson River off Spuyten Duyvil, or Randall's Island, the whole means of communication between New York and the outside world would be severed. At Spuyten Duyvil the network of railway lines conveying the great mass of food stuffs enters New York. One hostile gunboat could at once stop the passage of every train. In the vicinity of Randall's Island hostile guns could sweep the bridges over the Harlem River. All this is shown simply to indicate that a bombardment of New York or Brooklyn is not necessary to secure any ransom an invader may demand.

It is to provide against the danger threatening New York and Brooklyn in this direction, as well as all the great seaports, that Secretary Tracy urges upon Congress the authorization of more vessels of the Puritan type. The Puritan is now in process of construction. When built it is estimated she will be able to destroy any ironclad afloat. It is calculated that a fleet of four or five Puritans, if left free to move to any point of New York Harbor, could not only contend successfully against a heavy fleet of ironclads, but afford more security to this locality than would be possible under the best combination of forts.

The successful use of Puritan ships involves the employment in conjunction with them of a fleet of active torpedo boats, to match and checkmate the torpedo boats of the enemy. In this direction our government has done little or nothing, as is shown by a glance at the torpedo-craft fleets of Europe. England possesses 206, France 210, Germany 180, Italy 152, Russia 143, and so on. The United States possesses 1 boat in commission and 1 building.

Koch on Tuberculosis.

In his address on "Bacteriological Research," before the recent tenth International Medical Congress, Berlin, Dr. Robert Koch said:

I am convinced that bacteriology will one day be of the greatest importance from the therapeutical point of view also. It is true, I look for relatively smaller therapeutical results in the case of diseases with a short incubation period and a rapid course. In these diseases, as, for example, in cholera, the chief reliance will always have to be placed on prophylaxis. I am thinking more of diseases of less rapid course, as these offer more points of attack to therapeutic enterprise. And there is scarcely a disease which, partly on this ground, partly on account of its far surpassing all other infectious diseases in importance, so challenges bacteriological investigation as tuberculosis.

Moved by these considerations, very soon after the discovery of the tubercle bacilli I set about seeking for substances which could be used therapeutically against tuberculosis, and I have pursued this search (which has of course been often interrupted by my other occupations) perseveringly up to the present. In the belief that there must be a remedy for tuberculosis, I do not by any means stand alone.

Billroth has, in one of his last writings, expressed himself with all possible distinctness to the same effect, and it is well known that the same object is aimed at by many investigators. It seems to me, however, that the latter have not, as a rule, followed the right way in their investigations, inasmuch as they have begun their experiment on man. To that I ascribe the fact that everything which people have believed themselves to have discovered in that way—from benzoate of soda down to the hot air treatment—has proved to be a delusion. Experiments must in the first place be made, not on man, but on the parasites themselves in their pure culture; even if substances have been found which have the power to check the development of tubercle bacilli in the cultures, man should not forthwith be chosen as the subject of experiment. But the question whether observations which have been made in a test tube hold good also in living animal bodies should first be settled in animals. Only if the experiments on animals have proved successful should the method be tried on man.

Proceeding according to these rules, I have in the course of time tested a very large number of substances to see what influence they would exert on the tubercle bacilli cultivated in pure cultures, with the result that not a few substances have the power, even in very small doses, of hindering the growth of tubercle bacilli. More than this, of course, a remedy cannot do. It is not necessary, as has often been erroneously assumed, that the bacteria should be killed in the body. In order to make them harmless to the body, it is sufficient to prevent their growth, their multiplication.

I have proved the following substances to be remedies which hinder such growth even in very small doses (to mention only the most important): A number of ethereal oils: among the aromatic compounds, β naphthylamin, paratoluidin xylidin; some of the so-called tar dyes, namely, fuchsin, gentian, violet, methyl blue, chinolin yellow, aniline yellow, auramin; among the metals, mercury in the form of vapor, silver and gold compounds. The compounds of cyanogen and gold were especially conspicuous, their effect surpassing that of all other substances; even in a dilution of one to two millions they checked the growth of tubercle bacilli. All these substances, however, remained absolutely without effect if tried on tuberculous animals.

In spite of this failure I have not allowed myself to be discouraged from prosecuting the search for growth-hindering remedies, and I have at last hit upon a substance which has the power of preventing the growth of tubercle bacilli, not only in a test tube, but in the body of an animal. All experiments in tuberculosis are, as every one who has had experience of them has sufficiently discovered, of very long duration. My researches on this substance, therefore, although they have already occupied me for nearly a year, are not yet completed, and I can only say this much about them, that guinea pigs, which, as is well known, are extraordinarily susceptible to tuberculosis, if exposed to the influence of this substance, cease to react to the inoculation of tuberculous virus, and that in guinea pigs suffering from general tuberculosis even to a high degree, the morbid process can be brought completely to a standstill, without the body being in any way injuriously affected.

From these researches I, in the meantime, do not draw any further conclusions than that the possibility of rendering pathogenic bacteria in the living body harmless without injury to the latter, which has hitherto been justly doubted, has been thereby established.

Should, however, the hopes based on these researches be fulfilled in the future, and should we succeed in the case of one bacterial infectious disease in making ourselves masters of the microscopic but hitherto victorious enemy in the human body, then it will soon also be possible, I have no doubt, to obtain the same result in the case of other diseases. This opens up an oft-promised field of work, with problems which are worthy to be the subject of an international competition of the noblest kind. To give even now some encouragement to further researches in this direction was the sole and only reason why I, departing from my usual custom, have made a communication on a research which is not yet completed.

Allow me, therefore, to conclude this address with the expression of a wish that the nations may measure their strength on this field of labor and in war against the smallest but the most deadly foes of the human race, and that in this struggle for the weal of all mankind one nation may always strive to surpass the other in the success which it achieves.—*The American Practitioner and News.*

Continuous Rail Railway.

At a recent meeting of the Engineers' Club of Philadelphia, the secretary presented, for Mr. R. Taylor Gleaves, a description of continuous rails for railways, which are carried upon ordinary ties of wood or iron weighted down with a covering of earth, gravel or stone so that they cannot easily move. The spikes are not driven home by three-eighths of an inch, so that undulations may take place in the rail without disturbing either spikes or ties, and arrangements resembling turnouts are put in at fixed points, such as frogs, and at the foot of heavy grades, for the purpose of admitting of longitudinal motion.

The author explains how the rails are united so as to make them continuous. In the case he notes the rails were riveted together, with fish plates. He says that while the riveting was in progress the expansion gave some trouble, but since it has been completed there has not been the slightest buckling or any perceptible pulling in on the curves. The ties are covered with red clay containing some loam, and, to prevent dust, part of the track was turfed and grass seed sown over the remainder, so that now he says, "instead of a wrench, the watchman pushes a mower, and the road-bed looks like a pretty green lawn with two metal ribbons laid across it."

Speaking of the doubts which had been expressed as to the utility of this arrangement, the author says that it is a fact that "there is in Virginia a section of track laid with rails three miles long, that it has been in service since June, 1889, that it has not been surfaced or lined since put down, that the only expense of maintaining it has been the watchman, that engines weighing 104,000 pounds are frequently run over it at a speed of 50 miles per hour, that it is simply ballasted with earth, and that I shall take pleasure in showing it to any who care to investigate."

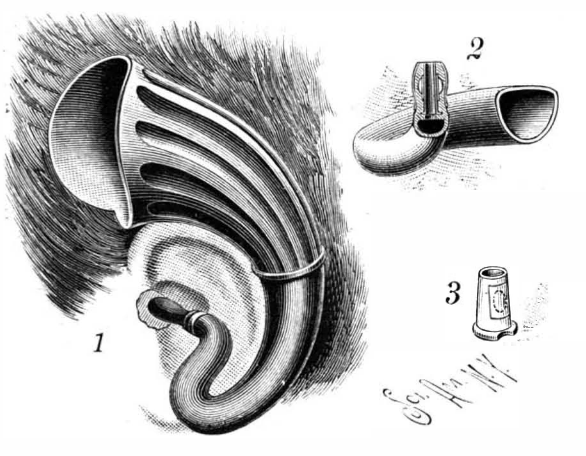
THE MUNDY ENGINE, built by J. S. Mundy, of Newark, N. J., furnishes the power on the derrick Reliance, illustrated in our issue of November 8, the same builder also furnishing all the machinery used in this class of derricks, the most of it being especially designed by Mr. Mundy for the work.

Icebergs.

The formation of icebergs was watched, last summer, by Mr. H. B. Loomis and Prof. Muir, while staying seven weeks near the Muir glacier (*Amer. Jour. of Science*). The falling of blocks from the terminal wall was very irregular; at times, about every five minutes; while at other times the observer might wait an hour without seeing one fall. One day, in twelve hours, 129 thundering reports from the falling bergs were heard at camp, about a mile off. In heavy rain, especially, it seemed as if a thunderstorm or cannonade were going on. Sometimes a block, breaking off, bursts into fragments, and falls like a cataract. Again, an enormous block will sink unbroken into the water, then rise, perhaps 250 feet, even with the top of the glacier, the water pouring off it; then topple on its side with a heavy thundering roar, scattering spray in all directions, and wallow about among other icebergs like a huge monster.

A CONVENIENT EAR TRUMPET.

An ear trumpet which may ordinarily be carried and supported about the ear in position for service without inconvenience to the wearer is shown in the accompanying illustration, and has been patented by Dr. F. M. Blodgett, aurist, of No. 1286 Broadway, New York City. The receiver or bell is of volute form, as shown in Fig. 1, the outer curve being of gradually increasing radius, while the inner curve is adapted to fit around the back and over the top of the ear, so that the trumpet stays in place without holding. A further parabolic curve in the diminishing end of the trumpet terminates in a horizontal tip to enter the ear orifice, a sectional view of the tip being shown in Fig. 2. In the interior of the tip is placed a small metal tube, Fig. 3, having side apertures over which are placed diaphragms of rubber or other tissue, these diaphragms covering inside spaces or chambers in the tip, to



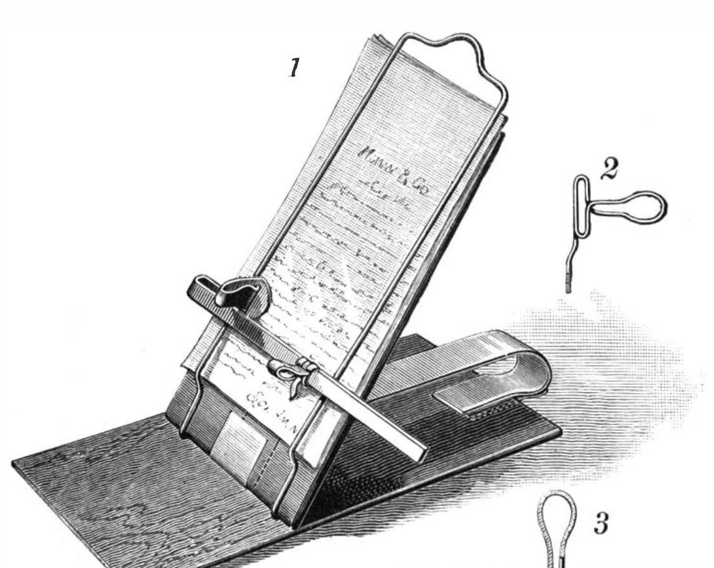
BLODGETT'S EAR TRUMPET.

modify or augment the sound waves as they pass through the trumpet and enter the ear. On the outer surface of the tip is a covering of soft rubber or other suitable material, to protect the ear orifice and partially adhere to it to assist in holding the receiver in place.

AN IMPROVED COPY HOLDER.

The device shown in the illustration is designed for the use of all copyists, but especially for recorders, and has been for some time in use in the office of the inventor, who is a recorder. By its use the copy can be conveniently followed down the page, and when the copyist is interrupted, the indicator may be made to point out the exact place at which he left off. Two longitudinally tapering boards are employed, one being used as a base board and the other as a copy support, and the copy-supporting board is connected with the base board by a spring metal strap having at one end a clasp adapted to be slipped upon one end of the base board, the other end of the strap having a clasp to be slipped on the lower end of the copy-supporting board, as shown in full and dotted lines in Fig. 1. A spring wire frame is attached to the front face of the copy-holding board, the lower portion of the frame having a bend near the bottom, while the ends of the wire are doubled under the lower end of the board, the extreme ends being bent inward and driven into the back side of the board. A cross bar, preferably made of spring metal, extends across the frame, and is doubled under at one end and returned upon itself and bent to form a slideway for one member of the frame. This bar, of which a section is shown in Fig. 3, has a spring clamp adjacent to the slideway, the clamp and bar being preferably formed of a single piece of metal. An indicator, shown in Fig. 2, is mounted to slide on the cross bar, the indicator being made of a single piece of spring metal doubled upon itself.

For further information relative to this invention address the patentee, Mr. George H. Seymour, Newark, Ohio.



SEYMOUR'S COPY HOLDER.

A Spider's Engineering Feat.

Popular interest at Syracuse, N. Y., has centered during the past few days in the operations of a spider of the *Tegenaria medicinalis* species over a bar in a saloon in that city. Thousands of people have gone into the place to watch the spider accomplish an engineering feat which displays in the insect almost human capacity, and the saloon keeper is becoming rich by the patronage of his visitors during the star engagement of the spider. The insect set out on Tuesday to lift a kernel of popped corn from a dish on the bar to its web attached to an electric light wire on the ceiling. It descended on the kernel by spinning a cable of the necessary length. It was evident, however, that when the spider hoisted the load clear from the dish, its uneven weight would cause it to lop to one side so suddenly as to probably snap the cable. To prevent such an accident the spider attached two smaller sized cables to projecting parts of the kernel and made them fast to the main cable about five inches above the burden.

All being ready, the spider returned to his headquarters and started its windlass, and the kernel began to rise. That was the situation when the people in the saloon first discovered what was going on. After getting the corn up about a foot, work was suspended for a time. The spider had begun to mistrust some of the machinery. It made an investigation, repaired a slight break or two above in the guys, and then slid down to the corn. Everything there was all solid, but the engineer thought prudence a mark of wisdom, and doubled up the cable where the main weight was seen to hang. This was at 11 o'clock on Tuesday night, and, with a more cheerful air of confidence than it had before displayed, the spider ran lightly aloft to the hoisting apparatus. The machine started, and so did the corn, and so did the eager throng of spectators, who burst into applause. Inside of a minute the corn was raised at least four inches. Then there was another delay, which was only short.

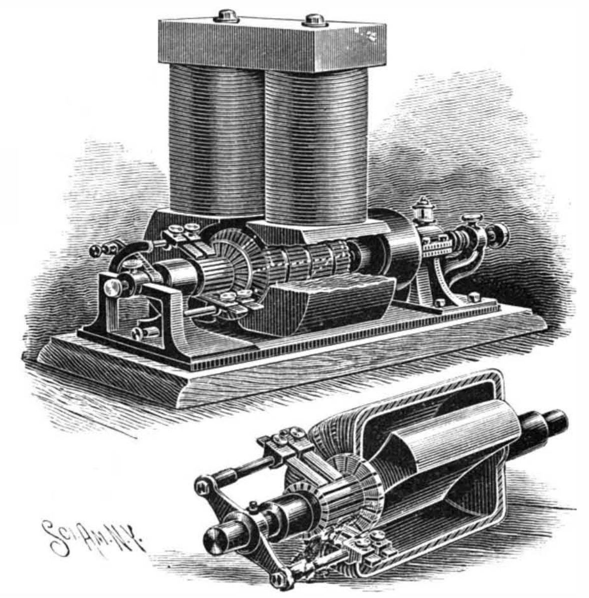
At midnight on Tuesday the corn had risen two feet. At daylight on Wednesday it was up thirty-six inches. There it seemed to stick. All day Wednesday only slight progress was made, though the spider never relaxed its efforts. Sometimes the burden even receded. Then there was a series of jerks, but the machinery overhead seemed to slip a cog, and no headway was made. Late on Wednesday night operations were temporarily suspended, and the spider retired to its inner chamber for contemplation. Thanksgiving day was spent in the completion of further plans or in rest, and Friday morning the work rested where it had stopped on Wednesday night. The spider went up and down the main cable time and time again, apparently mending it, and finally, toward evening, began to draw up, but with only partial success, though it was cheered on by a crowd of spectators. The sporting fraternity are backing the spider at 10 to 5.—*N. Y. Sun.*

Prepared Pumpkin Pulp.

The following method is by Gustav Bartel, of New York: Take pumpkins or squashes, open and peel them, and remove the seeds and all other parts which are of no use in the subsequent preparation of marmalade. The purified flesh of the fruit thus obtained is then cut up into small cubes and placed in a vessel with a sufficient quantity of water to cover the fruit. To this water add a small quantity of borax—about one ounce to five pounds of the purified fruit—and then heat the vessel till the water boils. By the action of the borax the peculiar unpleasant taste of the pumpkin or squash is extracted, and after the boiling has been continued for some time—say ten minutes—separate the pulp from the liquid, which can be done by pouring the contents of the vessel upon a suitable filter. The pulp obtained in this manner is free from the peculiar, unpleasant taste of a pumpkin or squash, while the same retains all its nutritious qualities, so that it can be used with great advantage for the preparation of marmalades of various kinds.

A REGULATOR FOR DYNAMOS AND MOTORS.

The illustration represents a regulator in which the armature core is designed to shift automatically in accordance with the drag or lead of the armature, always taking up its position with its poles in the strongest part of the field, the brushes being held to the point of the least sparking, and the adjustment of the brushes being effected automatically by every



CLEAVER & FASSOLD'S AUTOMATIC REGULATOR FOR DYNAMOS AND MOTORS.

change of load upon the dynamo or motor. The improvement has been patented by Mr. Fremont J. Cleaver, electrician of the Second Avenue Electric Power Railroad Company, Pittsburg, Pa., and Mr. George Fassold, of the same city. The armature has circular end pieces mounted on tubular shafts, and to these end pieces is secured a hollow cylinder of non-magnetic material, wound with the conductor in the usual way, as shown in the broken-away portion of the main view in our illustration, the terminals of the coil being connected with the commutator cylinder. Upon the central shaft, and loosely fitting the hollow cylinder, is an armature core consisting of the segment of a cylinder of iron having concave sides, as shown in the small view. The central shaft is prolonged beyond the tubular armature shafts, the ends of the central shaft being supported on pointed screws in yokes attached to the supports of the journal boxes of the tubular shafts. To the central shaft at its commutator end is secured a cross arm of insulating material in which are held rods carrying the commutator brushes. The cross arm also carries metallic contact plates electrically connected with the rods, and which touch curved bars which receive the current from the brushes, the curved bars having binding posts for receiving the conducting wires leading from the dynamo. On the end of the central shaft opposite that carrying the cross arm is attached one end of a spiral spring, attached by its other end to the yoke, to oppose the pull of the armature on the segmental core, and to return the core and the brushes to their original position when the machine is idle, so that the brushes will always occupy the same position relative to the segmental core.

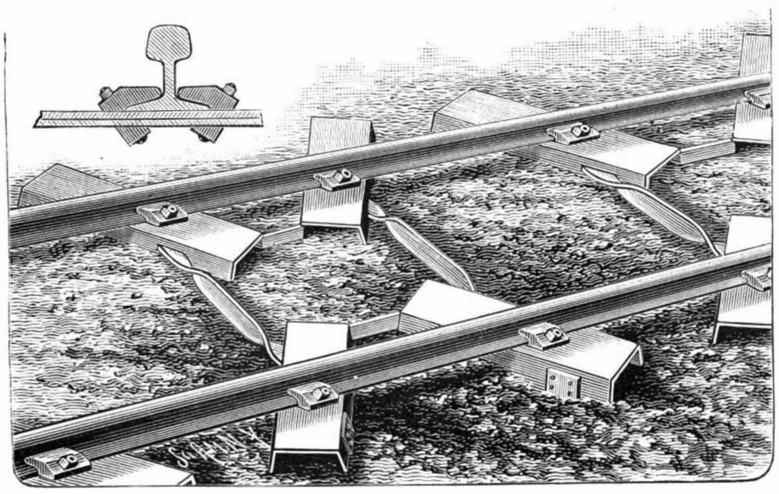
The Fireless Locomotive.

M. C. Rolland, in Mons, Belgium, has constructed a fireless locomotive for use in mines. It is provided with a tank that holds 0·550 cubic meter. The water is heated to 205° C. (or an absolute tension of 16 atmospheres) by a boiler placed on the surface; it is sufficient for a steady run of 3 to 4 kilometers. The heating is brought about by means of steam jets, as first proposed by Mr. Bede, Belgium. The heat thus stored up in the rather small space gradually evaporates the water required to run the machinery. At a speed of 2 meters per second, the locomotive works with 6 horse power, that of a horse being generally estimated at from 0·9 to 1·0 m., so that the locomotive, working day and night uninterruptedly, takes the place of from 12 to 18 horses, besides a good many laborers. The saving is calculated to be $200 per horse dispensed with. As a further advantage, this locomotive secures better ventilation. The weight of the locomotive is 3,000 kg.

WHEN selecting holiday gifts, remember our new book, *Experimental Science*. It is both entertaining and useful.

RAILROAD SLEEPERS ARRANGED IN PAIRS.

The illustration represents a novel construction of railway sleepers designed to hold the rails so that they cannot spread or be forced out of parallel alignment, the sleeper being made of light material and designed to box in ballast. It is made of four members placed at an angle to each other, and so arranged that they have the same relation one to the other as if the sleeper were composed of two members extending across the track and centrally crossing each other. Each of the four members has a depending flange flaring slightly outward, embedded in the ballast, and the inner ends of each pair on a side are united by strips bent to extend parallel with the flanges, to which the strips are bolted. The members opposite each other on opposite sides of the track are connected by tie rods, twisted to a vertical position in their central portion, but extending horizontally through perforations in the members, on the outer flanges of which the ends of the tie rods are bent down and bolted in place. The rails are held in position on the upper surface of the members by clips, as shown in the small sectional view, bolts extending diagonally through the clips and through the outer surface of the members and the tie rods.

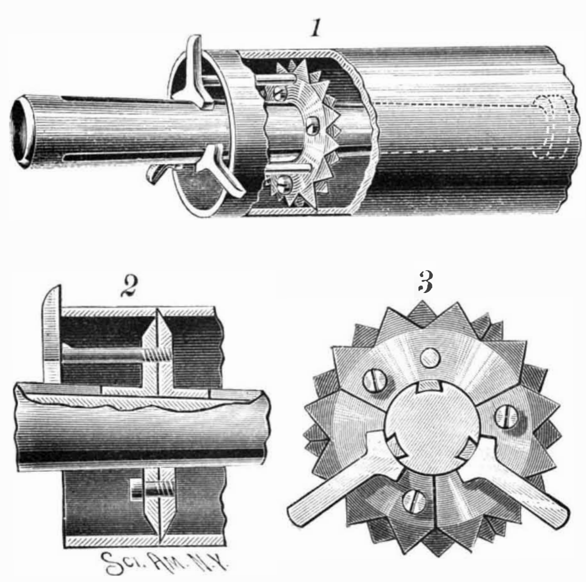


EWING & BOCKUS' RAILROAD SLEEPER.

Further information relative to this invention may be obtained of the patentees, Messrs. Charles H. Ewing and Charles G. Bockus, Ninth and Green Station of Philadelphia and Reading Railroad, Philadelphia, Pa.

AN IMPROVED PIPE OR FLUE CUTTER.

The device shown in the illustration may be readily applied, and is designed to quickly cut a pipe or flue at any desired point. Fig. 1 is a perspective view, partly broken away, to show the application of the device, and Figs. 2 and 3 are sectional views. The device is made with a tapering bar in which are longitudinal dovetailed grooves, adapted to receive correspondingly shaped flanges of two series of segmental cutter sections, each having at its periphery teeth placed alternately. The cutter sections of one set overlap those of the adjacent set, and they are fastened together by suitable screws. The cutter sections are also held by a bolt with a head having its lower end in the shape of a segment of a circle, and adapted to rest on the central bar, the head being adapted to engage the outer edge of the tube to be cut, as shown in Fig. 2, while holding the cutter sections in place at the proper distance therefrom. On the small end of the central bar is screwed a nut to prevent the cutter sections from sliding out of the longitudinal grooves, and the consequent liability of their being mislaid or lost. When the parts are adjusted to cut a tube, the operator strikes with a hammer on the large end of the central bar, the inward movement of which forces the cutter sections outward, so that the operation is effected by a few strokes.

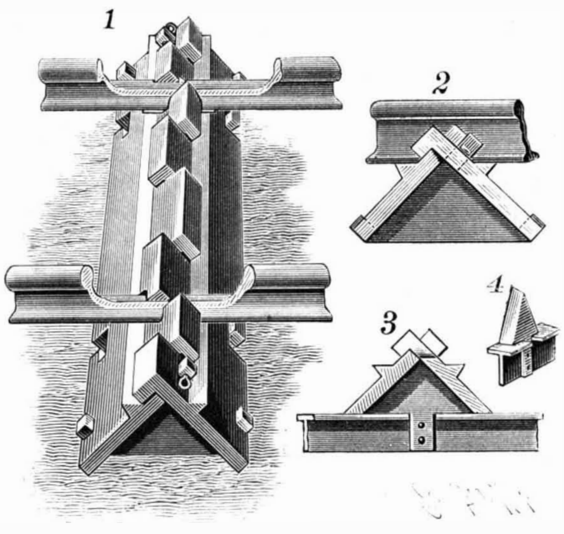


WARREN'S PIPE OR FLUE CUTTER.

Further information relative to this invention may be obtained of Mr. Joseph Warren, No. 150 Norman Avenue, Greenpoint, Brooklyn, N. Y.

AN IMPROVED METALLIC RAILWAY TIE.

The railway tie shown in the illustration is designed to possess a certain degree of elasticity, to prevent injury to rolling stock, while it may, if desired, be made to hold the rail without the use of separate bolts. It has been patented by Mr. Joseph J. Callahan, of Newburg, N. Y. Fig. 1 is a perspective view of this tie supporting two rails, which are partially broken away to show the construction of the tie plates; Fig. 2 is an end view of the tie and one rail; Fig. 3 is a sectional view of one end of the tie and a track beam on a trestle or bridge, Fig. 4 showing the anchor and beam. The two metal plates which together compose the tie are locked together at an angle to each other, the locking being effected by projections on the upper edge of each plate, while a space is formed in and between the projecting lips the size of the thickness of the flange of the rail, but giving room for its expansion and contraction without material displacement of the plates. The grip on the rail is as in a vise, the locking lugs grasping the rail with increasing force, according to the weight coming upon the rail. Flanges are formed in the plates at the rail seats, to furnish wide supports for the rails. In setting the ties, after the plates are locked and placed they are wholly or partially tamped from the open ends, which are then closed by triangular end pieces, each having lower lugs to enter a small socket in each plate and an upper key lug to pass through an opening in one of the plates and receive a key. These end pieces are not used on ties for bridges or trestles, and the plates have at their lower edges undercut slots forming lugs, whereby the plates may be conveniently fastened upon the beams. In these cases an anchor, as shown in Figs. 3 and 4, is secured to the rail between the plates, to prevent them from shifting and to limit the depression of the tie, the angle of the anchor being less than that of the plates, so that a space is left to permit the lower edges of the plates to slide slightly on the beam. The plates of a tie in which a switch rail is to be placed are formed with a wide seat therefor, in which a supporting and chafe plate is held by a projection passed down between the adjacent edges of the plates.



CALLAHAN'S METALLIC RAILWAY TIE.

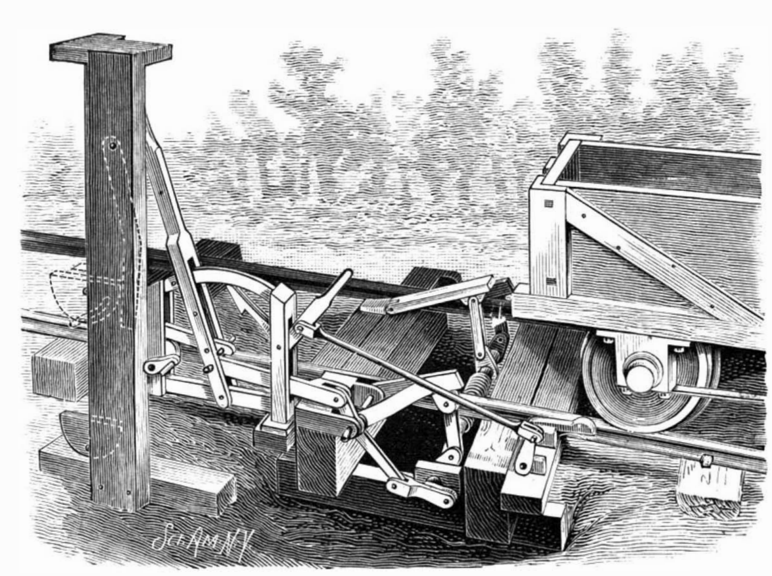
A DEVICE TO BLOCK CARS ON A GRADE.

The illustration represents a device which may be automatically set or tripped by the passage of cars over it, and which may also be operated by hand, being especially intended to block or trig mining cars running on a grade. It has been patented by Mr. Andrew Deets, of Plymouth, Pa.

At a convenient point is a pair of extra thick ties resting upon a base support, forming a recess beneath the rails in which is mounted a transverse shaft carrying a spiral spring, one end of which is fixed to the shaft and the other end to one of the ties, whereby cranks on the shaft are held normally in elevated position just outside the rails. Pivoted to the outer ends of the cranks are connecting rods which are pivoted at their upper ends to the ears of blocks arranged adjacent to the rails, the blocks being braced and pivoted at one end to short shafts mounted in plates bolted to one of the ties, so that when their free ends are raised they will engage the wheels of a car on the rails. Fixed to one end of the transverse shaft is a crank connected by means of a lever and rods with a lever pivoted in a rack, and having a pin to engage the hook of a bell crank lever. This lever is pivoted at its elbow between two members of the rack, and has at its forward end a hook, while its rear portion is connected by a pitman with a crank on a shaft in bearings on a tie, the inner end of the shaft having a spring-pressed lever extending parallel with the rail, and normally held in position to be engaged by a car wheel.

A vertically sliding block is mounted on adjacent vertical supports, on the inner side of which is pivoted a bent arm, a rod extending from which is adapted to engage one of the levers, the vertically sliding block being adapted to lock the device so that it cannot be automatically worked or release the lock so the device will be ready for operation. As a car comes down over the rails its forward wheels strike the spring pressed lever, when the pitman releases the bell crank from the lever pivoted in the rack, as shown in the illustration, and the spring on the transverse shaft raises the blocks in position to engage the car wheels.

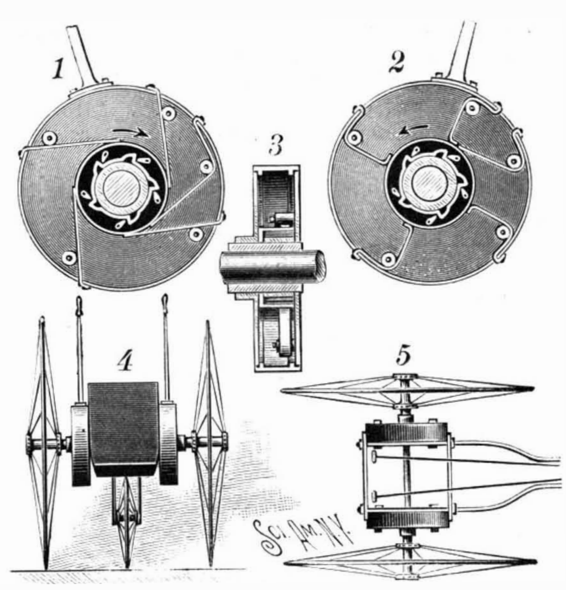
When the blocks are in elevated position they do not prevent a car from running in the opposite direction, as a crank on the transverse shaft is connected by a rod with a lever on the inner side of the rail, and adapted to be struck by a car wheel running in the reverse direction before it reaches the blocks, thereby depressing the blocks and bringing them into a position parallel with the rails.



DEETS' CAR BLOCK.

AN IMPROVED VELOCIPEDE.

In the machine shown in the illustration the driving mechanism is designed to be simple in construction and positive in operation, to propel the machine at a high speed with a minimum outlay of power. It has been patented by Mr. Frank Martin, of Fort Douglas, Salt Lake City, Utah. Fig. 4 is a front view of the machine and Fig. 5 is a plan view of its front portion, with the seat removed. Upon the hub of each of the large wheels are attached two spaced disks, and upon the periphery of the disks a collar is held to slide, covering the space between the disk plates, as shown in the sectional view, Fig. 3. A box collar is loosely mounted on the hub between the disks, and within this collar a ratchet casting is attached to the outer face of the hub,



MARTIN'S VELOCIPEDE.

pawls pivoted in one side of the collar being adapted to engage the ratchet teeth. Between the peripheries of the disks and the outer surface of the box collar are placed a series of spaced friction rollers. Four straps, each attached by one end to the box collar, are carried outward in contact with the friction rollers, their outer ends being attached to the sliding collar covering the peripheries of the disk plates. These straps are brought into operation by the back stroke of a lever attached to the outer surface of the collar, and extending within convenient reach from the rider's seat. A return strap is also attached to the outer surface of the box collar and the sliding collar, and is made to contact with a friction roller on the side opposite that with which the other straps contact with their rollers. One of these boxes containing driving mechanism is located at each side of the rider's seat, each provided with an upwardly extending lever. Fig. 1 is a sectional view through the driving mechanism, illustrating the position of the parts at the termination of the forward stroke of the lever, Fig. 2 showing their position at the termination of the rear stroke, the pawls engaging the ratchet teeth at each backward stroke, and slipping over them on the forward or recover stroke.

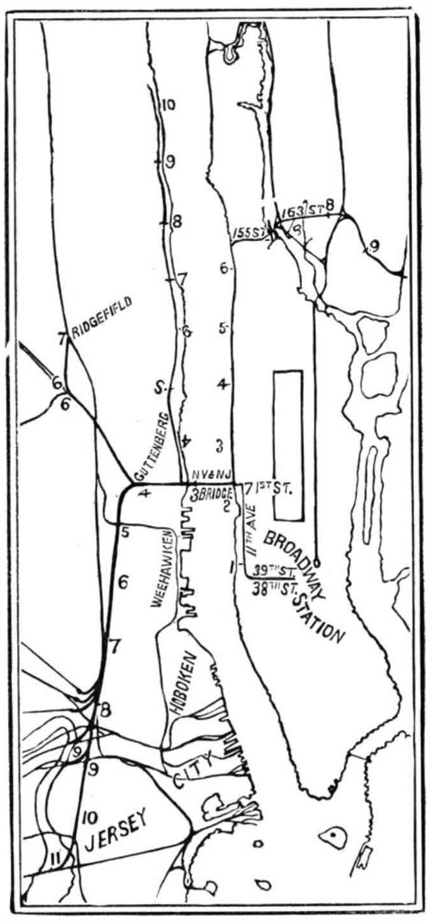
THE HUDSON RIVER BRIDGE.

An important move in the direction of the bridging of the Hudson River at the city of New York was taken during the past week. The New York and New Jersey Bridge Commissioners, a body of five representatives of the State of New York, appointed for this purpose, received a report from Messrs. Thomas C. Clarke, their chief consulting engineer, and Charles B. Brush, assistant engineer, designating a place for the bridge and the general location of its connections and approaches. The commissioners, by chapter 233 of the laws of the State of New York for 1890, have the power to locate the bridge and approaches, and this has now been done. The project next awaits the action of the Federal authorities. The navigation of the waters of the Hudson River is under the control of the United States. It rests with the Secretary of War to determine the span, location of piers, height, and character of the bridge. The army engineers in charge of the matter have as yet given in no report, so that nothing can be done in the way of designing the bridge. Informally it has been announced that a height of 150 feet will be acceptable to the War Department. This is used as a basis in determining the grades of the route as laid out. It is to be one mile distant from any site already granted to a bridge.

We give a map, showing the points so far determined The bridge is to cross the Hudson River between the lines of 70th and 71st Streets in the city of New York. The river is here 3,100 feet wide, not materially different as regards depth, character of bottom, etc., from other parts. At points further south the height would have to be increased, necessitating steeper grades for the approaches, and the width of the river would be excessive. The bridge enters the city at between 70th and 71st Streets, meets the approaches. The roadway is carried on an iron and steel viaduct, curving to the south, and running about 100 feet west of the west line of 11th Avenue, and then on the line of 38th Street to the proposed Union station between 38th and 39th Streets and Broadway and 8th Avenue. The main roadway will here have descended from the elevation of the bridge to 65 feet above high water mark. This will leave it 12 feet above the street, giving a basement for a freight depot. This plan gives a station 260 by 1,300 feet area, with room for twenty tracks and platforms. For the viaduct 100 feet right of way is required, and on the line selected there are now no valuable buildings.

On the bridge proper it is proposed to arrange for six tracks—two passenger, two freight, and two rapid transit. The viaduct is to carry eight tracks. The greatest grade required by this plan is 40 feet to the mile. The New Jersey railroads on the west end would be connected through the Palisade ridge partly by tunnel, partly by cuttings in the way shown on the map. In New York City connection would be made with the different roads now centering there. In all there are fifteen lines of railroad to be linked together by the bridge.

It is proposed to have both bridge and viaduct floored over and to lay the tracks in stone ballast, thus securing a perfect road bed. A speed of forty miles an hour can be maintained on the contemplated structure. As a sample of the connections the case of the Pennsylvania Railroad may be taken. From its proposed point of connection with this line to the Union depot the running time will at the above rate be 13½ minutes. At present, to cover the distance from the same point



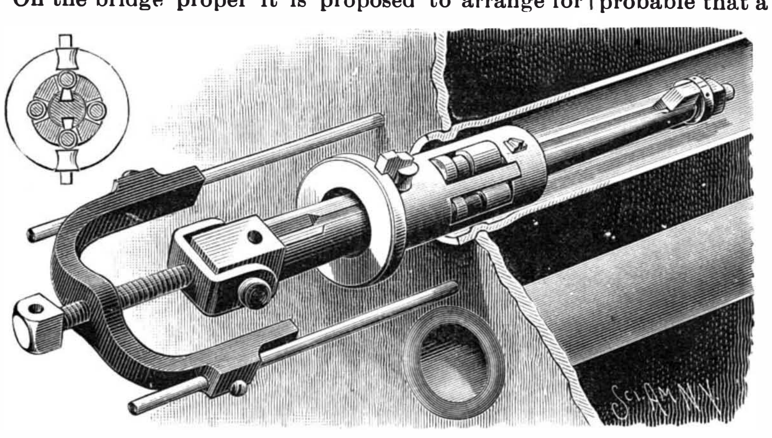
MAP OF NEW YORK, WITH SITE OF PROPOSED BRIDGE.

to the foot of Cortlandt Street, 20 minutes are required. It will be seen that for down-town connections there will be little saving in time. For up-town points and for through business with the New England States the bridge will be of extreme importance.

To reach the New England lines, a roadway part viaduct and part surface road is to be carried along the east bank of the Hudson River to about 155th Street. Thence by cut and tunnel it is to go across the island and cross the Harlem River, and connect on the further side with the tracks of the New Haven and Harlem roads at 163d Street. The distance from the Union station to this point is eight miles, only two miles greater than the distance from the Grand Central depot. It will be seen that this brings the western dock front of the city for about three miles in direct communication with all roads west of the Hudson River as well as with the New England territory. Incidentally it is proposed to run a special line up the west shore of the Hudson River opposite and bring that long-neglected region into communication with the city.

The high ground over the river will give great facilities for coal and grain delivery by gravity.

The plan, it will be seen, is of far-reaching scope, and embodies much that does not appear at first sight. The eminent engineers upon whose report the commission acted deserve much credit for their work. It is probable that a cantilever bridge will be selected. The work is to be executed by the New York and New Jersey Bridge Company. It has State charters from the States of New York and New Jersey, and the Federal authorities will undoubtedly take action on the matter in a short time.


HYLAND'S PIPE CUTTER, BEADER AND EXPANDER.

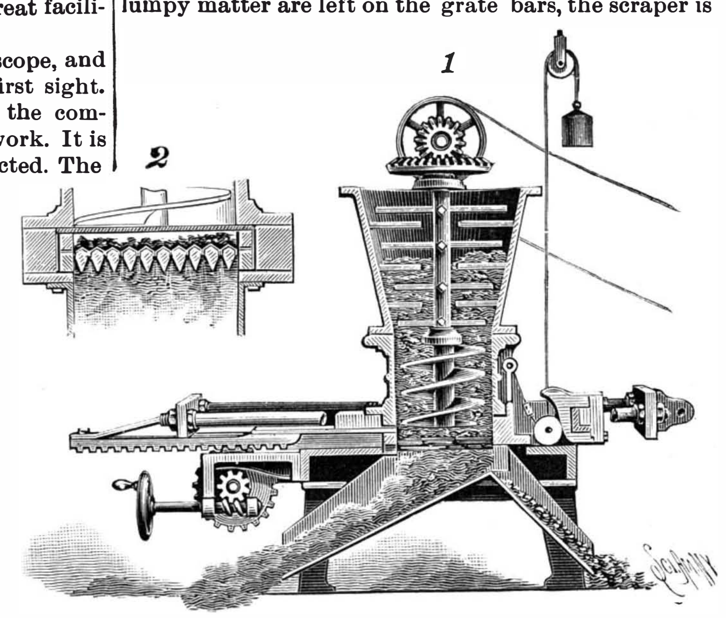
A PIPE CUTTER, BEADER, AND EXPANDER.

The accompanying illustration represents a combination tool, patented by Mr. Joseph Hyland, for readily and quickly cutting pipes or tubes, expanding them, and forming a bead thereon, as desired. A tapering spindle has longitudinal dovetails on opposite sides, and on its large end is a head adapted to be turned by a suitable tool, the spindle passing loosely through a cylinder containing a series of expanding rollers, each having an annular recess, while the cylinder has on one end a slightly dished flange. When the spindle is passed through the cylinder, all the rollers move simultaneously outward as the spindle increases in diameter. Inner cutters which can be readily removed and replaced are fitted to slide in radial grooves near one end of the cylinder, the cutters being moved outward as the spindle is passed in, while the turning of the spindle carries with it the cylinder and cutters. In order to form a bead on the end of the pipe, grooved rollers are employed, as shown in section in the small view, these rollers turning on radial shafts in brackets on the inner face of the dished flange on the end of the cylinder. To cut off the end of a pipe projecting too far beyond the outer face of the boiler, the brackets carrying the beading rollers are removed and circular cutting tools inserted in their place, to be operated by the turning and pushing inward of the spindle. In order to conveniently turn and gauge the spindle, a U-shaped arm is held on its head, in the middle part of which is mounted to turn one end of a screw rod screwing in a U-shaped frame having at its outer end a head adapted to be turned by a wrench or ratchet or other suitable tool. In the legs of the frame rods are fitted to slide, to be adjusted against the boiler plate and fastened in any desired position by set screws. A collar on the small end of the spindle prevents the head from sliding off and the cutting tools and dummy knives from being displaced.

Further information relative to this invention may be obtained of Messrs. Hyland & Mason, Charlevoix, Mich.

A PUG MILL FOR BRICK MAKERS.

The illustration represents a mill specially designed to remove all stones or lumpy matter which may pass the feed screw, and thus produce a clay of high quality for making bricks. It has been patented by Mr. Paul Stoerger, of No. 140 Wells Street, Chicago, Ill. Below the feed screw and its casing is a chamber whose bottom consists of longitudinally extending grate bars, the tops of which are slightly beveled, as shown in the transverse section, Fig. 2, similar bevels being also formed on the under side. These grate bars are placed a suitable distance apart to permit the fine clay to pass through the grate bars into a chute leading to one end of the machine, as shown in Fig. 1, the rear end of the frame of the grate bars discharging into a chute extending in an opposite direction for carrying off stones, lumpy matter, etc. A scraper with V-shaped notches and downwardly extending lugs adapted to pass between the grate bars is secured to side bars which support a cover plate adapted to close the lower end of the feed screw casing when the scraper is passed over the grate bars. A longitudinal rack secured to the under side of the cover plate or the frame of the scraper is arranged to mesh with a gear wheel on a transverse shaft on the main frame, and, by means of a hand wheel on a short shaft carrying a worm wheel, a sliding movement is given to the longitudinal rack to move the scraper and cover plate forward and backward. When the scraper is to be operated by power, the side bars are connected by a transverse beam with side rods connected with another beam adapted for connection with machinery capable of imparting a reciprocating movement. These side rods are also connected with a beam supporting cams adapted to press on friction rollers on the outside of a door forming the rear end of the chamber under the feed screw, while a rope connected with one of the bearings for the friction rollers extends upward and passes over a pulley, where it supports a weight, so that the door opens automatically when the cams slide away from the friction rollers. In operation, when stones or lumpy matter are left on the grate bars, the scraper is pushed forward to force them down the chute provided therefor, the door leading to this chute then opening automatically, while the cover plate covers part of the casing under the feed screw, so that no fresh material can pass downward until the scraper has been returned to its normal position.



STOERGER'S PUG MILL.

A CORRESPONDENT thinks that a fortune awaits the inventor who can produce a machine for filling, weighing, and sewing salt "pockets" at the mill.

THE MANUFACTURE OF SALT AT SYRACUSE, N. Y.

The famous salt region of Onondaga County, in the State of New York, has for over a century been a center for the production of this all-important substance. As long ago as 1770, salt from the salt springs then in existence was used by the Delaware Indians. Eighteen years later the white inhabitants began to make salt by the boiling process, near the site of the present city of Syracuse. The territory from which most of the salt is now produced is a government reservation whose status is established by a treaty made between the Onondaga Indians and the State of New York. The wells are maintained and the brine pumped by the State government, and the brine is delivered to the manufacturers at a royalty of one cent per bushel. The bushel is an arbitrary term indicating a net weight of 56 pounds or one half hundredweight. The wells, which are sunk and maintained by the State, vary from 150 to 340 feet in depth. Brine is pumped from them which at 60° Fah. averages 50° to 70° on the salometer. According to Dr. Englehardt's standard table of equivalents, these figures range thus:

Salometer	Baume	Per cent salt	Pounds salt in gallon	Gallons to 1 bushel
50°	13°	13·250	1·206	46·41
70°	18·2°	18·815	1·755	31·89

As a more appreciable standard it may be mentioned that sea water contains 2·7 per cent of salt and that it requires 350 gallons to make one bushel of salt.

Originally the tax or royalty was much higher than at present. At one time as much as twelve cents a bushel was charged the manufacturers. Since then it has been reduced, first to six cents, and finally, in 1846, to one cent per bushel. It is evident that at the higher rate a considerable revenue was derived from the wells. For the expense of building the Erie canal a sum of $2,300,000 was appropriated from the salt royalty. This sum represents nearly one third of the expense of construction, so that the salt makers are justified in their claim that but for the salt industry the Erie canal might never have been made.

The salt deposits lie in rocks of the upper Silurian age. The old springs were found in the marshy ground surrounding Onondaga Lake. The waters of the lake are excluded from the salt-bearing strata by impervious marl and marly clay. The wells pass through beds of fine sand and clay. After penetrating these layers a gravel is reached which contains the salt water. The brine is pumped from the gravel beds into reservoirs, whence it is delivered through log piping to the different works.

In Fig. 1 of the illustration is shown a pumping station and reservoir.

The Onondaga brine contains several impurities. The principal is calcic sulphate, more familiar in the form and under the name of gypsum or plaster of Paris. This runs as high as one half of one per cent referred to the brines, representing, therefore, two or three per cent of the dissolved salts. Calcium and magnesium chlorides, with traces of carbonic acid and oxide of iron, are also present. The iron oxide is only objectionable as spoiling the color of the salt, but owing to this its removal is imperative. The calcium and magnesium chlorides are deliquescent. Fortunately they exist in small proportions only in the brines. If in large quantity, they would make the salt moist and give it a tendency to cake, and eventually to become almost liquid. The calcium sulphate is not nearly so soluble as the other salts, and is partly precipitated in the evaporation, and most of it is removed from the concentrated brine. It is obvious that any insoluble matter would be considered an impurity, so that the manufacturer tries to remove this compound as completely as possible.

The salt is obtained by evaporation, either by solar or by artificial heat. In either case the first operation is to clarify the brine by settling. It is allowed to stand in vats in the open air, as shown in Fig. 3, or in factory buildings until the iron oxide has settled and the carbonic acid has escaped or has become precipitated.

At this stage the settling is sometimes aided by the addition of a little milk of lime. Alum or gelatine has been employed or suggested also as a clarifier. Two successive settlings in such vats are applied.

In the next step of the solar process the clarified brine is run into evaporating vats, shown in Fig. 2, where it is acted upon by the sun's heat, and gradually becomes concentrated. Movable covers or roofs are provided to be placed over the vats in case of rain.

As it becomes stronger, the comparatively insoluble calcium sulphate begins to precipitate. The slow evaporation favors crystallization, and the salt begins to separate as large crystals, and is called "coarse salt." As soon as crystals begin to appear, the saturated brine called "salt pickle" is run off into a fourth series of vats for final concentration. As the crystals accumulate in sufficient quantity they are removed and are washed in the fresh pickle. The object of this is to remove the strong brine, which contains a concentration of the calcium and magnesium chlorides. The product is then allowed to drain, and when sufficiently dry is removed to the storehouse. This is an outline of the process of making what is known as "solar salt."

Salt made by artificial heat is known as boiled salt. The term "factory filled" is applied to the purer brands. This term is indicated by the familiar letters F. F. branded on the large sacks. The kettle process, illustrated in Fig. 4, is largely used at the Syracuse works. The brine after settling and clarifying is run into kettles heated by fires underneath. An iron pan with an upright handle is placed in the bottom of each pan.

As the liquid evaporates and the gypsum separates, it accumulates in these pans, and is from time to time removed and thrown aside. This is termed "panning from the kettle." It is here that one essential difference between the solar and boiling process appears. Calcium sulphate or gypsum is less soluble in hot than in cold brine, so that a better separation of this impurity is effected than in the solar process. Each kettle has a capacity of 100 to 120 gallons, and fifty or sixty kettles may be set in a row. As soon as salt crystals begin to appear, the gypsum pan is removed and the salt is taken out by the workmen, is washed with fresh brine and is drained in baskets suspended over the kettles, as shown in the same cut. Brine is run in as required from the central distributing pipe.

The difference in grain in solar and boiled salt is considerable. The solar salt is so coarse that to adapt it for many uses it has to be ground in mills. This is done in the factories, and the product is known as "ground solar" salt. The boiled salt is of a much finer grain, and by the addition of some suitable substance to the kettles the grain may be made still finer. This process is termed "cutting the grain." Salt thus made is called "anthracite salt." The material added consists of traces of such matter as glue, resin, soap, etc. While the process has been known for many generations, it is condemned by many salt makers.

In Fig. 5 of the illustrations we show the modern washing process. The salt is delivered at one end of the apparatus through a chute. The brine enters at the same end and permeates the mass, and as the whole is kept in agitation the washing is very perfect. The salt saturated with the purer brine is drawn off and has to be dried. In the modern process this is done in centrifugal machines, one of which is shown in Fig. 6. There it is whirled around rapidly and the brine is expelled thoroughly by centrifugal force, exactly as sugar is treated for the expulsion of sirup. The separation is, of course, much more complete than where gravity alone is relied on, as in the draining process. When it is remembered that the calcium and magnesium chlorides are mainly present as ingredients of the residual brine, the importance of reducing the amount of this brine as much as possible is evident.

What the future of this historic industry will be is not absolutely certain. The expense of making boiled salt is largely due to the cost of fuel. The kettle process, which we have illustrated, although a relic of the last century, has not yet been superseded. Success has been attained in utilizing anthracite coal dust. Forty to forty-five bushels of salt are produced with the combustion of one ton of anthracite dust costing $1.75. Some years ago but thirty-seven bushels were produced with the consumption of one ton of bituminous coal costing $4.10. Yet this saving is offset by the fact that the evaporation per pound of fuel is only 5·83 lb. of water—less than half the work of a good steam boiler. One most serious menace comes from the West. Michigan, Ohio, and Kansas are now strong competitors with the New York works. There are two layers of rock salt, forty-five and fifty-four feet thick, seventeen miles south of Syracuse. These may be instrumental in changing the aspect of things in the near future.

The first leases in lots under the auspices of the State took place in 1797. The product for 1798 was 59,928 bushels of solar salt, under the superintendency of William Stevens. In 1889, under Superintendent P. J. Brummelkamp, 2,916,923 bushels of solar and 2,448,138 bushels of boiled salt, making an aggregate of 5,365,061 bushels, were produced. This is not high water mark. The following table gives the years of maximum production and the amounts produced:

Year.	Solar salt.	Boiled salt.	Total of both kinds.
1862............	1,983,022	7,070,852	9,053,874
1868............	2,027,490	6,639,126	8,666,616
1870............	2,847,691	6,260,422	9,108,113
1871............	2,464,404	5,910,492	8,374,896
1882............	3,032,447	5,307,773	8,340,220

Since 1882 the production has constantly decreased.

The State exercises a certain supervision over the manufacture. The salt, after making, must be stored at least two weeks before shipment. Before and after the storage period it is inspected by the State inspector. The product as delivered to the public is exceedingly pure. It is gratifying to know that it compares with the finest foreign product in freedom from objectionable magnesium and calcium compounds.

Positives Direct in the Camera.

Colonel Waterhouse's recent investigations, which have resulted in the discovery of a simple means for producing a positive image on an ordinary gelatino-bromide film—whether on paper or glass—and by the usual exposure in the camera, seems not unlikely to be the first step toward something like a revolution in photography. Indeed, when we consider the remarkable results obtained by adding extremely small quantities of certain derivatives of carbamide (urea) to the developer, it is difficult to suppose that the tourist—and perhaps even the professional photographer—will long fail to take advantage of so ready a means of securing reversed action, especially as the positive first produced can obviously be used for making subsequent copies by the same method, just as a negative is now used. A direct camera positive on paper or other opaque base will always be reversed unless some reflecting surface intervene between the object and the sensitive film.

In lieu of reflector, the *transparent* celluloid film may be used (not the celluloid roughened or ground on one face), and the originals thus obtained will show like enameled prints if the celluloid original is held or fastened face downward on a card or on the stiff leaf of an album; at the time, this original will always be available for the production of copies, not only by the gelatino-bromide reversal process, but also by such positive methods as the aniline method, the common blue process, or the primuline method.

Waterhouse's method involves no other variation from the usual routine than a simple addition to the developer, so that the final decision as to whether a negative or a positive shall be produced may be left to the last.

Of the two derivatives of thio-carbamide recommended by Colonel Waterhouse, our own experiments were made with a sample of allyl thio-carbamide.

Having prepared a saturated solution of water of the crystals of thio-sinamine—to use the shortest of the several names by which allyl thio-carbamide is known—to each ounce of ordinary pyrogallic or eikonogen developer we added from two to eight minims of the solution. Under these circumstances varying degrees of reversal resulted, ammonia appearing to be rather favorable to the reversal, and any considerable amount of bromide being evidently unfavorable. We failed to notice any advantage in giving more than a normal exposure; indeed, less than the normal exposure appears to be rather favorable than otherwise. This result is specially interesting, as to secure the best reversal by adding hyposulphite to the oxalate developer a long exposure is required—an exposure which may perhaps be estimated at over a hundred times the normal.

There is a wide field for experiment in connection with the method now touched upon, and although the best course for the present will probably be to thoroughly study the conditions under which the two agents described by Waterhouse will cause reversal with absolute certainty, it must not be forgotten that many analogous derivatives of thio-carbimide are known to chemists.—*Abs. from the Br. Jour. of Photography.*

Acidity of the Stomach.

This condition is due to germs, and the cure lies in getting rid of the germs. Germs of fermentation in the stomach produce first alcohol, then carbonic acid, and then acetic acid. A person troubled with this form of dyspepsia should be careful to take only such articles of food as do not favor the development of germs, and thus starve them out. Another thing to do is to wash the germs out of the stomach by drinking freely of hot water before meals. If food is put into a stomach already sour, of course fermentation will be set up immediately. Some persons notice that as soon as they eat, their stomachs become sour. The third important thing to do is to stimulate the stomach to make more gastric juice, which is a natural antiseptic, and prevents fermentation and also hastens absorption. The glands may be stimulated by applying hot fomentations to the stomach for half an hour immediately after the close of a meal, or, easier still, by wearing a rubber bag filled with hot water directly over the stomach for half an hour or an hour. Heat is a natural stimulant, and there are no possible ill effects from its use in this way.—*Good Health.*

The Massachusetts Institute of Technology.

This institute is now entering on its second quarter-century of existence. Its early history was excellently summarized in an address delivered last June at its twenty-fifth anniversary. It was founded by Prof. William B. Rogers, a native of Virginia, formerly director of the Virginia Geological Survey and Professor of Chemistry and Physics in the University of Virginia. After a hard struggle it began to be more prosperous, and in 1879 entered on its new career, with about 200 students. It now has about 1,000 students. Its present president, Gen. Francis A. Walker, was the superintendent of the census of 1880.

THE CODONOPHONE.

The codonophone (bell music) is a new instrument designed as a substitute for chimes in the theater. It consists of a series of metal tubes, which, under the action of a blow, enter into vibration and render sounds analogous to those of bells.

Mr. Gailhard, the director of the Paris opera house, when he mounted the ballet named "Le Rêve," the first representation of which took place last June, obtained from a manufacturer in England a sufficient number of tubes to form a true chime that imitated bells quite well and gave forth sounds of a very satisfactory purity.

These tubes are of brass, and of a uniform diameter of 1½ inch and a thickness of one-tenth of an inch. Their length varies according to the note to be obtained, and is determined by means of an iron rod that traverses the tube at each of its extremities, and is riveted externally on each side.

Mr. Lacape, a Parisian piano manufacturer, with these new elements constructed for the opera house a true musical instrument formed of twenty-five tubes, and having a range of two octaves (from *do* to *do*, key of *sol*). The heavy hammers that strike each tube have an escapement. They are set in action by means of a keyboard and of a mechanism analogous to that of a piano. The playing of this instrument is a very simple and easy matter.

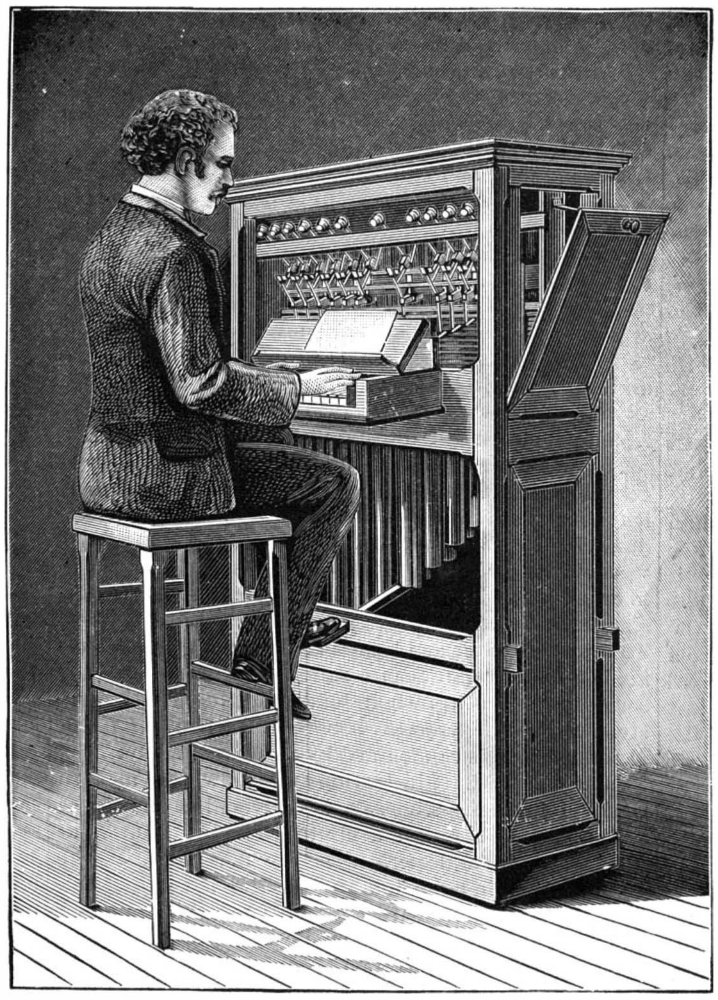
The lowest note is given by a tube 6 feet long that weighs about eight pounds and is equivalent, as to sound, to a bell weighing 176 pounds. The other tubes gradually diminish in length and weight up to the twenty-fifth, which is 3 feet in length and is equivalent to a bell weighing 72 pounds. The tubes collectively weigh about 220 pounds, and are equivalent to a chime of bells weighing from 3,300 to 4,400 pounds.

The codonophone, as now established, is capable of replacing what is called the sharp village chime. Although we thus succeed in producing sounds like those of bells, it must not be concluded from this that, as regards intensity and range of sound, we can succeed by this means in replacing those made in the open air.

In order to produce sounds analogous to those of large bells, it might be possible to use tubes of great length and wide diameter. This, in fact, is the method employed at the Bayreuth Theater in Richard Wagner's "Parfait;" but, in order to re-enforce the sound, large counter-bass cords and tam-tams are made to vibrate in unison, while the tubes are struck with hammers. In the "Rheingold" of the same author, an endeavor has likewise been made to imitate the sound of bells by means of a heavy cord that is made to vibrate within a sonorous box.

Again, we may mention a powerful chime composed of large bronze tam-tams, which is installed in the new Burg Theater of Vienna.

In the opera theater, in order to produce the sound of large bells in "Patrie," they use Mr. Sox's bell, which weighs but 15 pounds and gives the same note as an ordinary bell of several thousand pounds. This is formed of a sheet of brass six one-hundredths of an inch in thickness, in which several concavities have been made with the hammer. But, in order to re-enforce the sound and prolong the vibrations of this bell, it is necessary at the same time to produce the same note in unison with saxhorns, while an ordinary 220 pound bell gives it also, but two octaves higher.



THE CODONOPHONE A NEW MUSICAL INSTRUMENT, DESIGNED TO IMITATE THE RINGING OF BELLS.]

We shall recall the fact, *apropos* of this, that, according to what is generally admitted, the number of vibrations of a bell varies in inverse ratio of the cube root of its weight, that is to say that the latter increases very rapidly with the lowness of the sound. As bells are always very heavy and pretty high priced, relatively to the note that they give, we may see how advantageous it is to be able to produce the same note with lighter instruments, such as metal tubes, especially in a theater, where we have no need of the same intensity of sound as in the open air. For our figure of the codonophone we are indebted to *La Nature*, and for the description of it to *Le Genie Civil.*

Ribbed Boiler Tubes.

The Serve tube is a French invention, and differs from the common boiler tube in having a number of thin longitudinal ribs on its inside, usually eight, which extend radially toward its center. The boilers tested were each 10 feet 6 inches in both diameter and length, and were each provided with 126 tubes, 3¼ inches diameter and 7 feet 6 inches long. The heating surface of each plain tube was 5·95 square feet and that of each ribbed tube 10·42 square feet. The total heating surface of the ordinary boiler was 956 square feet and that of the ribbed tube boiler 1,536 square feet. The furnaces were alike, two furnaces to each boiler, each 2 feet 10 inches diameter. The area through the tubes for the passage of the gases was decreased by the ribs, being 802 square inches in the ribbed tube boiler and 852 square inches in the plain boiler. The grate surface in each boiler was 31 square feet. In a twelve hour test, in which the induced fan draught was carefully regulated so as to cause the same amount of coal to be burned in each boiler, the amount of coal burned in each was 11,872 pounds, and the water evaporated, from a temperature of about 60 degrees into steam at about 10 pounds pressure, was in the case of the ribbed boiler 114,600 pounds, and in the case of the plain boiler 103,000 pounds, an advantage in favor of the ribbed boiler of over 11 per cent. In another test of three hours' duration the gain in economy was over 14 per cent.

Another Proposed Large Tunnel under the Thames.

Sir Benjamin Baker, who was instructed by the London County Council to advise upon the practicability of carrying out the Blackwall Tunnel Scheme, has at length completed his labors, and his report has been issued to the members of the County Council.

It is chiefly based on observations of tunnels of a similar character in America, one of which has been successfully completed at Sarnia, while the other is in progress under the Hudson River. Sir B. Baker, who has only recently returned to England after inspecting these works, concludes, from his observations, that the proposed tunnel from Blackwall to Greenwich is entirely practicable. Sir Benjamin Baker recommends that in the first place a tunnel should be constructed of sufficient size to accommodate two lines of vehicular traffic, and that foot passengers should be provided for by a separate tunnel.

THE SEBAE OR SILK COTTON TREE.

BY J. F. COONLEY.

The sebae or silk cotton tree, *Eriodendron anfractuosem*, is a native of the West Indies. The one represented here is a very wonderful and interesting specimen, now existing at Nassau, N. P. Its branches spread over one hundred and seventy feet, and would extend still further, but are cut off frequently, as they

THE GREAT COTTON TREE OF NASSAU.

encroach on the police barracks. The huge roots seen in our picture spread nearly forty feet above the ground. When we take into consideration that here is a tree spreading its branches nearly or quite ninety feet northeast and southwest from its trunk, that owing to the rock on which it grows will not admit of its roots penetrating the earth to support such an immense spread of limb and foliage, we have to admire the wisdom of nature in building the immense braces or supports in the form of roots, by which this mass is upheld, and those all, or nearly all, on the surface of the ground. Several of the spaces between these roots would hide a horse completely from sight. The foliage falls near spring, and in a few days it starts again. I have seen it with bare branches Saturday evening and thick with foliage the following Monday morning. It seems magic the way the foliage develops. The immense roots and the extreme spread of the branches of this particular tree may be due, to a great extent, to its peculiar location. It stands in the rear of the public buildings, and is by them protected from the high winds from the sea and the hurricanes, and to that fact may perhaps be attributed many of its peculiarities. At one season of the year, near spring, it sheds a silky fiber like cotton, only much finer, that covers the ground for a long distance, wherever the wind takes it. This fiber probably gives it its name of the silk cotton tree, by which it is familiarly known. The engravings are from photographs of the tree.

THE GREAT COTTON TREE OF NASSAU.

Dangers of Gasoline.

A single breath of carbon monoxide gas will knock a man down as quickly as if struck by a club. *The Pantagraph* gives account of two recent cases at Normal, Texas, which should serve as a warning to those who use gasoline or coal stoves.

A short time ago Mr. John W. Gee and his wife and six months' old child came to Normal from El Paso. He came to attend the university, and they rented two upstairs rooms. In one of the rooms they had a gasoline stove and did their cooking, and the other was used as a sleeping room.

One morning they arose about 5 o'clock, and were heard for the last time about 6 o'clock. At 7 o'clock the Gee baby was heard crying, and a neighbor went upstairs to ascertain the cause. The baby was in the sleeping room, and she picked the child up and opened the door to the other room, which the Gees used as a kitchen. The bodies of Mr. and Mrs. Gee, lying in a cramped position, met her gaze. The sight was too much for her, and she ran shrieking down the stairs and fainted.

Mr. G. H. Warner, who lives next door, came in and, detecting the odor of gas in the room in which the bodies were, opened the doors and windows and attempted to resuscitate the man and woman. The bodies were cold and his efforts were of no avail.

At the inquest, Mr. Warner testified that he turned off the jets in the gasoline stove, opened the windows, and the stove was a new two-burner.

Prof. B. P. Colton, professor of chemistry in the Normal university, was called and said that the natural odor or fumes of gasoline was not suffocating; that the gasoline stove in ordinary running can and does sometimes produce a carbonic acid gas that would cause an intense headache, but would be slow in its effects. He said also that it produced a carbonic oxide when only partial combustion occurred, which would prove fatal if a full breath was taken. It is the same as that formed in hard coal stoves. Other roomers in the house testified to the happy relations existing between the deceased and that they had no trouble or differences.

The jury rendered a verdict to the effect that Mr. and Mrs. Gee came to their deaths by inhaling carbon monoxide gas, produced by a gasoline stove. The faces of the dead looked perfectly natural and gave evidence that the grim reaper's work was done quickly. The baby was slightly affected by the gas, but is now all right.

The room in which the accident occurred is a small one and the windows and doors were closed tight. The couple were dressed and had apparently had breakfast. The stove had been used, and from some cause, which does not clearly appear. gas was generated. It is believed that this was heavier than the air, and hence hung in a thick mass near the floor. The supposition is that Mrs. Gee stooped down for some purpose, and, getting a breath of the poisonous vapor, fell. Her husband, in attempting to pick her up, met the same fate, and fell dying beside her. This supposition is formed from the position of the bodies. For some time after the windows had been opened there was a strong smell of the gas in the room. Prof. Colton declared that the gas was so deadly that one breath was sufficient to destroy life.

Increasing the Sensitiveness of Photo. Films.

The following process is by York Schwartz, of Hanover, Germany. It consists in mixing the material for making the film with or coating the photographic films with formaldehyde or a compound of formaldehyde with bisulphite salts.

The process is based on the discovery that the sensitiveness of silver compounds to light is materially increased or that the effect of light on the same is continued by the presence of formaldehyde, or a compound of formaldehyde with a bisulphite of an alkali metal or of ammonia or of substituted ammonia (capable of forming bisulphite) in the sensitive silver compounds.

For photographic purposes these discoveries may be utilized as follows: First, by adding one or more of the specified compounds, either alone or in mixture with other substances, to the substances for making the films at the time of the production of the sensitive film; second, by bathing the finished photographic film in a solution of the said compounds or mixtures before the film is exposed to light; and third, by treating the photographic film after exposure with a solution of the said compounds or mixtures. In this case the changes produced in the film by the action of the light are continued, so as to obtain in this manner the same result as by a correspondingly longer exposure to light.

The application of the said compounds constitutes an important improvement in the manufacture of photographic films, because they possess in an increased measure all advantages of the substances hitherto employed for similar purposes without sharing their faults—for instance, the tendency to form clouds or specks or of imparting a yellowish tint to the film.

THE Otis Steel Company, of Cleveland, which has the largest plate mill in the world, a few days ago rolled a 20 inch ingot of 8,500 pounds down to three-quarter inch plate with one heat. Some of the members of the Iron and Steel Institute, who visited these works during their tour of inspection in this country, were surprised at seeing plates rolled direct from the ingots without being hammered or otherwise prepared.

Correspondence.

Ingrowing Toe Nails.

To the Editor of the Scientific American :

I notice the issue of the 15th Nov. contains a method of curing ingrowing toe nails. As I have had some trouble of that nature myself, I would like to suggest a method of relief which worked admirably with me. Raise the ingrowing part as much as possible by packing with lint or cotton beneath. Allow this to remain a day or so. Remove this and now put in its place mercuric oxide, HgO, easily obtainable at any drug store. Press in a little cotton to keep the mercury in place. Cleanse the parts every day or two, but be sure the mercury is kept over and around the ingrowing part. The mercury seems to destroy the nail where it touches it, and at the same time deadens sensation without producing any deleterious effects.

J. G. OWENS.

109 Ellery St., Cambridge, Mass.

THE BELT PROBLEM.

To the Editor of the Scientific American:

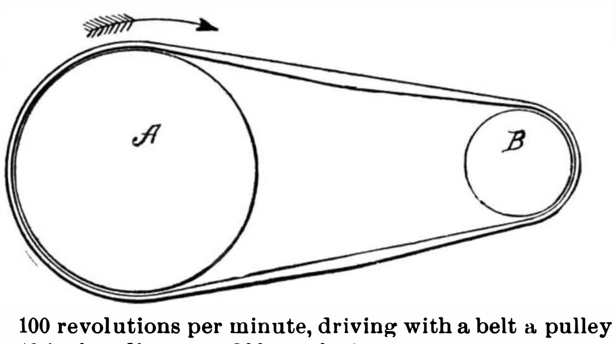
As no one has yet answered the query of your correspondent on that "Belt Problem" you published Oct. 4 last, I will try and do so.

The reason of the outside belt creeping on the inside one is because it is made to travel faster in consequence of the inside one increasing the size of the pulleys. For instance, if the inside belt is one-fourth inch thick, then the outside one would virtually be working over pulleys one-half inch diameter larger than the inside one.

The creeping process only takes place on the stretch of belt between the pulleys, and has considerable force. No wonder it pulled the rivets out of your correspondent's belt.

I don't see any objection to using two belts, one on top of the other, if the driving and driven pulleys are the same size ; but if they are not, then the case is seriously complicated.

To illustrate : A pulley 36 inches diameter, making



100 revolutions per minute, driving with a belt a pulley 12 inches diameter, 300 revolutions.

Now if you put on another belt, say the inside one is one-fourth inch thick, you virtually increase each of the pulleys one-half inch diameter, and you have a conflict raging between the two belts that is anything but desirable, the inside one trying to drive the small pulley 300 revolutions and the outside one trying to hold it back to 292, the number of revolutions a 36½ inch pulley would drive a 12½ inch one.

I think it is quite clear the difference of 8 revolutions has to be adjusted by the outside belt slipping over the inside one as they pass over the small pulley.

The lower or pulling side of the inside belt between the pulleys is taut and the upper side slack, while the outside belt is the reverse, which shows the outside belt to be pulling against the inside one, thereby wasting considerable power.

As a rule I have learned to discard double belts. They undoubtedly absorb a great amount of power, because of the conflict between their inner and outer surfaces.

J. A. LOUGH.

Kansas, Nov. 8, 1890.

The Prophet Nahum Predicted the Modern Locomotive.

To the Editor of the Scientific American:

I have read your article on Job's steam engine. Please read the 4th verse of the 2d chapter of Nahum the Prophet, and see if you can in as few words describe a train of cars and limited express. He was way ahead of Stephenson.

B.

Titusville, November, 1890.

The following is the verse referred to :

Nahum II., 4th verse : "The chariots shall rage in the streets, they shall jostle one against another in the broad ways; they shall seem like torches, they shall run like the lightnings."

To Make Blue Prints Green.

To the Editor of the Scientific American:

Make four solutions as follows :

Solution A.—Water 8 ounces and a crystal of nitrate of silver as big as a pea.

Solution B.—Hydrochloric acid 1 ounce and water 8 ounces.

Solution C.—Pour a solution of iodide of potassium (iodide of potassium 1 ounce and water 8 ounces) into a saturated solution of bichloride of mercury until the red precipitate is *just* dissolved, and then add four times as much water as the resulting solution.

Solution D.—Water 16 ounces and iodide of potassium 1 drachm.

Then take the blue print and bleach it with solution A, when the image will become pale slate color, or sometimes a pale yellow.

Then wash thoroughly and immerse the print in solution B, when the image will again become blue.

Then, without washing, immerse the print in solution C, when the image will become green, but the "whites" will be of a yellow tint.

Then put the print in solution B again, without washing.

Then wash and pour solution D over the print to purify the "whites" and to give the green image a bluer tint ; but do not leave print in this solution too long, as it has a tendency to make the print blue again.

LOUIS B. HAYS.

Pittsburg, Pa., Nov., 1890.

[Our correspondent has sent us an excellent print of green color as an example of his method.—ED. S. A.]

Hydraulic or Jet Propulsion.

BY JOHN S. MORTON.

The Evolution, built by Mr. W. M. Jackson, is completed and will soon be tested. Her method of propulsion (as invented and patented by him), which consists in forcing water by an engine and pumps into a conduit, and discharging it therefrom through a propulsive nozzle under heavy pressure, into the water of flotation, in a continuous stream at very high velocity, in quest of a "fulcrum" to push against, is not sound, as the result will prove. The pressure in pounds on the nozzle (0·5184 of a square inch in area) will be the entire sum of the propelling force of the vessel.

Her propulsion will be due to the reaction of said pressure, exerted inside the conduit at a point opposite to the nozzle, and not to the reaction of the nozzle thrust against an imaginary "fulcrum" in the water of flotation.

With 200 pounds of steam to the square inch on the high pressure cylinders, the propelling force of the vessel (after allowing for friction) will not exceed 1,007¼ pounds, which will not be sufficient to propel her much, if any, over 15 knots per hour. It will propel her just as rapidly as that number of pounds, suspended over a pulley and falling in space, would draw her, but no faster. If her nozzle thrust be 609 feet per second, as claimed, her slip will be nearly 96 per cent, and she will be utilizing in her propulsion but 46 of her 1,116 horse power.

Mr. Jackson can secure high speed only by increasing the conduit and nozzle pressure, or by enlarging the area of the nozzle, and the increased speed of the vessel will be proportionate thereto.

With her machinery as constructed and in place, by enlarging the nozzle to 3 inches in diameter, there would be exerted on it, with said 200 pounds of steam (after allowing for friction), a propelling force of 13,719 pounds, which would propel the Evolution as rapidly as that number of pounds suspended over a pulley as aforesaid would draw her, possibly up to 45 knots per hour.

Hydraulic or jet propulsion, properly applied (but not on Mr. Jackson's "theory"), must supplant the side wheel and the screw wherever speed and economy are estimated at their full importance and intrinsic value.

New York, Dec. 1, 1890.

The Denver, Lakewood and Golden Electrical Railroad, of Colorado.

This new road of standard gauge and double track, now in process of construction, to be completed in March, 1891, will be fourteen miles long, and will cost, fully equipped, $800,000.

A ten mile addition is contemplated to Lookout Mountain, which, when finished, will make it the longest electrical railroad in the United States.

The electricity will be generated by the water from the Clear Creek Canon and the Welch Ditch Co., fed by the melting snows of the Rocky Mountains, furnishing 1,200 horse power, owned by the company.

The surplus will supply electrical power to manufactories along the line of the road.

The electrical motor to be used for the rolling stock has not yet been decided upon. The cars will be made in Denver, similar in length, sumptuousness, and comfort to any now in use on trunk lines. The wheels will be of thirty-six inches diameter, and fitted with two thirty-five horse power motors, capable of moving sixty miles an hour and pulling loaded trailers when necessary.

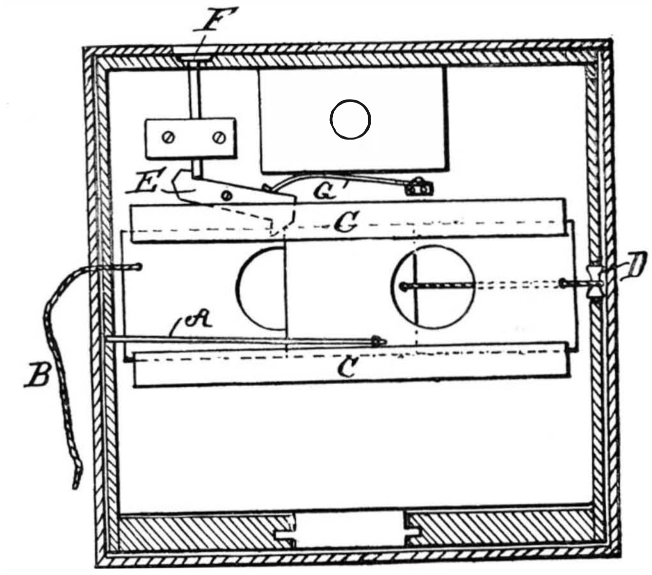
Cars will run hourly. Annunciator buttons will be placed at every seat to signal for the stoppage of the cars at any point along the road where passengers desire to alight. The management is largely interested in the land to be traversed by the road, and it is expected that, in due time, by judicious fostering the line will be a continuous suburban town.

The road will be brilliantly illuminated its entire length at night by incandescent lights at intervals of one hundred feet.

Golden, the Western terminus, a town of 3,000, is delightfully located in the foothills at the entrance of the canon to the Rocky Mountains, and is surrounded by such picturesque scenery that it is expected thousands of tourists and others will avail themselves of the facilities offered by the road during the summer months.

AN INSTANTANEOUS SHUTTER FOR HAND CAMERAS.

A great many amateur photographers make their own cameras, and many of the new ideas introduced into the camera of the stores result from some amateur's experiments. An ordinary hand camera is of very simple construction and can be made with few tools. The shutter is perhaps the most difficult part, and it is here that an amateur, with limited appliances for working, has to put in his study. The shutter shown in the illustration is well adapted for the hand camera and is very simple in construction. It is operated by a rubber band, A, and can be made very rapid by having a short band and slow by having a longer one. The illustration shows it set, an operation which is performed by pulling the string, B, out. When the shutter is sprung, the string pulls in out of the way, leaving just enough out to take hold of. The flaps can be made of thin wood, pulp board, hard rubber, or any similar substance. The hole in each is exactly the same size of the one in the end of the camera. They are put in place in the wooden grooves, C C, and a string is run from a hole in the end of one over the pulley, D, and to the end of the other, and tied so as to bring the three holes together. Then by means of the string, A, and rubber band, B, they are made to travel back and forth past each other in setting the shutter and making the exposure. The shutter is held open by the catch, E, which is operated by the thumb piece, F. This thumb piece is sunk into a hole in the



top of the camera, out of the way. A spring, G, holds the catch in place in a notch in the edge of the inside flap. There is no jar when the shutter is released, as the flaps move in opposite directions and one offsets the other. The front board of the camera has only two openings, one for exposure and one for the finder, and the only outside parts on the camera for working the shutter are the two for setting and releasing it. If the front board is hinged on, the speed of the shutter can be easily regulated by means of notches in the edge of the outside flap, making the rubber band taut or loose as required. The simplicity of the arrangement and lack of conspicuous brass work will recommend it to amateurs who wish to pursue their hobby without attracting too much attention.

A Plant that is Puzzling the Scientists of Pennsylvania.

A truly wonderful plant is at the Allegheny Conservatory, says the Pittsburg *Chronicle.* No one knows to what class it belongs or anything about it. It is the subject of much speculation among botanists, and they anxiously await the development of a bud that is forming. Then, they say, they can place the plant. The botanists have a suspicion that the plant is a tropical one, and Supt. Hamilton is treating it on that supposition.

The history of the plant so far as known is a unique one. During the summer one of a party of gunners brought down a crane. It was a beautiful specimen, and the taxidermist of the party set to work to mount it. In the bird's craw were found several seeds.

With a view to learning if the seed was killed by the bird eating it, they were placed in water. In a few days the seeds sprouted. They were planted in loam and kept in a warm room. Edward V. McCandless took charge of it. The plant was an object of interest to Mr. McCandless and his botanist friends, and its development was closely watched.

Recently it was transferred to the conservatory. The leaves are long and broad and heavy, not unlike a species of palm.

A NAUTICO-TERRESTRIAL VELOCIPEDE.

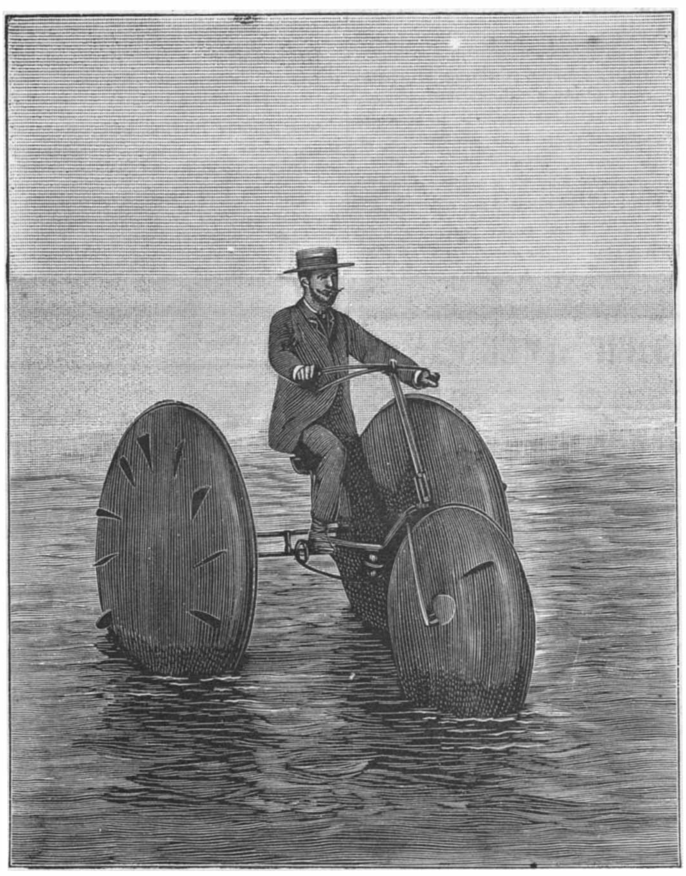
Trials have just been made at Marseilles of a velocipede that operates with the same ease upon water as upon land, without its being necessary to make the least change in its arrangement or the least halt in its running. The apparatus is of the tricycle type. It is actuated by pedals, is provided with a brake, is controlled by hand through a transverse lever, turns around with ease, and passes without transition from land into water, and *vice versa*. Let us imagine two plates connected by their edges (that we shall suppose the wheels of a tricycle), flanked upon their faces by two iron plate half shells, four inches deep and of a diameter equal to that of the wheels, and we shall have two hollow, light and strong double convex lenses in which rigidity is secured by cross braces. These lentiform wheels are provided on the edge with a channel for the reception of a strong rubber tire for preventing jolting, as in all velocipedes. In addition, they are provided externally with a dozen small copper paddles, that act like the float boards of the wheel of a paddlewheel steamer as soon as the apparatus enters the water. The accompanying figure shows the arrangement of the parts so well that it is useless to dwell upon details. It represents the apparatus returning to land after operating upon the sea. The wheels of the first model were truncated cones placed base to base. Those of the second model, here represented, are, as above stated, lentiform shells. In this model the small wheel is placed in front as in ordinary tricycles. A piece fixed to the center of the triangle formed by the three wheels supports the seat, double pedal, and the guide bar governing the direction. Motion is transmitted by an endless chain, as in bicycles. The diameter of the wheels is 4½ feet, their distance apart is 4 feet, and their thickness at the axle is 8 inches. The seat is situated 24 inches above the axle. Finally, with the rider in the seat, the wheels enter the water to a depth of but 16 inches. A few figures gathered with care, during the course of a series of experiments that the inventor and manufacturer made expressly in order to permit us to give our readers further information, will be seen to be very satisfactory. The apparatus started from Castellane Place, traversed, in ten minutes, the 2½ mile long Prado Avenue (which was obstructed by reason of the autumn horse races), entered the Roucas-Blanc bathing establishment, and then entered the water, wherein it continued its motion without stoppage or effort. The sea was calm and tractable, but there was a little swell. The first trials gave a mean speed of 2¼ miles an hour with the use of six 2 inch wide paddles per wheel, instead of the twelve 3¼ inch wide paddles that the apparatus will carry. The speed in running backward (for which the apparatus is wonderfully adapted) was a quarter less. The muscular effort giving this speed is scarcely equal to that necessitated by a tricycle on a good road. The complete evolution can be effected in a circle of a diameter of about eleven feet. In order to prove this, the manufacturer, in 130 seconds, made the following motions: A rapid immersion, a run of 33 feet, a volt, a run forward, two successive volts forward, then two backward, a volt, a run, another volt and a resumption of the motion toward the water. The apparatus then traversed the somewhat rough water of the establishment, and, followed by the primitive model, left the basin and took to the sea.

After half an hour's evolutions, the two apparatus returned to within sixty yards of the shore for experiments on stability. A tall swimmer then imitated a man in danger, clinging in all directions and in the least supposable poses to all parts of the apparatus. These experiments were made as follows: A man mounted at the back and stood upright upon the axle. The feet of the cyclist then remained out of water. The swimmer took his place upon the seat and his companion leaned upon the brake bar. The effect was the same. The swimmer held on to the axle, the paddles, and the upper edge of the wheels without being able to upset the apparatus, and the cyclist was not unseated. He lifted the apparatus by the front wheel, and the result was the same. The stability and the resistance to upsetting were surprising.

The last test was made near the shore. The swimmer, having taken to his feet, and having a firm position, was finally able, with the aid of the cyclist, to place the tricycle upon the side, and then to overturn it completely. The two men then mounted upon the apparatus, which had become a simple raft, and, afterward, jumping into the water and standing, they righted it. It is indisputable that two men at least (exclusive of the cyclist) might hang on, without inconvenience, to any part whatever of the apparatus, and, after having thus escaped an immediate peril, allow themselves to be carried by the apparatus, even when upturned, for many hours.

The apparatus is, however, only in its experimental period, and its inventor, Mr. Romanès, a naval mechanic, and its constructor, Mr. Rousseau, foreman of a large velocipede manufactory at Marseilles, are about to add some improvements, such as watertight compartments, larger paddles, lighter wheels, etc., so as to be able to attain a speed of 4¼ miles in the water without any trouble.

It is clear that in a heavy sea the apparatus will be difficult to manage, but a rowboat would be in the same situation, and this is not a normal case. What seems to us to result from the experiments is that the lightness of the apparatus, its easy management, the feeble resistance experienced in complete immersion, and especially the ease with which it permits of passing from a road to a lake or pond, or even to an agitated sea, and, inversely, from a river, etc., to a road, without any preparation, class this velocipede among the useful inventions.—*La Nature.*



NEW WATER VELOCIPEDE RECENTLY TRIED AT MARSEILLES.

Exercise for Health and Beauty.

Few theories are carried to a more unwarranted extreme than that of the importance of physical exercise and muscular development. Because exercise improves health, and muscle is a fine thing to own, half-educated reformers preach exercise and muscle as if there could not be enough of them. Any plain-spoken physician will say at once that there can be too much exercise and that unwise forms of exercise can be injurious. He will also say that there is very slight essential connection between muscle and that supreme physical quality—vitality. Many a man has developed muscle at the expense of vitality, and many a nervous temperament has impaired health by dragging itself through exercise when it needed rest. Muscle is all right in its proper place, but ahead of it come heart, lungs, brain, and stomach. Cultivating muscle does more for beauty, probably, than for health, and since beauty is really one of the proper objects of effort, the forms of exercise which bestow most symmetry of outline and grace of movement are to be studied. One of the women writers who deal out instruction to the sex has recently advocated running. She is nearer the right track than most of the didactic writers of her kind. Running is the great beautifier of figure and movement. Running gives muscular development, strong heart action, and free lung play. The muscle comes where it ought to be, the shoulders go back, the loins hold the trunk well balanced, and the feet take their correct positions. It was running which made the Greek figure. The more active tribes of American Indians have been runners from time immemorial, and from the chest to the heels they are much more beautifully built than the average of white men. Running peoples have usually the firm but elastic texture of flesh which is the beauty of flesh. We know infinitely more about taking care of the human body than Greeks or Indians, and if we would train our children to regular and wisely supervised running exercise, supplemented with other exercises for the hands, arms, and shoulders, we could surpass them in beauty and activity. A general adoption of such a system seems very far from likely, since we have none of the appropriate grounds or apparatus. The next best thing is walking, but most of us walk on our heels, and lift up the feet instead of springing forward with them and driving the body on with the back muscles of the legs Fashionable people will pay high prices for grooms and riding masters to go out and teach correct horseback movements, but who ever saw a man, woman, or child with an instructor in walking? Yet horseback riding is a trifle beside good walking in its effect either on health or on those qualities of figure and carriage which the whole world holds in high estimation. Gymnasium exercise is so easily overdone, and may be so injurious in some cases, that it is doubtful whether anybody should go in for the gymnasium strongly without the superintendence of a skilled physician in at least the early stages.—*Kansas City Times.*

A Proposed Ship 1,000 Feet Long and 300 Feet Wide.

At the recent convention of the Iron and Steel Institute, at Pittsburg, Sir Nathaniel Barnaby, K.C.B., constructor for the British navy, read a paper on "The Protection of Iron and Steel Ships against Foundering from Injury to their Shells: including the Use of Armor." In this he gave expression to his own theories as to the value of armor. He said that we are greatly worse off in these days of steel and iron than when ships were built of oak, teak, and pine, as to the perils arising from perforation of the shells or hulls of ships. Increased speed and increased momenta in collisions had increased the risks, and at the same time the material of which the hull is composed submits so easily to perforation that he was inclined to value the opinion of many eminent men who are strongly opposed to the abandonment of wooden bottoms, both in commerce and war. One-fiftieth of the value of the vessels in the mercantile marine, he said, was required annually to make good losses and repairs entailed by collisions alone. He prophesied that America, possessing nearly one-sixth of all the wooden sailing ships of 100 tons net and upward in the world, would probably find it to her advantage for many years to come to continue the use of wooden ships.

In the course of his paper the essayist suggested a most interesting possibility in the development of passenger steamships. He said:

"I have never thought that size is a disadvantage in merchant ships, supposing they can be worked financially. On the contrary, the advantages arising from size in passenger ships seem to me to be so great that I do not see where we shall stop.

"I was consulted some years ago by a business man, well known on both sides the Atlantic, as to the possibility of building a steel ship which would not roll, or pitch, or heave in the sea, and in which, therefore, the bulk of passengers would be in a less desperate hurry to get ashore. He thought fifteen knots an hour sufficient speed.

"It appeared to me to be perfectly practicable with a draught of water of twenty-six feet. I thought the minimum length and breadth would be 1,000 feet long and 300 feet broad. I estimated that with engines of 60,000 horse power an ocean speed of fifteen knots could be obtained.

"Two sets of apparent difficulties had to be overcome, viz., those connected with the building of the ship afloat, and those relating to receiving and discharging cargo. The ship would be a steel island, incapable of entering any docks. The building difficulties soon disappeared. They had no real existence. To meet the other difficulties, I proposed to form shallow, still-water harbors or docks within the ship, entered by gates in the sides, and to carry, always afloat there, the loaded barges and tugs, turning the barges out and taking in fresh ones already loaded at the ports of discharge and shipment.

"Such a ship would require to be fortified and garrisoned like a town. She could be made absolutely secure against fatal injury arising from perforation. The subdivisions required for this purpose might be made to serve effectually against the spread of any local fire. I do firmly believe that we shall get the mastery over the seas, and shall live far more happily in a marine residence capable of steaming fifteen knots an hour than we can ever live in seaside towns."

A Great Line of Hoisting Machines.

Messrs. Volney W. Mason & Co., of Providence, R. I., have just completed for Lowell M. Palmer's new hay sheds, at North 9th Street, Brooklyn, N. Y., Palmer's Docks, an extraordinarily long line of quick-speed hoists, fifty-two in number, worked by a single line of shafting 450 feet long, for unloading an entire train of cars at once; also for loading on teams on opposite side of building.

A new and useful application of their hoisting machinery has been made at Providence by Messrs. Mason & Co., in connection with and operated by an electric motor—10 H. P.—operating three hoists at once to handle hard pine lumber, at the R. I. Lumber Co., in that city. This is said to be the first instance of lumber being handled successfully by electric motor power.

RECENTLY PATENTED INVENTIONS.

Engineering.

CRANK SHAFT. — Martin A. Green. Altoona, Pa. This invention provides a counterbalance for the crank shafts of center crank engines, which may be applied to the common center crank so as to be practically as solid as if formed integrally with the crank and the shaft, adapting the center crank thus counterbalanced for use in high speed engines without producing vibrations.

SLIDE VALVE. — Gustav Duvinage, Pasewalk, Germany. This valve is cylindrical in form, and fitted to slide in a cylindrical steam chest having near one end an inlet pipe, and connected at its bottom by ports with the cylinder, in which operates a piston in the usual way, the construction being such that the valve is counterbalanced so as to be almost entirely relieved of steam pressure.

Railway Appliances.

SLEEPER AND RAIL FASTENER.— Michael A. Glynn, Havana, Cuba. This sleeper has a depending tongue to be embedded in the earth, a broad portion adapted to rest on the surface of the earth, and a longitudinal rib having slots to receive the chains which carry the rails, with other novel features designed to produce a sleeper with the necessary elasticity, which is inexpensive and easily placed in position, and with means for so fastening the rails that they cannot get out of place.

CAR COUPLING. — Casper F. Phelps and Raymond A. Lucas, Kohala, Hawaii. This device has a longitudinally separable drawhead in an interior recess of which is pivoted a slotted disk having an integral locking tongue, a latch dog below which is a cam block being adapted to interlock with notches in the disk, while a hook bar pivoted to the cam block is adapted to engage a toe on the slotted disk, a rock shaft supporting the cam block, with means for rocking it, whereby cars may be automatically coupled and uncoupled without going between the cars.

Agricultural.

HORSE HAY RAKE. — Barton W. Harmer, Avoca, Neb. This invention provides an attachment by which the hay, after being raked into windrows, may be easily dragged, slid or swept to the place where the stack is to be formed, a system of levers being also employed by which the rake teeth and cocking attachment may be simultaneously operated, the parts being held in proper position by the weight of the driver.

Miscellaneous.

LENS GRINDING MACHINE. — Richard B. H. Leighton, Philadelphia, Pa. The machine has a bed on which is a fixed carriage carrying the lens, a radius bar being pivoted on the bed, while a second carriage movable on the bed carries a grinding tool, the second carriage being secured to the radius bar, with other novel features, whereby the machine will grind a lens of any reasonable size, being readily and accurately adjustable to various sized lenses, to grind them perfectly true, and so that the focus may be changed and regulated to a nicety.

STOP WATCH.—Thomas J. Wrangham, Rutland, Vt. This invention provides an attachment for stop watches whereby the movement may be controlled by air pressure, a flexible tube extending from the watch and terminating in a bulb to be operated by the hand, or a mouthpiece, so that the watch need not be removed from the pocket of the wearer in timing a horse or the movements of athletes.

VENDING MACHINE. — George B. Cornell, New York City. The invention covers a novel construction of a machine, with but few parts and simply arranged, whereby a package may be withdrawn from the machine only after a genuine coin of a certain denomination has been properly introduced, other coins or imitations not interfering with the mechanism.

ODOMETER. — Albert Wareham, West Charlton, N. Y. This device has a split worm wheel with overlapping ends, to permit of increasing or diminishing the size of the wheel according to the size of the vehicle wheel, and is designed to be quickly applied to any vehicle to measure the revolutions of a wheel.

THRESHOLD GAUGE. — Alexander Watson, Brookline, Mass. Rectangular plates are adjustably attached to the ends of an adjustable body, second plates having one beveled end being also attached to the ends of the body, the opposed plates being adapted to extend laterally in opposite directions, while third plates are also adjustably attached to the first named plates, forming a simple tool whereby threshold plates may be readily and accurately fitted to door frames.

SPRING GUN. — George W. Seebach, New York City. This is an improved toy gun of simple and durable construction, in which the follower is actuated by means of springs, the recoil of which and of the follower is taken up so as to prevent breakage and wear of the parts.

BOAT OR CANOE CHAIR.—Thomas H. Chubb, Post Mills, Vt. This invention provides a chair with back, side arms, and legs adapted to be readily and strongly attached to the seat of a canoe or boat, the device when not in use being foldable into a small package.

MOISTURE PARTITION FOR CIGAR BOXES.—Fred. G. Heydt, New York City. This is a self-supporting loose-fitting partition, formed of an angled plate with perforations and a broad supporting foot, the plate being movable in the cigar box, for supplying moisture to the cigars, the device being so formed that it may be packed with the cigars and not take up much room.

STEP FOR LADDER OR FIRE ESCAPES. David H. Rivers, Thomaston, Me. This device comprises a rung, with brackets to receive its ends, sleeves to embrace ladder ropes, and clamping devices, making a simple and convenient step to be secured to the ropes of ships' ladders or fire escapes, and which when attached will not encumber the ropes, but permit their being rolled up into small compass.

NECK YOKE. — Charles E. Davis and Charles Lewis, Neosho, Mo. This is a strong, simple and convenient device for draught animals, to permit one or both of a pair of horses connected by it to a vehicle pole to move laterally and avoid obstructions in the roadbed, and then resume a normal position with regard to the vehicle and its pole.

ICE VELOCIPEDE. — William F. Flickinger and George J. Wiett, Orchard Park, N. Y. A driving wheel having spurs on its outer edge is mounted between runners in a suitable frame provided with a seat and means for revolving the wheel and steering the device, which is simple and strong in construction and adapted to be easily and rapidly propelled over snow or ice.

STONE POLISHING WHEEL. — Harry W. Whitcomb, Barry, Vt. This is a device for smoothing the rough face of a slab of stone or slate, and consists of a metal disk with detachable scroll-shaped flanges and having connections for a vertical pendent shaft, whereby the disk is rotated horizontally on the upper face of the stone to be dressed, acting thereon through the agency of sand or small pellets of hard cast iron.

HEATER AND VENTILATOR.—William R. Macdonald, Allegheny, Pa. This is an improvement on a former patented invention of the same inventor in an apparatus to be used as a heater, or as a heater and ventilator, or as a ventilator alone in warm weather, to draw off vitiated air from apartments and supply pure air, the arrangement being such that no mingling can take place of the escaping vitiated air with the fresh air entering from the outside.

DEVICE FOR MEDICATING AIR.—The same inventor has obtained another patent covering a novel arrangement of air-tight cabinet in an apartment, with means for warming, cooling, purifying, or charging the incoming air with antiseptics or medicaments for any particular ailment, these cabinets to be separately applied to a series of apartments in a building, so that each apartment may be isolated from the other, although all the apartments may have a general outlet and means for drawing off the vitiated air.

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

Business and Personal.

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Notes & Queries

HINTS TO CORRESPONDENTS.

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

(2632) J. T. L. asks: Will you please answer the following questions through the Notes and Queries of your valuable paper? 1. Will the large plunge battery described in "Experimental Science" do the same amount of work when it is placed on a moving vehicle as when stationary? A. Yes. 2. Can any steam engine be run by compressed air, that is, if the same amount of pressure is used in both cases, and which will be the cheaper? A. One horse power engine run by compressed air, if it can be done, or the simple electric motor described in "Experimental Science," and what per cent cheaper? A. Yes; provided the accumulation of frost in the engine is prevented by warming the air before use. A compressed air engine would be more economical than an electric motor driven by battery power. 3. Is there any way of getting a description of all the air ships which have been invented all over the earth? A. We refer you to May's "Ballooning," $1, and to back numbers of the SUPPLEMENT. 4. We have a tank here, and would like to know how many cubic feet of water there are in it, what pressure is there at the bottom, and how high should it throw a stream 1 inch in diameter, the tank being 100 feet high and 45 inches circumference? A. The pressure at the bottom of your tank is 41·88 pounds per square inch. The tank contains 16,200 cubic feet. The distance the above pressure would project a jet would depend upon the length, diameter, and straightness of the pipe. Under the most favorable circumstances you could probably throw a jet 60 feet.

(2633) A. K. Jr. asks: 1. What is the best non-conductor of heat known to science? A. Vacuum. 2. What is the best fireproof non-conductor of heat known to science? A. Zirconia. 3. Should the object that is to be protected have a polished surface to give the best results? A. Yes. 4. Does it make any difference of what color the protected object is? A. White is the best color. 5. Is a vacuum as good a non-conductor of heat as the same space would be filled up with air? A. Yes; better. 6. Does heat radiate through solid non-conductors of heat as well as through air? A. No.

(2634) J. J. C. asks (1) for a preparation for rebronzing a bust on a lamp. The bronze has all worn off. A. Use bronze powder mixed with the varnish sold for the purpose. 2. Can you tell me what oil of tartar is, and where I can get some? A. It is a strong solution of potassium carbonate. If this salt is exposed to the atmosphere it absorbs water, and as the old name for the salt was salts of tartar, the solution thus formed was called oil of tartar. It may be seen by adding potassium carbonate to weak alcohol. The salt absorbs the water from the alcohol, dissolves and forms an oily layer at the bottom of the vessel. Any druggist can supply it.

(2635) T. H. asks. 1. Why will not American clay answer for crucibles as well as the German? If there are different ingredients what are they? A. It is quite possible that were the demand sufficient, clay for every variety of crucible would be mined here. The ingredients are principally silica and alumina. A very slight difference might largely affect the value of the material. Such difference might not be disclosed by analysis. 2. Why can't we hear something from the Lick Observatory, after all the noise that was made about it? A. Reports of work are published and work perfectly satisfactory to the astronomical world is being executed there. The observatory was erected for scientific uses, not merely to obtain popular fame. 3. Can illuminating gas be compressed so as to be used as a portable hand lamp? A. Practically this is impossible.

(2636) C. A. asks (1) how to curl ostrich tips. A. Draw the fibers, one at a time, over the back of a knife, pressing them against it with the finger. Skill will tell in the quality of the work. 2. How to prepare and apply a lacquer for silverware to protect it from the action of natural gas? A. A solution of shellac or seed lac in alcohol may be applied. The articles must be absolutely clean. Even a finger touch will mar the work. The best plan would be to have the work done by a japanner. The following may be tried, as it has more body than the above: Shellac 7 ounces, alcohol 1 quart. Filter and add 3 1/4 ounces gum elemi and 14 drachms Venice turpentine. Warm, stir and thoroughly filter, if necessary.

(2637) F. F. M. submits following problem: Purchased a lot for $2,500, held it six months and sold it for $6,300, allowing 8 per cent interest on the investment and $315 commission. What was my gain per cent? A. $2500×0·4=$100 interest. $6300—$2500=$3800 gross gain. $3800—(100+315)=$3385 net gain. 3385÷2500=135 2-5 per cent.

(2638) Prospector.—You will find a dynamo described in SUPPLEMENT, No. 161, which with the addition of a circuitbreaker will answer for setting off blasts.

(2639) F. J. L.—Wood is sometimes coated with an imitation of marble, by covering the wood with glue and while hot applying marble dust. But this would not stand exposure to the weather very long. Imitation headstones are made of iron, covered with a white smooth enamel resembling marble, which is put on by heat, somewhat similar to the lined cooking utensils known as porcelain lined.

(2640) I. N. S.—For storage batteries, see page 22, vol. 61, SCIENTIFIC AMERICAN.

(2641) T. G. asks: 1. If there were 12,147 deaths during seven months, among a population of 850,585, how would this fact be expressed as an annual death rate per one thousand of population? A. Multiply 12,147 by 12 and divide by 7. Divide quotient by 850,585, treating the comma as a decimal point. 2. Can you prove, by the method of casting out 9s, that the following is incorrect? 73084163×7584=554270392192. Explain the rule for casting out 9s. A. Proof by excess of 9s is not absolute. An incorrect multiplication might appear correct by this proof. To apply it to your example: Excess of 9s in multiplicand=5, in multiplier=6; 5×6=30. Excess of 9s in grand product as given=4; excess of 9s in 30=3; therefore, as the excess of 9s in the grand product is 4 and is not 3, the multiplication is wrong. The correct product is 554270292192, in which the excess of 9s is 3, indicating a correct result. The principle of casting out 9s is this: The excess of 9s is the remainder left after dividing any number by 9. If two numbers are multiplied, the excess of 9s in the minor product obtained by multiplying the excess of 9s in the one by that in the other should equal the excess of 9s in the original product. The quickest way to find the excess of 9s is to begin at the left hand and add the digits of the given number until the sum of 9 is reached or passed. Then start anew with the excess over 9 as a starting point, thus casting out the first 9s and continue until a second sum of 9 is reached or passed, and so on. The final sum less than 9 is the excess of 9s. Thus taking the correct grand product as above, the excess of 9s is thus determined:

	55	42	70	29	21	92	
Excesses	1	5	7	0	1		3=excess of 9s.

or developed as follows:

5+5	=10 excess=1	
1+4+2+7=14 excess=5		
5+0+2+9=16 excess=7		
7+2	=9 excess=0	
0+1+9	=10 excess=1	
1+2	=3	= excess of 9s.

3. What is Gregory's powder? A. It is compound rhubarb powder; it is made by mixing calcined magnesia 2 1/2 ounces, powdered Turkey rhubarb 1 ounce, powdered ginger 1/2 ounce. Some druggists add chamomile 1/2 ounce with magnesia 2 ounces and ginger 1/4 ounce for same quantity rhubarb. 4. What is the chemical composition of Seidlitz powders, upon mixing? A. Neutral sodium tartrate and potassium sodium tartrate, in aqueous solution charged with carbon dioxide gas.

(2642) E. N. asks how to make oiled clothing. A. To do this, without making it sticky, it must be dried at about 150° Fah. by artificial heat. The sun will do it on a hot day. Set as much boiled oil as is necessary, mix enough lampblack to blacken it, if for black work; if yellow, use ground yellow ocher instead. Then lay the fabric on a smooth surface, and put the oil on with a brush—a shoe brush is best; let the first coat get quite dry before putting on another. A little patent driers will make it dry quicker, say 1/2 pound to a gallon of oil; if the last coat remains sticky after it is dry, give it a light coat of shellac dissolved in alcohol. Lay the oil on as thin as possible or it will not dry. Or dissolve 1 ounce beeswax (genuine) in 1 pint boiled linseed oil, using a low heat. Rub it well in, and in general follow directions as above.

(2643) F. L. asks: 1. Will a clock (with a pendulum) and a watch which both show the same time at the equator show the same hour and minute if carried to any point between the equator and pole? A. The pendulum beat will gain on the watch as it is carried toward the poles. A pendulum beating seconds at the equator should be 12-100 of an inch longer to beat seconds at the latitude of London, England. 2. Does cutting off the forests increase the amount of water or volume of a river? If so, would the amount of increase be lasting? A. Cutting of the forests may not materially lessen the yearly rainfall. The forests retain the water, lessen the flood wash, and thus equalize the climatic effect of atmospheric moisture. 3. What is the length of the day at the tropic of Cancer? A. The length of the day at the tropic of Cancer is 12 hours when the sun on the equator, at all other times it varies with the sun's declination. For the solution of the problem see Norton's "Astronomy." 4. What is the difference between heat and sheet lightning? A. Heat lightning is the distant flash that is not directly seen. Sheet lightning is seen in its broad flight from cloud to cloud, generally in complex thunder storms.

(2644) F. McL. asks: 1. Which is the better way to color a meerschaum pipe, with or without a false bowl? Isn't there a preparation that they can be boiled out in to help the coloring? A. Smoking is the best thing. There is a quick process, but it is kept a secret. They are sometimes boiled in wax. You might refer to queries 2364 and 2474. 2. What is the best way to select a meerschaum? A. Buy from a maker of reputation. No general rule of value can be given. 3. Is there any way to rid a building of cockroaches? A. Buhach or erythreum is highly recommended. It must be fresh. Also powdered borax and Persian powder have been found efficacious.

(2645) H. H. B. asks: 1. How to harden brass wire after hard soldering? A. Burnishing it will do this to a certain extent. 2. The unit of measure used in the sizes of watches, like size 18, 16, 6, etc.? A. The size is an arbitrary standard; in Europe the line (1-12 inch) is used; 16 size corresponds to 18 lines. 3. The unit of measure of watch glasses? A. The line (1-12 inch) is the unit. 4. Is there any thin substance which, brought between a permanent magnet and the bar which connects the poles, to cut off the magnet's influence from said bar? A. No; except a piece of polarizable metal such as iron, but none in the sense of your question. We do not understand your fifth query.

(2646) Photog. asks: Can you inform me through your paper how to prevent show windows (in stores) from frosting during cold weather? A. Ventilate from top of window casing by several three or four inch openings, with hoods to exclude rain.

(2647) Plumber asks: Will you be kind enough to send me a sample copy of the "Plumber's Problems"? A. We can supply you with the book called "Plumbing Problems," price $2.

(2648) S. M. H.—It would be impossible from the specimen sent, without further data, to identify the plant whence the sample was derived. The substance is not a fiber, in the true sense of the term, but is of the nature of straw. It might be used in the manufacture of paper, but it has no fibrous quality that would cause it to hold together when twisted into twine. In addition, it is wanting in strength.

(2649) W. F. B. asks if any other color of hektograph ink may be made besides the violet, which is the only one he can find in the market. If it can be made in black, red, green, blue, or any other colors, please state what ingredients to use and how to make it? A. For hektograph inks use any colored aniline dissolved in a very little alcohol and diluted with water.

(2650) A. P. McR. wants a receipt for flint lime glass. A. The following are given as formulæ for flint glass:

	I	II	III
Silica	100	100	100
Oxide of lead	66	70	80 to 85
Carbonate of potash	26	40	35 to 40
Nitrate of potash	7	3	2 to 3

(2651) W. H. B. asks: Which profession, civil engineering or mechanical engineering, offers the better opportunity to a young man at present? A. So much depends on opportunities that a general answer is difficult. The profession of mechanical engineer is more apt to lead to permanent positions, and is a stepping stone to electrical engineering. In civil engineering the first steps are more difficult, and many positions, such as on railroad work, are only temporary. The different branches cannot well be enumerated. They include draughting room work, supervision of machine shops, surveying, bridge building, etc.

(2652) V. G. Van S. asks how mercurial thermometers are made to ring an alarm for heat and cold. To tell when the heat has reached a certain point and when it sinks a few degrees below. As glass is really a non-conductor I do not see how a contact point is made with the mercury inclosed in a tight tube of glass, especially when you want the alarm at different degrees of heat. A. Platinum wires are sealed into the glass, penetrating the walls of the tube and coming into contact with the mercury as it rises or falls. On this principle electric connections may be made or broken as desired.

(2653) H. W. S. asks: What is the reason for writing aluminium instead of aluminum? A. It is a matter of taste. Either spelling can be used. The names of the newly discovered metals generally terminate in *ium*, yet many of the Latin names for metals terminate in *um*, as plumbum, ferrum, argentum, etc. Aluminum is more etymological, aluminium more in accord with modern nomenclature.

(2654) J. C. F. asks for the receipt for making a hektograph. A. You will find full directions and illustration of above in our SUPPLEMENT, No. 438.

Replies to Enquiries.

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

Aquarium.—I would suggest to inquirer No. 2537 that he would be much more likely to have a permanently successful aquarium if he made the frame of three-quarter inch angle iron riveted with copper rivets. Twenty feet will be the length required and will cost about thirty cents. First make the entire frame, uniting the pieces together at corners, and then screw it down to the wooden base. The bottom should be lined with glass, slate, or a layer of cement and the sides made of plate glass well bedded in same. Aspinwall Bath Enamel is excellent for painting all parts exposed to water. See Dr. Bateman's delightful book, "Fresh Water Aquaria," published by Gill & Co., London, 1890.—WILLIAM H. PATTERSON.

NEW BOOKS AND PUBLICATIONS.

A RUSSIAN COUNTRY HOME. By Carl Detlef. Translated from the German by Mrs. J. W. Davis. Photogravure illustrations by Walter H. Goater. New York: Worthington Co. Pp. 311.

LEGAL HYGIENE, OR HOW TO AVOID LITIGATION. By A. J. Hirschl, of the Iowa Bar. Davenport, Ia. 1890. Pp. 203, iii.

This work is devoted to the tricks and subterfuges that may be practiced on the unsuspecting and to the means for meeting legal difficulties. It is spiritedly written and makes an interesting treatise of a very practical tone.

STATISTICS OF RAILWAYS IN THE UNITED STATES TO THE INTERSTATE COMMERCE COMMISSION FOR THE YEAR ENDING JUNE 30, 1889. Washington, Government Printing Office. 1890. Pp. 566.

But one commentary can describe this work, which is the statement that within its limits it is quite exhaustive. It gives the mileage, earnings, incomes, and other data of the United States railroads in such clearly classified form as to be invaluable to those interested.

SOUND, LIGHT, AND HEAT. By J. Spencer, B.Sc. London: Percival & Co. 1890. Pp. viii, 223.

The author of this work is headmaster of the science department, Bradford (England) college. The work is neatly printed, well illustrated, and is prepared as a class book for the elementary stage of the science and art department. Although calculated for this special horizon, its usefulness is not diminished thereby, and it is a good introduction to these three branches of physics.

TO INVENTORS.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

December 2, 1890,

AND EACH BEARING THAT DATE.

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

DESIGNS.

TRADE MARKS.

A Printed copy of the specification and drawing of any patent in the foregoing list or any patent in print issued since 1863, will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian Patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated, the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

PROPOSALS.

U. S. Engineer Office, 34 West Congress Street, Detroit, Mich. November 28, 1890.—Sealed proposals, in triplicate, for furnishing all materials and labor and building the masonry of a lock at St. Mary's Falls Canal, Michigan, will be received at this office until 2 o'clock, p. m., January 27, 1891, and then publicly opened. Preference will be given to materials of domestic production or manufacture, conditions of quality and price (import duties included) being equal. Attention is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, statutes at large. The government reserves the right to reject any or all proposals; also to award the contract upon other considerations than the price. For further information apply at this office, or to the U. S. Engineer Office, Sault Ste. Marie, Mich.
O. M. POE, *Col. Corps of Engineers, Bvt. Brig.-Gen., U.S.A.*

U. S. Engineer Office, Room 90, 134 Van Buren Street, Chicago, Illinois. November 24, 1890.—Sealed proposals in triplicate, for rebuilding superstructure over 5,243 feet, more or less, of breakwaters in Chicago Harbor, Illinois, will be received at this office until 12 o'clock, noon, Saturday, December 13, 1890, and opened immediately thereafter in the presence of bidders. Proposals will be accompanied by a guarantee that if the bid be accepted, contract will be entered into within ten days after notice of acceptance. The United States reserves the right to reject any or all bids. The attention of bidders is invited to the acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, p. 332, and Vol. 24, p. 414, Statutes at Large. Preference will be given to articles of domestic production or manufacture, conditions of quality and price (including in the price of foreign articles the duty thereon) being equal. No contract will be awarded for furnishing foreign articles when the domestic article of suitable quality can be obtained. For specifications, blank proposals, and all other information, apply at above address to
W. L. MARSHALL, *Capt. Corps of Engineers, U. S. A.*

Municipality of Bombay.

ELECTRIC LIGHTING.

NOTICE.

SEALED TENDERS will be received by the MUNICIPAL COMMISSIONER for the City of Bombay up to 1 P. M., on Monday, the sixteenth day of February, 1891, for experimental lighting by Electricity of certain streets of the City of Bombay for a period of two years.

2. Forms of tender and schedule of conditions and a sketch of the portion of the City showing the streets to be lighted may, on payment of Five Dollars, be obtained from CHARLES HALLETT CLARK, Washington Buildings, No. 1 Broadway, Rooms 209 and 210, New York, who will on application give any further information that may be required.

3. Tenders must be accompanied by a deposit of Rupees, One thousand in cash (not to bear interest) or in Public Securities for that amount to be paid to the Chief Accountant of the Municipality of Bombay, which will be forfeited to the Corporation in case of refusal to sign the Contract embodying the conditions mentioned in the Schedule above referred to.

4. A further payment to make the total deposit equivalent to 5 per cent. on the contract amount will have to be made by the Tenderer whose tender may be accepted, before signing the contract.

5. The Municipal Commissioner does not bind himself to accept the lowest or any tender.

By order of the Municipal Commissioner,
RIENZI WALTON,
Executive Engineer, Municipality.
EXECUTIVE ENGINEER'S OFFICE,
BOMBAY MUNICIPALITY,
BOMBAY, India 13th October, 1890.

To Builders of Pumping Engines

Sealed proposals, endorsed "Proposals for Pumping Engine," will be received at the office of the Lowell Water Works, City Hall, Lowell, Mass., until 2 P. M., on Friday, January 16, 1891, for the construction, delivery, and erection of a ten million gallon Steam Pumping Engine, for the City of Lowell, Mass., and at that time will be publicly opened and read. Specifications will be mailed upon application to Water Works office, City Hall, Lowell, Mass. Other information may be obtained upon application to Lowell Water Works office, or from George H. Barrus, M.E., 95 Milk Street, Boston, Mass.
JOHN STOTT, MILES F. BRENNAN, EDWARD W. THOMAS, } *Committee on New Engine of Lowell Water Board.*
Lowell, Mass., November 24, 1890.

U. S. Engineer Office, St. Augustine, Fla. November 26, 1890.—Notice is hereby given that on the 27th day of December, 1890, at 12 o'clock, noon, standard time, I will sell at Mayport, Fla., for cash, to the highest bidder, the wreckage from the bark "Neva," consisting of about 35 cords (more or less) of logwood. The logwood is apparently in good condition. It is in sticks from 4 to 5½ feet long, and from 3 inches to 20 inches in diameter. The wood must be removed within 30 days from sale, and until removed will be at owner's risk. For further information apply to this office.
W. M. BLACK, *Captain, Corps of Engineers, U. S. A.*

The Scientific American

PUBLICATIONS FOR 1891.

The prices of the different publications in the United States, Canada, and Mexico are as follows:

RATES BY MAIL.

The Scientific American (weekly one year	$3.00
The Scientific American Supplement (weekly), one year.	5.00
The Scientific American, Spanish Edition (monthly) one year.	3.00
The Scientific American, Architects and Builders Edition (monthly), one year.	2.50
COMBINED RATES.	
The Scientific American and Supplement,	$7.00
The Scientific American and Architects and Builders Edition,	5.00
The Scientific American, Supplement, and Architects and Builders Edition,	9.00

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This includes postage, which we pay. Remit by postal or express money order, or draft to order of
MUNN & CO., 361 Broadway, New York.

THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made; how to apply the written letter to the pad; how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **438.** Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.

ICE-BOATS — THEIR CONSTRUCTION and management. With working drawings, details, and directions in full. Four engravings, showing mode of construction. Views of the two fastest ice-sailing boats used on the Hudson river in winter. By H. A. Horsfall, M.E. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, **1.** The same number also contains the rules and regulations for the formation of ice-boat clubs, the sailing and management of ice-boats. Price 10 cents.

THE PHONOGRAPH.—A DETAILED description of the new and improved form of the phonograph just brought out by Edison. With 8 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **632.** Price 10 cents. To be had at this office and from all newsdealers.

ELECTRO MOTOR, SIMPLE, HOW TO make. By G. M. Hopkins.—Description of a small electro motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **641.** Price 10 cents. To be had at this office and from all newsdealers.

SCIENTIFIC AMERICAN SUPPLEMENT. Any desired back number of the SCIENTIFIC AMERICAN SUPPLEMENT can be had at this office for 10 cents. Also to be had of newsdealers in all parts of the country.

ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, **59.** Price 10 cents. To be had at this office and of all newsdealers.