SCIENTIFIC AMERICAN

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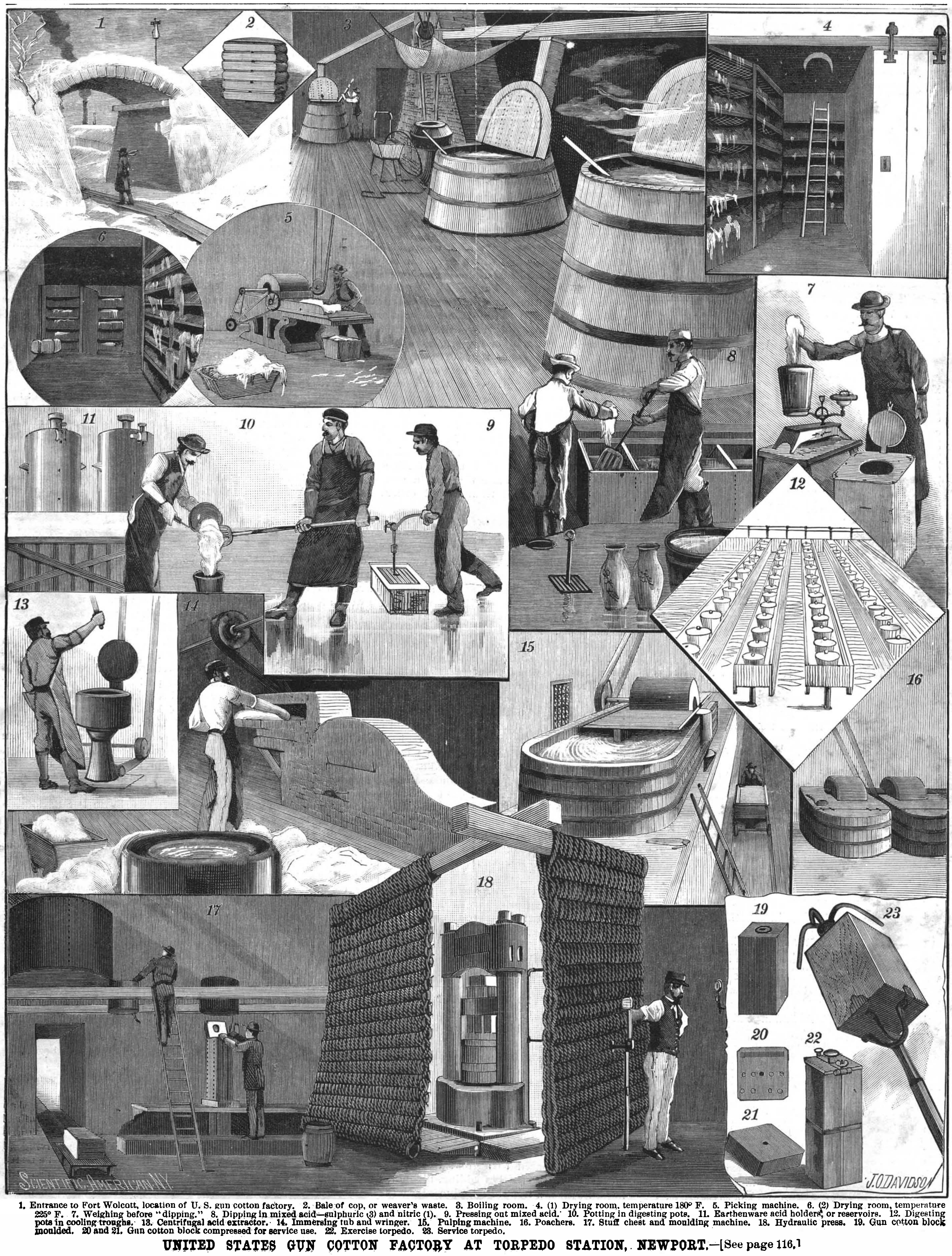

1. Entrance to Fort Wolcott, location of U. S. gun cotton factory. 2. Bale of cop, or weaver's waste. 3. Boiling room. 4. (1) Drying room, temperature 180° F. 5. Picking machine. 6. (2) Drying room, temperature 225° F. 7. Weighing before "dipping." 8. Dipping in mixed acid—sulphuric (3) and nitric (1). 9. Pressing out mixed acid. 10. Potting in digesting pots. 11. Earthenware acid holders, or reservoirs. 12. Digesting pots in cooling troughs. 13. Centrifugal acid extractor. 14. Immersing tub and wringer. 15. Pulping machine. 16. Poachers. 17. Stuff chest and moulding machine. 18. Hydraulic press. 19. Gun cotton block moulded. 20 and 21. Gun cotton block compressed for service use. 22. Exercise torpedo. 23. Service torpedo.

UNITED STATES GUN COTTON FACTORY AT TORPEDO STATION, NEWPORT.—[See page 116.]

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 686.

For the Week Ending February 23, 1889.

Price 10 cents. For sale by all newsdealers.

REPORT OF THE COMMISSIONER OF PATENTS FOR 1888.

The special report of the Commissioner of Patents to Congress, for the year 1888, has lately been presented, and is in many respects a very able and interesting document. The Commissioner, the Hon. Benton J. Hall, gives a very forcible statement of the existing condition of the Patent Office and the changes or reforms most urgently needed to improve the working and increase the utility of the bureau. It is a long document—equal to six of our pages—full of valuable suggestions and information.

The number of patents granted during the year 1888, including designs and reissues, was 20,506, being about one thousand less than for the year 1887, and nearly four thousand less than for the year 1885. The applications filed during 1888 were 37,797, and about the same number have been filed every year for six years. More rejections and fewer issues of patents appear to have been the order in 1888. The cash receipts of the office for 1888 were $1,118,576, and the expenses $973,108, leaving a surplus for the year over expenses of $145,407.

The Commissioner shows how seriously the business of the office is crippled for lack of sufficient room. He says:

"The various divisions of the Patent Office are crowded into narrow, inconvenient, and, in many instances, unhealthy limits. The records and drawings and other material, which should be conveniently arranged and made accessible in proper rooms, are stored in corridors and by-way places, where classification is almost impossible, and where access can only be had to the particular subjects desired after long search and delay. Not only this, but great quantities of valuable records, descriptions, specifications, and drawings are constantly exposed to the danger of conflagrations involving the safety of the entire building. It needs only an examination or investigation to demonstrate the absolute necessity that exists for making some change in the arrangement between the bureaus occupying this building, in order that each shall have proper room and facilities to discharge its respective functions. The force under the control of the Commissioner of Patents is scattered and located in remote parts of the building on different floors to such an extent that in order to communicate with the various divisions, transfer records back and forth, and conduct the business, much more time and a greater amount of labor are required than would otherwise be involved."

Of the *Official Gazette*, 6,500 copies are printed weekly, of which 2,265 copies are sold, and 4,235 given away to libraries, members of Congress, etc.

The Commissioner dwells upon a number of different subjects, all of greater or less importance. The difficulties of making official examinations of inventions are constantly increasing; but if more space were afforded, he thinks the present force of employes could do the work. He favors the protection of the inventor in the enjoyment of the exclusive right to his invention, but asks that the patent shall be dated from the time the patent was allowed and passed for issue, thus practically reducing the life of the patent.

The present law by which the term of the American patent is reduced to that of the term of the previously granted foreign patent he thinks should be repealed. He favors the allowance of caveat registration to foreigners; also a modification of the record law for assignments. The renewal of lapsed cases is found to be attended with complications, and a change is recommended. A modification of the law in the case of joint inventors is also proposed. The Commissioner defends the present system of official examination of inventions, but at same time indicates that it is full of serious difficulties. He shows the hardships of interference proceedings, and offers suggestions for a partial remedy. He points out some of the absurdities and difficulties attending the international union respecting trade marks and patent properties. He thinks the examiners should have an increased compensation. Attention is also called to the importance of perfecting and finishing the abridgment of patents.

The total number of patents granted since the organization of the United States government is 405,262.

A REPLY TO THE NEW YORK "WORLD."

Principal Examiner W. W. Townsend has recently published in pamphlet form an able and scathing reply to the recent attacks of the New York *World* upon the good name and fame of the Patent Office. We regret the limits of our space prevent us from giving Examiner Townsend's essay in full. It would occupy almost two of our pages. We are obliged to content ourselves with an extract from the concluding portion, which will convey some idea of the author's views and the vigorous, clear style in which he presents them:

"The inventive genius of the country may, in truth, be aptly compared to a great tree, deep rooted in a genial clime, constantly budding, blooming, and fruiting. But it is a tree that produces both good and bad fruit; and oftentimes a great deal of husk covers a very small kernel, scarcely worth the saving.

"The Patent Office is the great winnowing machine, through whose operation vast masses of rubbish which would otherwise obstruct the industries of the nation are consigned to the waste heap. To abolish the official search would be to destroy this machine, and substitute what? A host of similar machines, badly made, unfinished, and left to run themselves at enormously increased aggregate expense. Do away with the system of official examination, and you are more likely to practically legalize a species of robbery now but rarely practiced, and only upon the easily duped, rather than to effect an improvement such as would warrant such an extreme measure.

"It is admitted that the present system has many defects. But they are not inherent in the system itself; they are rather the result of the manner in which the system is administered, and largely of the disposition to consider public office as spoils of war and not as a public trust; of the niggardly policy which allows upward of three millions of dollars to lie idle in the Treasury to the credit of the Patent Office, while the salary of the Commissioner is at such a figure that in the last thirty-eight years there have been nineteen incumbents of the office. Experience has developed defects in the details of the law; but Congress utterly ignores the Commissioner's oft-repeated recommendation as to the cure.

"But what is the remedy? The inventors of the country have it in their own hands. Let them insist that the office shall have ample means, ample room, ample force, so that there shall be an end of inaccessible records and extra hours of labor, with their demoralizing tendency to lax and hasty work. Let them insist upon having a commissioner and assistant commissioner trained in science as well as in the law, and with such a salary as will insure their incumbency for a reasonable period, and consequently a much needed stability in the practice of the office. Let them insist upon an examining force selected and tested and promoted by rigid competitive examination and not by political influence, as has too frequently been the case. Let the organized inventors insist upon these things, and they will get them; and having got them, I will undertake to say that the business of granting patents will be carried on with as little friction and individual hardship as necessarily accompany the administration of any great public function. But without the requisites named, inventors will continue, as now, to suffer occasional hardship, while as a class obtaining substantial justice and protection, and the public will continue sometimes to be robbed in the name of the law through the wrongful issuance of patents."

OFFICIAL TRIAL OF THE GUNBOAT YORKTOWN.

The gunboat Yorktown was subjected to an official trial on Wednesday, February 13, to determine her acceptance or rejection by the government. The trial as far as reported was a complete success, the contract requirements of speed and horse power being exceeded. Four hundred tons of pig lead were distributed through the ship so as to represent her stores, guns, and other equipments. Thus seventy-two tons of lead was placed in six piles at the positions to be occupied by the guns. This weight brought her down to draught in fresh water of 13 ft. 4 in. forward and 15 ft. 4 in. aft—a mean draught of 14 ft. 4 in., with a displacement of 1,703 tons. The day before the trial she ran down the bay and anchored inside the breakwater. Early the next morning preparations were made for the trial. This was to be a four hours' run. The run over the measured mile has been discarded as a satisfactory test, as the speed thus shown is fallacious, in the sense that it may be largely in excess of that which can be maintained for any length of time. Three to five minutes is not sufficient time in which to prove a vessel's capabilities.

The Yorktown ran out to sea, and at 9:45 A. M. the official test began. Quite a heavy breeze was blowing, with considerable sea. The chip log and taffrail log were kept in use continually, and a large corps of government inspectors took indicator diagrams from her different cylinders, so as to obtain full data for speed and developed horse power.

The ship started nearly southeast, with the wind abeam, her speed increasing quickly from 16·7 to 17·2 knots per hour. After an hour's run the ship was turned so as to bring the wind on one bow, and the speed dropped off to 15·3–15·9 knots. The wind was next brought dead ahead, when a speed of 14·9 was shown. The four hours' run ended where it began, off Cape Henlopen. The steam pressure varied from 145 to 168 lb. In all the four hours' work no journal became heated.

The chip log, used at 15 minute intervals, showed an average of 15·67 knots, and the average of two taffrail logs was almost exactly 16 knots. Every 15 minutes twelve different indicator cards were taken, giving 192 to be calculated. The indicators are first to be tested for accuracy, and it is probable that the slower of the two taffrail logs will need a correction in favor of the ship. The results of the trial are, therefore, not yet definitely known; but it is thought that they will show about 3,550 horse power and over 16 knots speed.

This will give the contractors a bonus of upward of $50,000. The consumption of coal was about 120 tons a day under forced draught and at high speed. For a 10 knot speed it is about 30 tons a day.

Evolution was next tested, and it was found that a little over five minutes was needed for a full turn, whether by running her engines in opposite directions or by the rudder only. The diameter of the smallest circle was estimated at from 150 to 200 yards. Nothing was gained by reversing one engine. The full speed could be checked and the ship brought to a dead stop in 1 m. 1 s., in about 200 yards. Taking the warships and merchant vessels together, it is estimated that the Yorktown could overtake 95 per cent of them.

Overcoats.

The teaching of modern science and of ancient custom goes to show that heat production within the body has much to do with the tissue changes concerned in muscular activity and with healthy digestion. It is conserved by warm and moderate, wasted in evaporation by excessive clothing. Finally, by a simple nervous reaction, it is increased after the contact of external cold. It follows from these observations that, if we be so clad with comfortable underclothing that surface perspiration is not formed in excess and is rapidly removed, one great cause of chill—sudden evaporation—is done away with. Outer cold, then, provided it is not too severe, only touches, as it were, the spring of the heat-making metabolism, and, exciting an elastic rebound in the chain of vaso-motor fibers, awakens that oxidative action by which every tissue is made to yield its share of heat to the body. This bracing influence is lost wholly or partly to those who are too heavily clothed, and in its place we may have a dangerous excess of surface heat. It is for this reason that we have before protested, as we now do, against the indiscriminate use of the thick and heavy overcoat. We would rather see men in fairly robust condition, especially if young, clad warmly next the skin, and wearing either a light top coat or none at all. There can be no doubt that the habitual use of great-coats is indirectly accountable for the chills which they are intended to prevent. Were the overcoat worn continuously, it might attain its object. Its intermittent use, even when ample underclothing is worn, affords no solid guarantee of safety, but rather the reverse. The man of sedentary habits has especial need to remember this. He emerges daily from a warm breakfast room clothed in his ordinary winter garments, with probably woolen underwear, and over all the heavy ulster or top coat. After a short walk he finds that the sense of warmth he began with is more than maintained. He arrives at his office or place of business, and off goes the overcoat, though the air of the newly opened room is as cold as that without, and draughty in addition. During the day perhaps he travels to and from adjacent business houses wearing only his house clothing. The overcoat is laid aside till closing time reminds him of the journey home. The frequent result is that somehow, between the hours of his departure and return, he is chilled. No doubt he would run as great a risk if, lightly clad, he were to face the rigor of a winter day. In this case, however, exercise and habit might do much to develop the power of endurance, and there would, at all events, be less danger of sudden cold acting upon a freely perspiring surface. Woolen underclothing represents a state of healthy comfort intermediate between these extremes, and more resistant to chill than either. In commending its use, however, we do not assert that the influence of age and constitution is to be overlooked. Youth can oppose a power of resistance to depressing agencies which does not reside in the worn-out nerve centers of a riper age. Similarly, that elastic reaction which characterizes the nervous and sanguine types is not to be looked for in the lax tissues of the lymphatic. The weaker physique naturally calls for fuller protection than the stronger; and any rule requiring the disuse of the overcoat should allow of reasonable exceptions in favor of the old and constitutionally feeble. Unusual severity of weather, especially if associated with night air and the loss of sleep which this implies, is another condition which might well constitute an exception. In such a case we are compelled to add some form of overcoat to the ordinary amount of clothing. Some parts of the body—for example, the chest, throat, and feet—are certainly more susceptible to cold than others. As a useful safeguard, cold or tepid bathing of such parts is in merited favor. The custom so common with many persons, especially women, of walking out in thin-soled boots often plays an important part in catching cold. The progress of time and of rational thought may be expected to bring in a more comfortable arrangement by clothing the foot in woolen hosiery and a stouter boot.—*Lancet.*

THE alligator of the South, like the buffalo of the West, is likely soon to become extinct. The slaughter of the alligator for its hide, like the slaughter of buffaloes for their hides, has been so great that it will be only a few years before the lonely lagoon of Florida will have lost its last survivor.

New York Cigar Makers.

Over 30,000 men, women, and children are employed in the tobacco industry of this city, of whom about 16,000 are cigar makers proper, the rest being cigarette makers, strippers, bunchers, packers, pasters, box makers. More than 6,000 cigar makers are women, girls, and small children. Some branches of the trade are almost monopolized by girls. For instance, the making of cigarettes. The nationalities which predominate among the cigar makers are the Germans, Bohemians, and the English, but there are also quite a number of Poles, Hollanders, Cubans, and Hungarians, with a sprinkling of Spaniards, Americans, French, and Russians.

The best cigar makers are the Germans and Bohemians; the Cubans and Spaniards rank next. The Poles are ruining the trade here by cheap work done in basements in Division Street and its neighborhood. They work, as it is termed, " below zero," just as the Chinese are doing in San Francisco. The Cubans and Spaniards make a special grade of goods called " Spanish work." Cigar making has of late years become so unprofitable to the working people that the average weekly wage ranges only from $6 to $7. Even the best workers, making cigars by hand, average only $15 per week if working full time all the year round on first class material, but this fortunate class comprises hardly fifteen per cent of all cigar makers. The poorest class of workers average only $5.50 per week, and therefore their wives and children must help by their work to swell the income of the family. The working time is about eight hours a day—a result of their strong organization.

Eleven manufacturing firms own tenements in this city in which they house their workers under the so-called tenement house cigar making system. These mean firms keep the tenement horror alive by employing 546 entire families. Counting at the lowest estimate five working members to each family would give us the correct number of tenement house cigar makers, viz., 2,830. Each family has either two or three rooms, small, poorly ventilated, and dark. In these accommodations they have to pay $3 more for their monthly rent than they would if they were allowed to live where they liked. But—and here the fine game of the cigar manufacturing landlord comes in—no rooms, no work. So these poor people have only the alternative to accept low wages, high rent, and long hours of work (fourteen hours daily on an average) or walk the streets and starve. In these houses, which cannot be called homes, one finds the greatest filth, misery, and degradation imaginable.

To sensitive persons a description of the horrors would be insupportable. It is happily true that "one-half the world does not know how the other half lives." Cannot these conditions be amended or abolished? For years the cigar makers have banded together in unions to suppress this terrible, inhuman system. Some headway they have made in their endeavors—for which they have been called conspirators and revolutionists. If American workmen were obliged to live in this manner, they would have been revolutionists long ago.

There are 1,800 cigar factories in New York City. Of these the great majority employ from one to fifty hands each. Large factories, of which there are 350, employ from 50 to 500 hands, while the largest class of factories, of which there are only ten, employ from 500 to 1,000 hands. The vital statistics gathered in the course of years by some organizations show that among the cigar makers lung troubles are of common occurrence. Women must frequently stop work to recuperate from the bad effects tobacco has upon them.

There is another danger which threatens the cigar makers and promises to thin the ranks already thinned by competition among themselves. Last year bunching machines threw 400 persons out of work. Yet cigar making machinery is only in its infancy. In the opinion of many cigar makers, the trade is leaving New York City, and will never be as good and prosperous as it was in past years. New York is fast losing its former prestige by manufacturing cheap cigars in too great quantities.

Since 1864 the cigar makers have made determined efforts to organize themselves and, through organization, to better their condition. They have succeeded in accomplishing a great amount of good to their craft. The Cigar Makers' International Union of America has been in existence for thirty-five years. The number of its members is very large and probably exceeds 25,000. Of the cigar makers in this city about 8,000 are organized. They stick to their organizations faithfully and are among the best, most intelligent, and most energetic working men.

Since 1879 the International Union has paid out for strike benefits $369,833, for sick benefits $182,425, for death benefits $21,843, and for traveling benefits $196,882. The present fund in its treasury amounts to over $253,000. The powerful agitation for the suppression of the tenement house system has resulted in greatly mitigating that evil. Their union label is an effective weapon against unfair employers, and has brought many of them to terms. At present it is used by 386 manufacturers in this city alone, who have to observe certain rules of the union for the privilege of using it. Manufacturers who sell tenement-made goods are debarred from its use.—*The Metropolis.*

George Simon Ohm.

In view of the near approach of the hundredth anniversary of the birth of George Simon Ohm, which took place on March 16, 1789, a meeting was held recently in the meeting room of the Royal Society, London, under the presidency of the Right Hon. Lord Rayleigh, secretary of the Royal Society, for the purpose of appointing a committee to co-operate with the committee formed in Germany to promote the erection in Munich of a statue of the great physicist, to whom the science of acoustics owes no less than does that of electricity. In the course of the meeting the following gentlemen were selected to act on the English committee: Sir F. Abel, D'Atkinson, Mr. Vernon Boys, Mr. Conrad Cooke, Professors Ewing, Fitzgerald, Fleming, G. Carey Foster, Mr. Glazebrook, Professor D. E. Hughes, Mr. Norman Lockyer, Professors Hugo Muller, John Perry, Mr. W. H. Preece, Lord Rayleigh, Professors Reinold Rucker, Stokes (president of the Royal Society), Mr. Swinburne, Sir William Thomson, and Professor S. P. Thompson. Lord Rayleigh was elected president; Professor Hugo Muller, treasurer; and Professor G. Carey Foster, of University College, London, and Professor John Perry, of the Finsbury Technical College, undertook to perform the duties of secretaries, and to receive subscriptions.

Tragic Fate of Mr. Ryland.

An accident lately occurred at Hawkesbury Bridge, Sydney, New South Wales. Mr. Ryland, of Messrs. Ryland & Morse, of New York, sub-contractors for the erection of the superstructure of this great bridge, was walking along the top of one of the spans when he missed his footing and fell some fifty feet into the river below. Even as he was falling a huge shark was observed immediately below, and the unfortunate man had scarcely reached the water when the monster seized him, and both disappeared under the water, which at once became tinged with blood. A number of workmen and others on the bridge who witnessed the accident remained horror-stricken and helpless. The deceased, with his partner, was just bringing to a successful close a contract of considerable magnitude. The Hawkesbury Bridge, it will be remembered, was built by the Union Bridge Company, of New York. Messrs. Anderson & Barr, of this city, were sub-contractors for the piers.

Hard Work at the Post Office.

Some idea of the vast amount of matter which passes through the New York City post office may be gained from the following statistics:

Last year there were 128,131,755 letters, 32,310,025 postal cards, and 35,943,203 miscellaneous packages delivered during the year by carriers, and 52,994,536 letters, 8,519,869 postal cards, and 30,995,086 miscellaneous packages through boxes, making a total of 287,994,464 pieces in all. In the registered letter department, ther were 1,317,168 pieces delivered, and 1,049,029 pieces of domestic and 453,850 of foreign origin recorded and distributed to other offices. At the general post office, 1,095,915 money orders were issued and paid, amounting to $10,230,895.50, and 783,872 postal notes, amounting to $1,263,378.79. At the sixteen branches the number of orders issued and paid was 220,144, amounting to $3,250,961.10, and the number of postal notes 88,311, amounting to $174,476.66. The aggregate business of the money order department for the year amounted to $87,299,158.95, giving an increase in the business over the previous year of $4,788,347.21. The total receipts of the office were $5,162,968.81, and the total expenditures $1,891,982.48 (including $802,017.91 expended for free delivery service), giving a net revenue of $3,270,-986.33. The receipts for the last quarter of the year aggregated $1,458,585.27, an increase of $121,034.65 over the receipts of the corresponding quarter of the previous year. There were sold during the year 178,218,226 postage stamps, equal in weight to thirteen tons net, 35,302,500 government stamped envelopes, and 46,437,150 postal cards. The total weight of mails received and dispatched daily during 1888 was 248 tons.

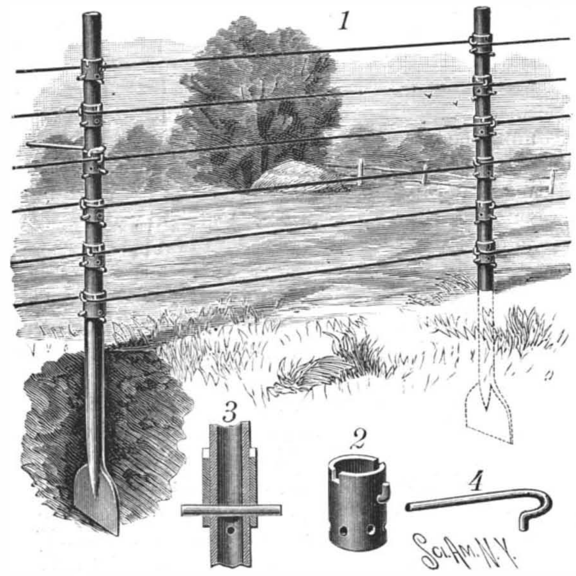
Venus, the Evening Star.

Mr. Walter H. Smith, President of the Astro-Meteorological Association, Montreal, has been making special observations on the planet Venus with the aid of a reflecting telescope, and reports rapid changes in the shape and outlines of the horns, due to the planet's rotation bringing mountain ranges to the edge of the disk.

A peculiar indentation has been seen at the north horn, similar to observations made by De Vico, Pastorf, and other astronomers. Three spots, believed to be continents, and similar to those seen at the Roman College in Italy, were also noticed. Mr. Smith is the founder of the society, and is well known as a careful observer.

AN IMPROVED WIRE TIGHTENER.

The illustration herewith represents an invention patented by Mr. Thomas Reily, of Blencoe, Iowa. The post for fences with which such device is used preferably consists of a metal tube having a spade-like lower end, whereby it may be readily driven into the ground and will be held from turning. The post has a series

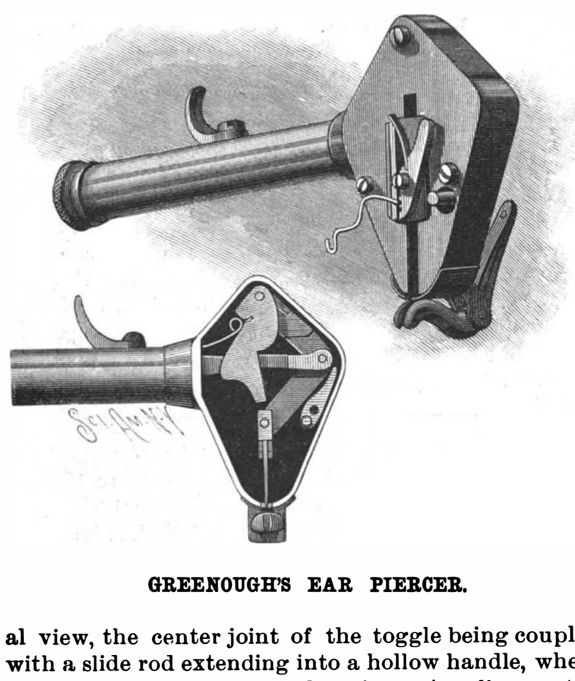


REILY'S WIRE TIGHTENER.

of diametrically opposite apertures, as shown in Fig. 3, one aperture for each strand of wire to be used in the fence, and just above these apertures are similar ones at right angles thereto. Collars or sleeves, as shown in Fig. 2, are adapted to be slipped over the post, and held to turn loosely thereon by pins passed under them through the apertures in the post. In the lower ends of these sleeves are apertures adapted to register with one of the series of apertures in the post, whereby the sleeves can be turned around on the post and held in desired position by pins passed through the sleeve and the post. The sleeve has an upwardly extending arm, adapted to engage and support a fence wire, and in the upper end of the sleeve are vertical slots, to engage the lip of a wrench shown in Fig. 4. After the strands of wire have been secured to the end posts, the wire passing from post to post in contact with the sleeves, and in engagement with the upwardly extending projections, the wrench is inserted in one of the slots of the sleeve and turned in the direction in which the wire is to be tightened, the sleeve being held in fixed position, after the wire has been drawn sufficiently taut, by passing a pin through one of the apertures therein and a corresponding registering aperture of the post.

A DEVICE FOR PIERCING EARS AND INSERTING EARRINGS.

The illustration herewith represents an ear-piercer, patented by Mr. John J. Greenough, by which the needle is instantly projected through the ear and retracted, the needle also carrying the wire of an earring to remain lodged in the incision, the hole being bored, the earring inserted, and the needle withdrawn at a single instantaneous operation. The ear is held while being pierced by a spring lip on the bottom of the device, adapted to lightly embrace the lobe of the ear. The needle slide is attached to a toggle joint, the upper end of which is jointed to the case, as shown in the section-



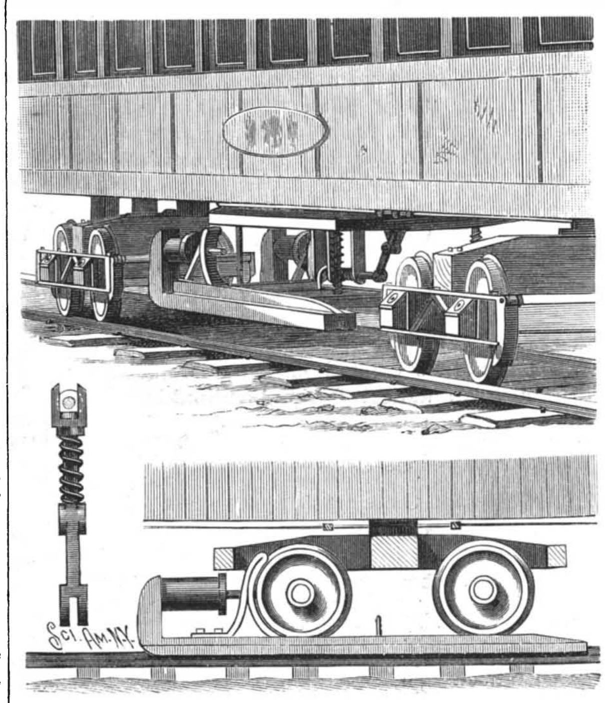
GREENOUGH'S EAR PIERCER.

al view, the center joint of the toggle being coupled with a slide rod extending into a hollow handle, where it is surrounded by a spiral spring. A collar on the rod has a stud working in a slot in the handle, there being a notch to engage the stud and hold the slide rod back with the spring compressed. Then, on releasing the stud, the slide-rod in moving forward forces the toggle joint past its center to the same distance on the other side, moving the needle-slide forward and back by the single impulse of the spring. Directly over the piercer is a slot through the cover, in which slides a forceps block carried by the needle slide, this block having a groove in which the wire of the earring is held, by a movable eccentric jaw, against a corresponding groove in the needle, this forceps block pressing the wire of the earring into the groove of the needle only during the downward motion of the latter, so that the needle retreats without drawing back the wire.

For further information relative to this invention address Mr. George W. Langdon, Clinton, Mass.

AN IMPROVED BRAKE SHOE FOR RAILROAD CARS.

A brake shoe, adapted to be carried beneath the cars of a train, all of the shoes being capable of being brought into simultaneous action, whereby the cars may be expeditiously stopped from the engine cab, is illustrated herewith, and has been patented by Mr. Gustav A. Diedel, of No. 375 Third Avenue, New York City. This brake is principally designed for use in case of emergency, on trains carrying other brakes, as an auxiliary means of suddenly stopping the cars. A rectangular turntable is pivoted centrally beneath the car, and held in position by a bolt passing through the car floor and into a recess in the upper face of the turntable, the bolt being normally locked by a spring. About the center of the under side of the table is a hanger, in the posts of which a horizontal releasing bar is held to slide, to the outer end of which is pivoted a trip lever, shown in detail in the small view. This lever is fulcrumed upon a bracket, the upper end of the lever being curved to one side and carried upward through and beyond the turntable. The trip lever is manipulated by a rod, chain, or wire rope, sliding be-



DIEDEL'S BRAKE SHOE.

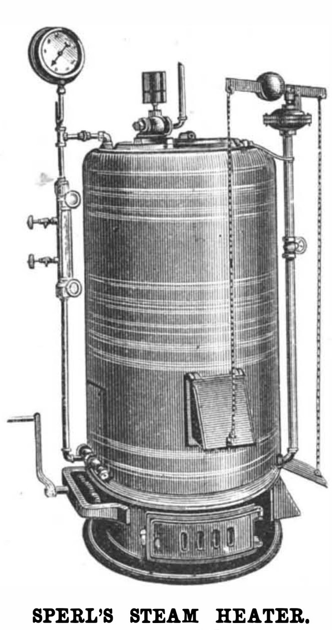
neath the car body, and with a suitable lever within or adjacent to the engine cab, similar connections being made with all the different brake shoes employed on the same train. The brake shoe consists of two side bars, spaced to the width of the track rails by cross bars, each side bar having a track formed longitudinally on its upper surface, while its lower side is adapted to fit snugly over the rail head. The side bars are also connected by a cross beam, from which a head block is projected, with a horizontal air cylinder attached, with a small vent and piston head and rod, the outer end of the rod being carried through and held to slide in buffers attached to the side bars, so that when the truck wheels ride upon the shoe track, an effective air cushion will thus be formed. When the shoe is attached to the turntable, it is manipulated to bring the buffer end in the direction of the forward end of the car, this being done by lifting the bolt through the car floor and revolving the turntable, the trip lever being then disengaged from the draw rod. To stop the train, the engineer pulls the cab lever, which withdraws the releasing bar from the hook or staple of the shoe, in each shoe in use on the train, the shoes then dropping and remaining saddled upon the rails.

Street Tramways in New York.

During the year ending September 30, 1888, the number of passengers on the street railways and elevated railways of New York City was 376,913,586, an increase of 18,000,000 over the number for 1887. This, at the uniform fare of five cents, represents a total revenue of $18,845,679.30. There are nineteen "city railway" companies, eighteen of which are horse car surface lines, and the other is the elevated railway system, with its four parallel lines. The equipment consists of 3,054 cars and 13,586 horses. The elevated lines have 921 cars and 291 locomotives. The number of employes is 11,725.

AN IMPROVED STEAM HEATER.

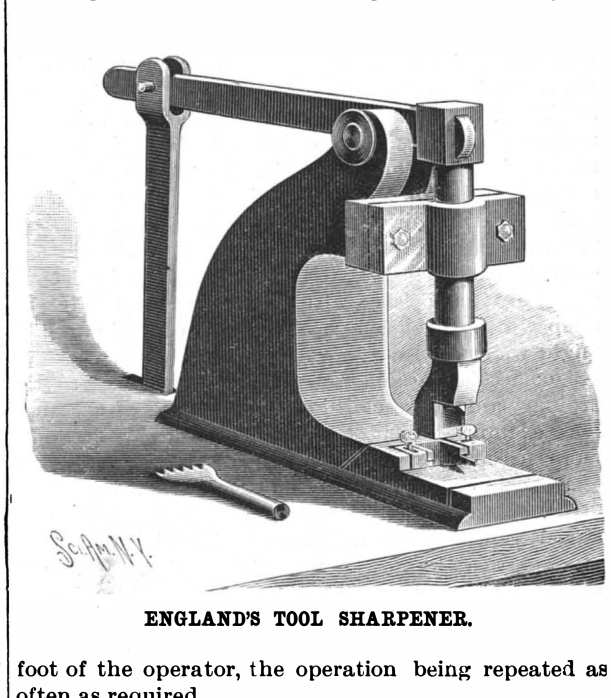
A heater designed to make steam quickly, and maintain a high degree of heat with a comparatively small quantity of fuel, is illustrated herewith, and has been patented by Mr. Henry Sperl, of Susquehanna, Pa. This heater is made with a tubular base ring and a tubular crown ring, these rings being connected by a circular series of vertical pipes, each of which has on its inner side a rod, the ends of the rods passing through openings in the top and bottom rings, where they are secured by a rod and firmly hold the several parts of the heater in position. Above the base and between the pipes a ring-shaped reservoir is mounted, having a central opening and flues arranged in a circle, short horizontal pipes connecting some of the vertical pipes with the reservoir, while another pipe connects the reservoir with one of the vertical tubes at its upper end. The heater has an outer and an inner jacket, each having an opening for the reception of a damper box, and the outer jacket also has an opening for the admission of a water induction pipe, and another for a discharge pipe, each pipe communicating with the tubular base ring. The furnace fire quickly heats the water in the central reservoir, setting up a circulation through the series of pipes and the base and crown rings, and rapidly generating steam, the products of combustion passing upward around the pipes, thence over the top of the inner jacket, and downward between the jackets to the discharge flue near the base, several dampers being provided for the easy regulation of the draught.



SPERL'S STEAM HEATER.

A DEVICE FOR SHARPENING STONE-CUTTING TOOLS.

The accompanying illustration represents a simple mechanism for sharpening tooth chisels, tooth axes, etc., and for gumming saws and punching holes in metals. It has been patented by Mr. Edward England, of No. 16 Buchanan Street, Duluth, Minn. A cutter or punch is held in a shank or chuck fastened to an upright shaft operated through a compound lever by the foot or other mechanical power. A throat plate is firmly secured to the under jaw of the device, forming a guide to the shank through a throat, the guide being secured to the ledge of the throat plate by a thumb screw to move in and out from the ledge and regulate the length of the teeth. A gauge is also secured to the ledge of the throat plate by a thumb screw, and can be moved from right to left or left to right to regulate the width of the teeth. The proper size cutter or punch having been fixed in the chuck, and the guide and gauge adjusted, the edge of the chisel or other instrument to be sharpened is heated red hot and held against the ledge of the throat plate, when the lever is pressed down by the



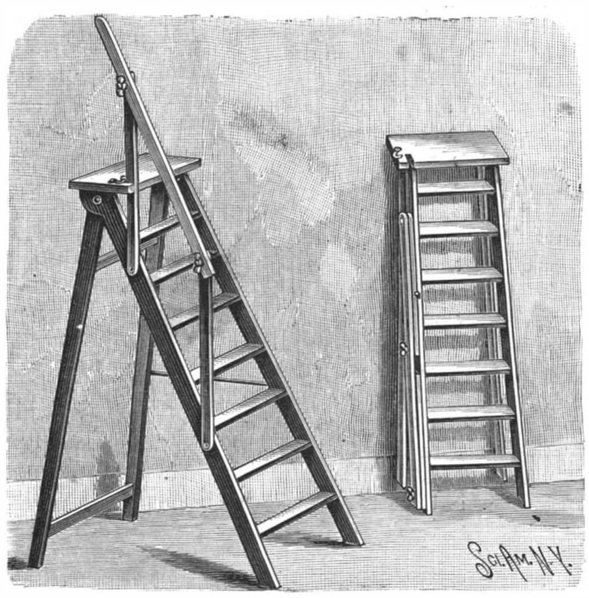
ENGLAND'S TOOL SHARPENER.

foot of the operator, the operation being repeated as often as required.

The *Electrical Review* suggests that our city authorities should put danger signals over all electrical subway manholes. Then when the unwary passer-by is hurled against Trinity Church spire, he or his heirs won't have so strong a suit for damages.

AN IMPROVED GUARD FOR STEP LADDERS.

A step ladder having foldably attached thereto a hand-rail guard, to give greater safety in its use, is illustrated herewith, and has been patented by Mr. Otto J. Meisel, 129 Ohio St., Terre Haute, Ind. The top step has a notch or recess in its edge, in which an arm pivoted to the side-piece of the ladder is adapted to enter when

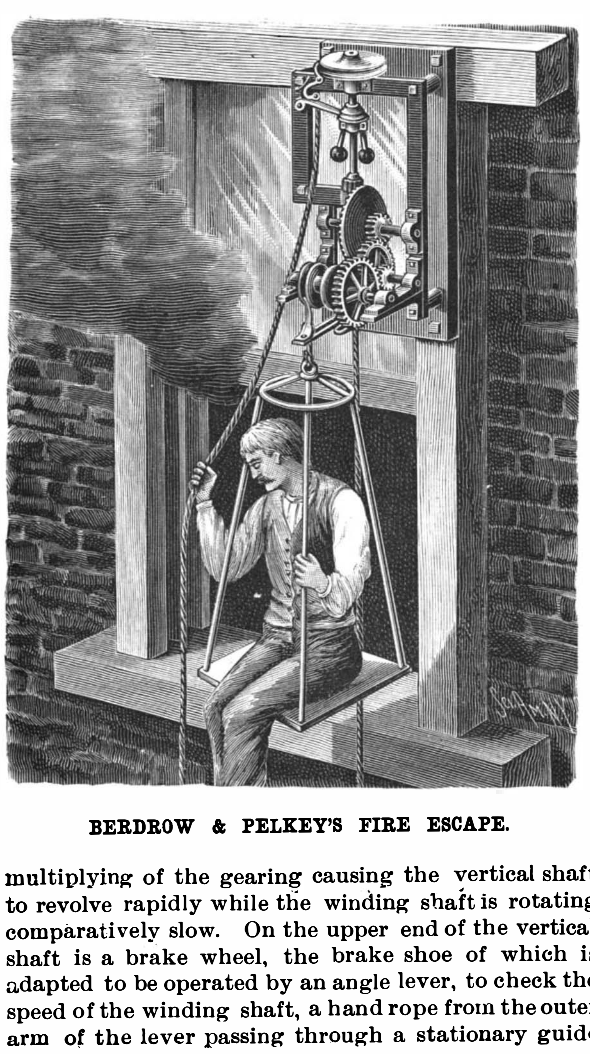


MEISEL'S GUARD FOR STEP LADDERS.

the hand-rail is to be used. There are two of these arms pivoted to the upright, the outer ends of the arms being connected by thumb-screws to the guard rail, and in the upper arm is a staple with which a hook on the top step is engaged to hold the hand-rail and arms in position when the top arm is entered in the notch. To fold the hand-rail it is only necessary to loosen the thumb-screws and disengage the hook, when the arms can be turned down to the position shown in one of the views, the thumb-screws being then tightened again to hold the arms and guard folded.

AN IMPROVED FIRE ESCAPE.

A device designed to facilitate escape from a burning building is illustrated herewith, and has been patented by Messrs. James G. Berdrow and Frank A. Pelkey, of Seward, Neb. It has a frame adapted to be rigidly secured to the outside of a door or window casing, the frame having near its bottom forward projecting bearings in which is mounted to turn a transverse shaft having fixed thereto a pair of grooved winding drums. Hoisting cables are wound in opposite directions on the drums, the cables having hooks on their lower ends for attachment to suitable cars or cages, so that when one car descends, the other cable will be automatically wound up, bringing up its attached car for use by the next person. On the winding shaft is a cog wheel gearing with a pinion on an inner shaft, the latter also gearing with another shaft carrying a bevel gear communicating motion to a vertical shaft, the



BERDROW & PELKEY'S FIRE ESCAPE.

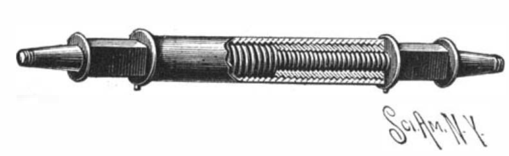
multiplying of the gearing causing the vertical shaft to revolve rapidly while the winding shaft is rotating comparatively slow. On the upper end of the vertical shaft is a brake wheel, the brake shoe of which is adapted to be operated by an angle lever, to check the speed of the winding shaft, a hand rope from the outer arm of the lever passing through a stationary guide down to where it can be conveniently grasped and drawn upon by the person descending in the car. An automatic governor device is also fixed on the vertical shaft, whereby any excessive speed of the descending car will cause the brake to be applied without the use of the hand rope.

Refrigerator Cars.

The refrigerator cars in which meat is brought from Western stock yards to Eastern markets are 29 feet long inside, 8 feet 2 inches wide inside, and 7 feet 2 inches from the floor to the cross beams to which the hooks are fastened, above which is a space of 14 inches to the roof. At each end are galvanized iron tanks filled with a mixture of pounded ice and coarse salt. The temperature of the cooling rooms and the cars is kept as nearly equal as possible, about 30° to 36°. Between the cooling room and the car shed is the shipping room, where the beef that is to be shipped is weighed, quartered, and rigidly inspected. When loaded, a car contains about thirty carcasses, averaging 650 pounds. All the hind quarters are hung in one end of the car, and the fore quarters in the other. The cars are iced the day before shipping, refilled just before loading, and are iced again every twenty-four hours at regular stations on the route. Experiments have proved that in this way beef can be kept sweet for two or three weeks, and will taste quite as well at the end of that time as meat killed and eaten within two or three days. When the cars return empty, they are side-tracked at the packing house, and undergo a thorough scrubbing and cleaning with boiling water, the hooks are washed and polished, and the car is allowed to stand for twenty-four hours with open doors before it is again loaded for the Eastern market. The amount of traffic with the meat trains is something enormous.

AN IMPROVED AXLE.

The accompanying illustration represents an axle so constructed that, if one section should break, it may be detached from the other and a new section put in place, thus obviating the necessity of losing the whole axle. It has been patented by Mr. Charles H. Wilson, of No. 17 Beacon Avenue, Jersey City Heights, N. J.



WILSON'S AXLE.

The axle is made in two sections, each having their inner ends externally screw-threaded, one section having a reduced screw-threaded portion or shank and the other section having an internally screw-threaded cavity to receive this shank. The outer surfaces of the central portions of the two sections are screw-threaded, and upon them is screwed a coupling sleeve or tube, which is held in place by a collar and set screw on each end.

Russian Petroleum.

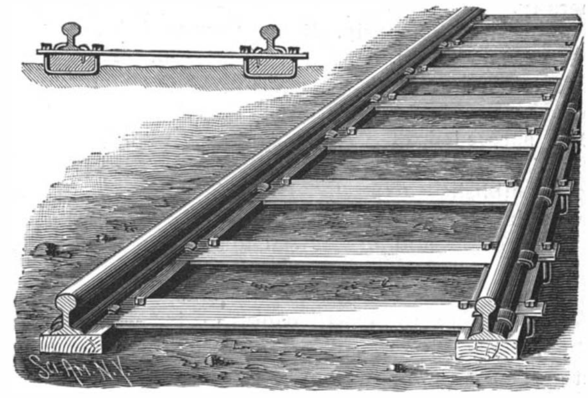
M. De Tchihatchef, a Russian writer, asserts that the average flow of petroleum in the Baku region is 88,000 barrels per day, as against 25,300 barrels in the United States. The chief drawbacks encountered by those who have worked the Baku oil fields have been lack of transportation and want of cheap package. A railway to Batoum, on the Black Sea, opened two maritime routes to Europe, and met the first difficulty. Cars and vessels constructed to carry crude oil met the last, and enabled refineries to be built in the interior of the empire wherever fuel might be cheapest. It is confidently predicted, since the completion of the Batoum Railway, that Russian oil will displace American in European markets, and that it will even be possible for the Russian product to compete for the markets of the United States. M. De Tchihatchef points out a probable demand in the near future for petroleum to serve as fuel on the great lines of railway completed and still building in Asia.

How Scarlet Fever Poison is Distributed.

The *Medical Era* relates the case of a girl aged about eight, living at Fortress Monroe, Va., who was some months ago attacked by scarlet fever, the disease running a typical course. For a long time no possible source of contagion could be discovered. The child had not been absent from home, had been with no one lately exposed, and no other case was known to exist anywhere in the vicinity. Subsequently Dr. Brooke learned that one of the house servants had nursed a case of scarlet fever in a distant city just about a year before. After the case terminated she packed some of her things, including some clothing then worn, in a trunk and left the place. A year later she had the trunk sent to her, opened it and took out the contents, the little girl being present and handling the things. Very soon after the latter was attacked, as stated

AN IMPROVED RAILWAY.

According to the invention illustrated herewith, which has been patented by Mr. Robert P. Faddis, of Socorro, New Mexico, a suitable stringer of timber is employed, with recesses in which the ends of metal ties are seated, so that the rails rest flat on the stringers. The tie has its ends divided, or split longitudinally, one portion being then turned upward to engage the outer side edge of each rail, the inner edge of the rail being engaged by a spike driven through an aperture in the tie into the stringer. The ties and stringers are, however, mainly held together by stirrups, which embrace the stringers from below, as shown in the small figure, the arms of the stirrups extending up along the



FADDIS' RAILWAY.

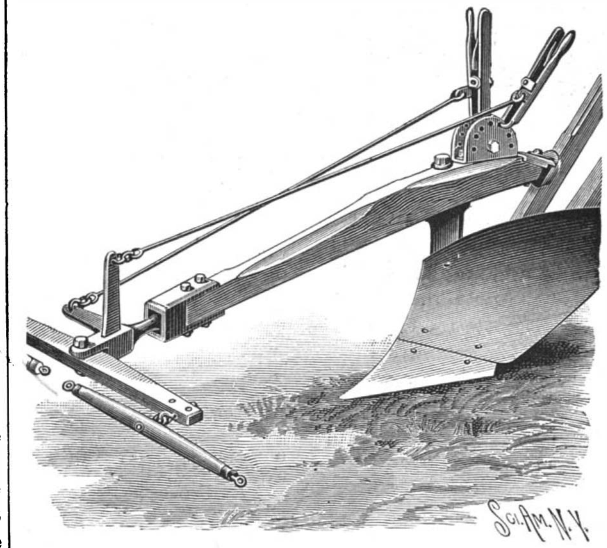
opposite sides of the stringers through the tie and being secured by nuts.

Paper from Wood.

The discovery of the value of wood in paper making is credited to Dr. H. H. Hill, of this city. About forty years ago the doctor visited the paper mill at Vassalboro, and after looking over the machinery suggested the feasibility of using wood, and asked why the manufacturers did not get a few bales of excelsior from Augusta, where it was made, and try the experiment of making paper from wood. "It can't be done," said the manufacturers. "Have not you as much gumption as the hornets, whose nests are made of wood paper?" asked the Doctor. The result of the conversation was a letter, some time later, from the firm's wholesale agents in Boston asking what they were putting in their paper to make it so much better than it had been. It was the wood, then first used in this way.—*Kennebec (Me.) Journal.*

AN IMPROVED PLOW CLEVIS.

A clevis, with mechanism for adjusting it, whereby the clevis may be maintained in proper position during irregular movement of the plow and team, is illustrated herewith, and has been patented by Mr. Marshal T. Cole, of Claremont, Minn. The clevis has a vertical arm and a lateral arm, each connected by adjusting rods with levers pivoted in a U-shaped bracket secured to the plow beam adjacent to the arms of the plow. The rearwardly extending arm of the clevis terminates in a knob or ball, and is connected to the plow beam by the ball resting in a socket formed by two castings bolted to the plow beam, and with recessed heads fitting together, whereby a universal joint connection is made. To hold the clevis in elevated position, and in line with the plow-beam, the levers are adjusted as shown in the illustration, but the direction of the clevis to the right or left may be effected by differently



COLE'S CLEVIS FOR PLOWS.

adjusting one of the levers, or it may be held at a different angle vertically by changing the adjustment of the other lever. By this means the draught connection may be readily altered for a gradual or instant change of depth or width of work, or for both simultaneously, as may be required in ground of different surfaces or variable soil.

GUN COTTON—ITS HISTORY, MANUFACTURE, USE.

BY KARL ROHRER, U. S. N.

The explosive of this name was discovered in 1833 by Braconnot, who dissolved paper and starch in concentrated nitric acid, and recovered a powdery white substance, which burned with a flash when brought in contact with flame.

Pelouze, about the same time, observed that starch so treated gained in weight. He also noticed that by dipping cellulose matter in nitric acid of 1·5 sp. g. it became very inflammable.

In 1846, Schonbein announced the discovery of a new explosive, having four times the power of gun powder, and as being eminently suited to take its place as a propeller of projectiles and in explosive work generally.

Almost simultaneously, Bottger succeeded in producing what he called explosive cotton. He combined with Schonbein to practically utilize their joint discovery.

Otto succeeded in producing gun cotton independently of Schonbein and Bottger, working up from Pelouze's published experiments. Otto's product was weaker than Schonbein's, as he only used nitric acid in its preparation, and not mixed nitric and sulphuric acid, which the latter used. The publishing of Otto's experiments and their results led many expert and amateur chemists to investigating in this field.

Knop, Heeren, and Karmarsch discovered that the best gun cotton was produced by dipping cellulose in the mixed acids, nitric and sulphuric, a fact which was the secret of Schonbein and Bottger.

Publishing and discussing the various ways of producing gun cotton created great excitement in the scientific world of that day. As a humorous scientist put it, "The current literature breathes gun cotton, and the consumption of nitric acid is colossal."

In the meantime efforts were made in France, Russia, and England to introduce gun cotton, and substitute it for gun powder. But the processes of manufacture and the impurity of the raw materials used were such that the results were unsatisfactory. Fatal explosions occurred in France and England in 1848. The political revolutions of that time drew further public attention from the subject.

An Austrian officer, Captain Von Lenk, by study and investigation, succeeded in producing gun cotton which excelled all its predecessors in the regularity of its effect and in its keeping properties. Experiments with it from 1849 to 1853 tended to justify faith in its future, and the Austrian government bought the Schonbein-Bottger patents.

In 1853 the first gun cotton factory established and worked upon a rational plan was erected at Hirtenberg, near Vienna, under Von Lenk's superintendence. His method of manufacture was kept secret until 1862, when he gave it to the French and English, and patented it in the United States in 1864.

In 1865 the Austrian government abolished the use of gun cotton in its service because of two fearful explosions of magazines filled with it, the cause of which could not then be determined.

In this year Abel made the discovery which took gun cotton out of the realm of possibly useful explosives and placed it in that of the safe, practicable, effective, and useful ones. This consisted in pulping it, to admit of its proper purification, and in compressing it to increase its explosive effect. Upon the Von Lenk-Abel method all gun cotton is now produced. Essentially, this method is to dip good and thoroughly cleansed cop or weaver's waste in pure and strong mixed nitric and sulphuric acid—one part by weight of the former and three parts by weight of the latter; to wash, boil, pulp, and liberate the resulting gun cotton from all free acid; then to mould and compress it into the desired shapes and sizes for use.

For the manufacture of gun cotton in the factory established at the naval torpedo station and war college (Fort Wolcott) in 1883, the cotton used is cop or weavers' waste, which is received in bales of about 500 pounds each. (Fig. 2.) The bales are opened, and the cotton is picked over and placed in the cotton boiling tubs, about 200 pounds in each tub (Fig. 3), to which is added about 250 gallons of water and 35 pounds caustic soda. The cotton is boiled in this solution for eight hours, then drained overnight; it is then boiled for eight hours in clear water, again drained, and then thoroughly washed in a centrifugal wringer or extractor. It is thus freed from oil and other impurities.

It is then spread on the wire netting shelves of a suitably arranged dry room, through which hot air, at about 180° F., is circulated, and is sufficiently dried to be picked.

The cotton as received in the bales is full of knots and rolls, and the boiling adds to them. To prepare it for conversion into gun cotton, it is necessary to take them out, that the acid may penetrate easily and quickly through all parts of it. To accomplish this result, the cotton is passed through a picker, a machine common to all cotton factories (Fig. 5).

Having been opened out by the picker, it is dried as thoroughly as possible. This is done by placing it in the wire-netting-bottomed drawers of a specially constructed drier, which is closed when filled, through which, and its contents, hot air at about 225° F. is driven by a Sturtevant blower, which draws its air through a steam heater. In this drier it is left for eight hours, at the end of which time it is estimated that not more than ¼ to ½ of one per cent of moisture remains (Fig. 6). Water is liberated by the action of nitric acid upon cotton, and to avoid weakening the former any more than is absolutely necessary, and to prevent dangerous increase of temperature, the latter must be as dry as possible.

When dry the cotton is stowed away in powder tanks (Fig. 7), so that it may be conveniently handled, and also kept dry. It is now ready for the conversion process.

This is carried on in the dipping room, which is fitted with cast iron dipping troughs, located in a tank of running water, proper cooling troughs, and acid reservoirs. The acid used is received already mixed, contained in iron drums of about 1,200 lb. capacity. The mixture is, as nearly as possible, one part by weight of pure nitric acid of 1·5 specific gravity to three parts by weight of pure sulphuric acid of 1·85 specific gravity, and costs 3¼ cents a pound. As in the converting and the two succeeding steps of the purification process a great deal of acid fume is liberated, the dipping and two following pieces of apparatus are connected with a fan, to take it up and drive it out. The prepared cotton is brought to the dipping room on the railway running through the factory. The dipper fills the troughs with acid and arranges his tools for use. The helper weighs out a pound of dry cotton, with which he approaches the dipper, and pitching about a third of it into the acid (Fig. 8), the latter submerges it with a steel fork, made for the purpose, and so on, until the first trough is charged with the pound of cotton. The other three troughs are similarly charged. When about ten minutes have elapsed, the dipper returns to the first trough, and with the fork gathers the gun cotton out of the acid and puts it on a grating at its further end, and there squeezes the surplus acid out with a hand press (Figs. 9 and 10). By the time this is done, the helper has placed a stone jar, into which the two place the gun cotton from the first trough. The helper presses it down in the jar, puts a cover over, and sets it in a cooling trough. The dipper replenishes the acid, and the trough is charged with cotton as before, and so on, until the day's dipping, about 110 pounds, is finished. The jars are left in the cooling troughs overnight, so that their contents may thoroughly digest, and there remain no unconverted particles of cotton (Fig. 12).

From the cooling troughs, the gun cotton is taken to a centrifugal wringer, two jars at a time, in which the acid is extracted and caught in a drum (Fig. 13). This spent acid is sold to the acid manufacturers for three-quarters of a cent a pound. Extracting it is a delicate operation, and great care must be taken that no oil or water finds its way into the wringer, for, if it does, the gun cotton will be ignited, and, under such circumstances, it is very difficult to draw the line between a fire and an explosion.

The gun cotton, having been approximately freed from acid, is taken to the immersing tub, in which washing out the free acid is begun (Fig. 14). Immersing acid gun cotton in water is dangerous, and must be carefully and intelligently done. In this tub revolves a paddle wheel, over which is a hopper, which communicates with the wheel by a slot. The gun cotton is brought from the wringer in a tray, and placed in the hopper, from which it is fed by separate handfuls, down the slot, upon the revolving wheel, and into the flowing water in the tub. If it is otherwise fed down to the wheel, so much heat is developed in that part at the edge of the water that it may ignite, and burn the contents of the hopper, and do other damage.

The gun cotton is taken out of the immersing tub, and thoroughly washed in a centrifugal wringer, and then placed in a gun cotton boiling tub. These tubs are similar to the cotton boiling tubs, differing from them in having the steam enter through the top, going to the bottom, then through a coil, and out. The boiling space is insulated from the metal pipes by perforated boxing. Live steam does not come into contact with the gun cotton, nor does the metal of the steam pipe. In this tub it is boiled in fresh water, and 10 lb. of carbonate of soda, for eight hours. It is then drained, and thoroughly washed in a centrifugal wringer, and boiled again for eight hours, in fresh water, and again drained, and washed as before.

After the second boiling and washing, it is taken to the pulping machine (Fig. 15), which is similar to the machine used in paper mills, for pulping paper stock. In this machine, which is suitably filled with water, it circulates between the knives until pulped to about the fineness of corn meal.

From the pulping machine it is drawn off into a poacher, which is a large oval tub provided with a paddle wheel in the middle of one side, working just clear of a platform with inclined approaches (Fig. 16). The pulp and a sufficient quantity of water being in the poacher, its paddle wheel is made to revolve, which causes both pulp and water to circulate, and the latter to wash the former. After an hour's washing the paddle wheel is stopped, upon which the gun cotton settles to the bottom. The soiled wash water is drawn off by means of a telescopic pipe at one end of the poacher. Fresh water is added, and the cleansing continued until the washing water ceases to become soiled. The gun cotton is then supposed to be clean and without free acid.

A sample is taken from the bottom of the poacher, and submitted to the solubility test, to determine what percentage of soluble gun cotton it contains, which must be less than ten per cent. The lower orders of gun cotton are soluble in a solution of one part alcohol and two parts ether, and by means of this solution the test is made. It is then submitted to the heat test, to determine whether any free acid remains. To make this test, small quantities of the sample, thoroughly dried, are placed in test tubes which are filled in a hot water bath, carrying a suitable thermometer. The mouths of the test tubes are closed with corks, under which are suspended pieces of iodide starch paper, which has been very carefully prepared. The bath is heated to 150° Fah., and the gun cotton must bear this temperature for not less than fifteen minutes, without turning the test paper brown.

Having passed the tests, the next step is to prepare it for service use. To every poacher full of it there is added three pounds precipitated chalk, three pounds caustic soda, and three hundred gallons of lime water. So fortified with alkali, it is pumped into what is called the stuff chest, a round tank with a vertical shaft, carrying feathers to keep the pulp agitated and mixed with the water (Fig. 17).

The gun cotton being in the stuff chest is drawn thence and moulded, or pressed into shape for compressing, which is accomplished by means of a hydraulic press arranged for the purpose. Knowing the size of the compressed block desired, it is determined by experiment how much of the pulp is necessary to produce it, increasing or decreasing the length of stroke of the press pistons, then the moulding is proceeded with. The standard gun cotton block for naval use is 2·9 inches square and 2 inches high (Figs. 20 and 21), to produce which the moulded block must be 2·8 inches square and 5½ inches high (Fig. 19), moulding at a pressure of 100 pounds to the square inch.

From the moulding press the blocks are taken to the final press, which is one of Sellers hydraulic presses with an 18 inch ram (Fig. 18). In the receiver of this press the moulded blocks are placed between two perforated steel plates, a traveling block is then hauled over and the pump started, which forces up the ram and the pistons on top of it, which act on the gun cotton in the receiver. The naval service gun cotton is compressed at three tons to the square inch, and leaves the press with from 12 to 16 per cent of moisture, which is increased to about 35 per cent before issue to the service. It goes into the service packed in the standard tin exercise torpedoes and tinned sheet iron service torpedoes, which are capable of being made water and air tight, and have the necessary fitments for filling, fusing, and being attached to spars preparatory to explosion (Figs. 22 and 23).

The public owes much to the various experimenters with gun cotton, but owes most to Von Lenk and Abel. The former determined the facts that the strongest and best gun cotton is secured from the purest and best raw materials, and that to make it safe, its free acid must be extracted. The latter discovered how to make it safe, and how to increase its explosive effect. He also realized its true sphere of usefulness.

The filaments of cotton in the natural state are hollow, and all the spinning, weaving, and other processes to which it is subjected in the manufacturing and commercial worlds fail to destroy these tubes, as they may be called. Their existence caused the failure of the early gun cotton makers, because, upon dipping the cotton into acid, it permeated the hollows of the filaments, and no ordinary method of washing served to extract it. With free acid in gun cotton it is a question of short time for decomposition to begin, and explosion to follow.

Abel, by discovering the pulping process, enabled the gun cotton to be thoroughly purified of free acid; as by pulping the filaments are broken up, and the worker is able to wash it out. Again, by fortifying the purified pulp with a percentage of alkali to neutralize the nitrous exhalations which all nitrated bodies give off, sooner or later, and then compressing this purified product, he presented to the military world the ideal explosive for its purposes.

It is extensively manufactured in England, by government as well as by private individuals. In Germany, Italy, Austria, and other countries it is manufactured by private parties. It is used by the military services of the whole world, and is constantly growing in favor. The Chinese and Japanese are taking steps to establish their own factories, and thus free themselves from the European manufacturers.

The United States government should to-day have a half million tons of it, contained in torpedo and mine cases, distributed along the Atlantic, Gulf, Pacific, and lake coast, and at central distribution points along that line. It should also have a well drilled and organized naval militia, prepared to lay them out properly and put the life of death into them for those who attack us.

In these days, when the Monroe doctrine is expounded to embrace islands 2,000 miles and more from the continent; when interoceanic canals are to be controlled; and when it is the mode to twist the tails of the British and Spanish lions, to pull feathers from the Gallic cock and the eagles of Germany and Austria, it were well that many and rapid steps be taken to enable the country to maintain and prosecute a fight, if one should be developed. From the point of view of one to whom war means promotion, aggressive foreign policy might be very promising, other things being equal. Alas! other things are not equal; and while this country, in area, wealth, population, and latent defensive and offensive war strength, ranks among the highest of first class nations, yet in its immediately available defensive and offensive power, upon the sudden declaration of war, it ranks little, if any, higher than Denmark. Modern guns, forts, ships, torpedoes, mines, and gun cotton must be accumulated, and the fighting strength of the nation trained in their use.

Wet compressed gun cotton is the safest high explosive yet produced. It can be readily and safely transported by any conveyance whatever. It is eminently convenient and safe to handle, store, and work with. It can be sawed, turned, cut, and bored easily and with perfect safety; and the turnings, cuttings, and borings may be worked over, as may old, distorted, or obsolete shapes. It can be compressed in any shapes or sizes.

Dry compressed gun cotton is safer, in every way, than gun powder, and a very small percentage of the whole weight of any charge for explosive work need be dry.

In view of the daily accidents with the ordinary market high explosives, it is pertinent to ask what would happen if the work of lining our whole coast with mines and torpedoes charged therewith were attempted? Our defense would be as dangerous to ourselves as to our enemy. No man fights well who is afraid of his weapon.

The time has arrived for private enterprise to take hold of gun cotton. The processes and machinery for its manufacture can be greatly simplified and improved, and its sphere of usefulness much increased. It is certain that the overweening common sense of our naval and military ordnance authorities will, in the near future, cause it to be adopted as the normal high explosive for government use. Even now, reasonable inducement might be received for private parties to move in the matter.

As superintendent of the factory whose processes this paper describes, I have, in the past three years, made many tons of it, handling it under various circumstances, in both the wet and dry states, without injury to person or property.

That Ache in the Back.

An Albany physician, says a contemporary, declares that Americans suffer more generally from Bright's disease and nervous diseases than any other people, and he says the reason is that Americans sit down so persistently at their work. He says: "Americans are the greatest sitters I ever knew. While Englishmen, Germans, and Frenchmen walk and exercise, an American business man will go to his office, take his seat in his chair and sit there all day without giving any relief to the tension of the muscles of the back. The result is that these muscles surrounding the kidneys become soft and flabby. They lose their vitality. The kidneys themselves soon become weak and debilitated. If Americans would exercise more, if they would stand at their desks rather than sit, we would hear less of Bright's disease. I knew of a New York man who had suffered for some years from nervous prostration until it was recommended to him that he have a desk at which he could stand to do his work. Within a year he was one of the healthiest men you ever saw. His dyspepsia and kidney trouble had disappeared, and he had an appetite like a paver."

A Mountain of Iron.

Dr. Noetling, of the Geological Survey of India, in a recent report on magnetic rock among the Shan Hills of Upper Burmah, describes a mountain or hill at Singaung which "consists of a huge mass of iron ore." Having, he says, noticed on the way numerous pieces of iron ore, which became still more frequent on the southern side of the hill, he examined the latter in several directions. He found the surface everywhere covered with large blocks of iron ore, originating evidently from superficial decomposition of lower beds. He concluded that the whole hill consisted of a large mass of iron ore. He was unable to ascertain the geological conditions under which this ore occurs, or its exact limits and extensions, on account of the dense jungle and the tremendous attraction, rendering his compass useless. He estimates, however, that the hill covers, at least, an area of about a square mile, and that it rises about 200 feet above the level of the Twiunge valley. The ore is hematite peroxide of iron.

Correspondence.

Wheat in Geranium Stalk.

To the Editor of the Scientific American:

A peculiar growth has lately come to my notice, which may be of interest to some of your readers. About three weeks ago I was told, when about to plant some geranium cuttings, that if the lower end of a cutting was split and a grain of wheat inserted, it would much promote the growth, so I tried the experiment. It did not have the desired effect, as the cutting never grew at all; but when I pulled it up I found that the wheat grain had grown to the height of about 7 inches up through the pith of the cutting, and had two perfectly formed pale green leaves, closely folded up within. The only part of the wheat projecting from the geranium was about one inch of root. WM. H. P.

The Great Lakes.

To the Editor of the Scientific American:

I accidentally, a few weeks since, came in possession of the SCIENTIFIC AMERICAN of August 18, 1888, in which I read an article on the formation and changes of the level of the great lakes, by Mr. C. K. Gilbert. I was greatly interested in his theory and opinion of the changes of level of Lake Erie, of Lake Huron, of Lake Michigan, and Lake Superior. It is evident from the indications and marks on the south shore of Lake Erie that that body of water was, at some anterior date, many feet above the present level. Also, that Lake Huron's and Lake Michigan's present levels are many feet lower than they were at some anterior date.

In 1835 and 1836 I traveled on foot through the region of country from the southwest portion bordering on Lake Michigan in a southwest course to the Desplaines River, commencing some six miles south of Chicago, near or at the mouth of the Calumet River. The country at that time (1835) was a low, swampy region for some four or five miles in width, extending in a south by west direction toward the Desplaines River. Some ten or twelve miles from Lake Michigan, the low, swampy character of the land was contracted to about a mile in width, and from that point on to the Desplaines River was known as or called the sag. This sag was a wet, swampy piece of land, almost impassable, overgrown with long swamp grass and flags. This was the general character of the sag, or low ground, until it united with the Desplaines River, some six or eight miles above the town of Joliet. This low ground, commencing at Lake Michigan, and the sag, or valley, has every appearance of once being the bed of a large river. In June, 1835, I was at the town of Joliet, which had then but four or five buildings—but one house on the east side of the river (Desplaines) and three or four buildings on the west side of the river.

The valley of the Desplaines River, from the junction of this low, swampy sag, or valley, I should say is from one-half to three-quarters of a mile in width from thence to its union with the Kankakee River. From Joliet I traveled on foot down this valley, following an Indian trail most of the way to within a short distance of the town of Ottawa. The peculiar formation of the bottom, or land, of this valley, between the bluffs, was such that it led me to believe it was, at some ancient period of the world's history, washed by a large river. At Joliet, on the east side of the river, there was no soil of consequence. The valley was covered with round, coarse gravel and sand for from six to ten inches or more in depth; then the rock formation commenced; this extended down the valley for some two miles. This coarse gravel and small stones had every appearance of having been washed by water, they being so round and smooth. Some three or four miles below Joliet there is a mound, or mountain, as it was called at the time (1835) that I was looking at the country. This valley, on each side of the mound, had every appearance of having been washed by a large river. This mound is, I judge, some 60 or 80 feet in height, and the top of the mound is on a level with the country on either side of the valley. The top of this mound contains several acres of rich soil of the same character as the prairies in that vicinity. The upper end of this mound, at the base, is composed of a ledge of rock. There are also distributed throughout this valley, to its junction with the Fox River at the town of Ottawa, numerous small mounds, from 15 to 20 feet high. All of these had the appearance as if they were islands in the bed of a river. The formation of these mounds was precisely that of all islands in large rivers—broad and round at the upper end, and washed to a point at the lower end like this . From the town of Ottawa to the town of Peru, the head of navigation on the Illinois River, the bluffs on either side of the river have the appearance of having been washed by the waters of a vast river. In fact, the Illinois River, with its tributary, the Desplaines, to its union with the Mississippi, I have no doubt, was the channel through which the waters of the great lakes, Erie, Huron, Superior, and Michigan, once found their way to the Gulf of Mexico.

There is no question, in the minds of scientific men, as to the fact that the surface of these lakes was many feet higher than at the present time. From the formation of the surface of the country at the southwest end of Lake Michigan, some ten or twelve feet elevation of this lake would discharge the water through the channel above mentioned into the Illinois River. There is no doubt but the ridge of rock formation extending from Lockport to and across the Niagara River was, at some anterior age of the world, a barrier to the outlet of Lake Erie; hence the evidence from indications on the south shore of the lake shows that the water of the lake was from forty to fifty feet higher than at the present time. There is, according to engineering surveys, but twenty-two feet fall from Lake Huron to Lake Erie; hence this elevated ridge of land crossing the Niagara River would be a barrier to the outlet of Lake Erie into Lake Ontario. Therefore the waters of Lake Erie flowed into Lake Huron and through the Straits of Mackinac into Lake Michigan and thence through the Illinois River to the Gulf of Mexico.

C. T. S.

Creolin in the Local Preventive and Curative Treatment of Infectious Throat Diseases.

BY F. W. KOEHLER, M.D., LOUISVILLE, KY.

In Nos. 17, 18, and 19 of the current volume of the *Wiener Medizin. Wochenschrift*, Dr. James Eisenberg describes a series of experiments made with the new antiseptic creolin. He shows it to be an extremely powerful germicide, and yet, even in large doses, altogether harmless to man. These qualities made it appear to me an ideal remedy for the preventive and curative treatment of infectious throat troubles. Adults can use gargles of the ordinary poisonous antiseptics, like the bichloride of mercury, but for children something is needed which can be safely swallowed. Soon after I had read Dr. Eisenberg's article I procured a supply of the creolin, and have since used it to the exclusion of other local applications. My success with it has been very pleasing indeed. In treating infectious throat troubles, I now always put not only the patient, but also all the well members of the household, on the creolin treatment. Thus I have prevented, I think, diphtheroid sore throat from going through entire families of children, which it had previously, under other modes of treatment, always done.

But it is as a preventive of true diphtheria that I expect most from the creolin. Dr. Eisenberg's experiments show that no form of pathogenic germ can resist its action; and it is therefore reasonable to suppose that the germ of this disease will also succumb to it. Recently I was called to see an old lady, who, a day or two after exposure to a case of diphtheria (proved to be so by paralysis occurring several weeks afterward), was taken sick with rigors, fever, and sore throat. Almost simultaneously her daughter and son-in-law were taken in the same way; but her little grandchild, a boy of four years, showed no signs of the disease when I was called. I at once, however, put him, as well as the others, on the creolin treatment. The child, although always rather predisposed to throat and bronchial trouble, escaped an attack altogether, and his parents and grandmother recovered promptly.

Diphtheria is certainly one of the most dreadful diseases that confront us, and any treatment that might reasonably be expected to prevent its spread should be given a trial. I am inclined to believe that if the mouths, throats, and nasal passages of children were kept as clean as their faces, there would be much less of the disease. When diphtheria prevails, no child's toilet should be considered complete until the upper air passages have been thoroughly douched with some suitable antiseptic; and in the long list of such agents I know of none that fulfills the requirements so well as creolin.—*Medical Record.*

Good Counsel.

How true it is, as the *Practical Mechanic* says, thousands start well, but never finish one thing at a time. They have a dozen things on hand and no one completed. Time is wasted on unfinished work. Always finish what you begin. One thing finished is worth a hundred half done. The completion of an undertaking yields more pleasure and profit than dozens of plans. The man who is always planning or scheming is rarely, if ever, successful. He often furnishes ideas for others, who go persistently to work and finish what his ideas suggested. "That was my idea—my plan," we frequently hear some one say, but the man who carried it out was the one who benefited himself and others. Do not begin what you cannot finish. What you undertake to do, *do*, and reap the reward of your own ideas and skill. This is good advice both in and out of the shop.

New Automatic Rifle.

A new automatic magazine rifle, invented by R. Dewhurst and H. A. Pitcher, has been brought out at Neillsville, Wisconsin, where it is making quite a sensation. Like the Maxim gun, the cartridges may be fired singly, by pulling the trigger for each desired discharge, or the gun may be set so as to fire itself off, with great rapidity, until all the cartridges in the magazine are used.

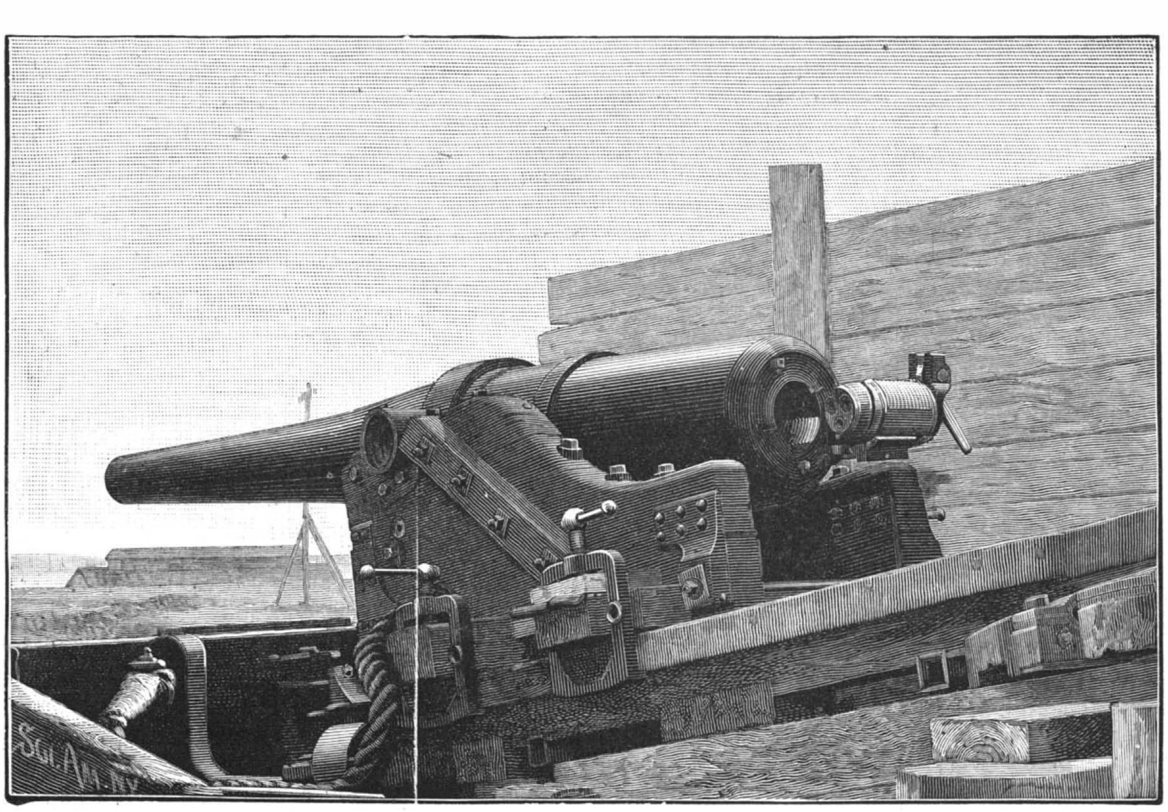
TEST OF THE CAST STEEL BREECH LOADING RIFLE OF OPEN HEARTH STEEL.

An act of Congress approved March 3, 1887, appropriated $20,400 for the purchase and completion of three rough-bored and turned steel cast 6 inch guns, one to be of Bessemer steel, one of open hearth, and one of crucible steel. One gun of Bessemer and one of open hearth steel have been finished, but no proposals for a crucible steel gun have as yet been received by the navy department. These castings were to be of domestic manufacture, of best quality of raw material, uniform in quality and free from all imperfections of casting. The guns were to be of one piece, except the trunnion band, if so desired, and they were not to be forged.

The test and bursting of the gun of Bessemer steel was described in our issue of December 29, 1888. The second gun, of open hearth steel, has recently been tried at the proving ground, at Annapolis. In external appearance it differs from the former gun in having a trunnion band of cast steel screwed on, instead of having its trunnions cast solid with the rest of the piece. It also has a slightly greater diameter across the cylinder or breech, and is nearly three thousand pounds heavier than the Bessemer steel rifle. The gun was cast, rough-bored and turned by the Standard Steel Casting Company, of Thurlow, Pa., and was fine-bored, chambered, and rifled at the gun shops at the Washington navy yard. As in the case of the Bessemer steel gun, the interior work shows most creditable machining by the government workmen at the navy yard. The interior profile was made exactly the same as that of the service 6 inch rifles of Bureau of Ordnance design, so that direct comparison could be made of ballistic results from the two classes of guns. The naval built-up gun is considerably lighter than the cast steel gun, its weight being about 10,800 pounds, as against 13,125 pounds for the Thurlow gun.

The physical characteristics of specimens from this casting are quite uniform. With the eight specimens experimented upon, the ultimate tensile strength varied from 79,246 pounds to 81,334 pounds, the elastic limit varied from 36,414 to 38,961 pounds, while the elongation ranged from 19·10 to 27·85 per cent.

As will be seen from the plan of the gun, the breech is a cylinder, while forward of the trunnions the profile of the chase and muzzle slope away in a curve of such a trend as to make the resistance of the gun at any point correspond with the ordinate of the pressure curve at that point. The breech is closed on the interrupted screw system used in most breech-loading guns. The De Bange pad seals the joint between breech plug and gun chamber, preventing any escape of gas to the rear, and the front face of the "mushroom" or nose plate is fitted with the housings of three gauges for recording the gas pressure in the chamber of the gun. The following are the principal dimensions of the gun:



RECENT TEST OF 6 IN. CAST STEEL BREECH LOADING RIFLE.

Length	193·5	inches.
Length of bore in calibers	30	cals.
Diameter across breech	22·2	inches.
" of bore across lands	6·0	"
" " powder chamber	7·5	"
Capacity " " "	1,400	cu. in.
Twist of rifling—increasing from 1 turn in 180 calibers to 1 turn in 30 calibers at muzzle.		
Weight of gun	13,125	lb.
" " projectile	100	"
" " powder charge	48¼	lb.

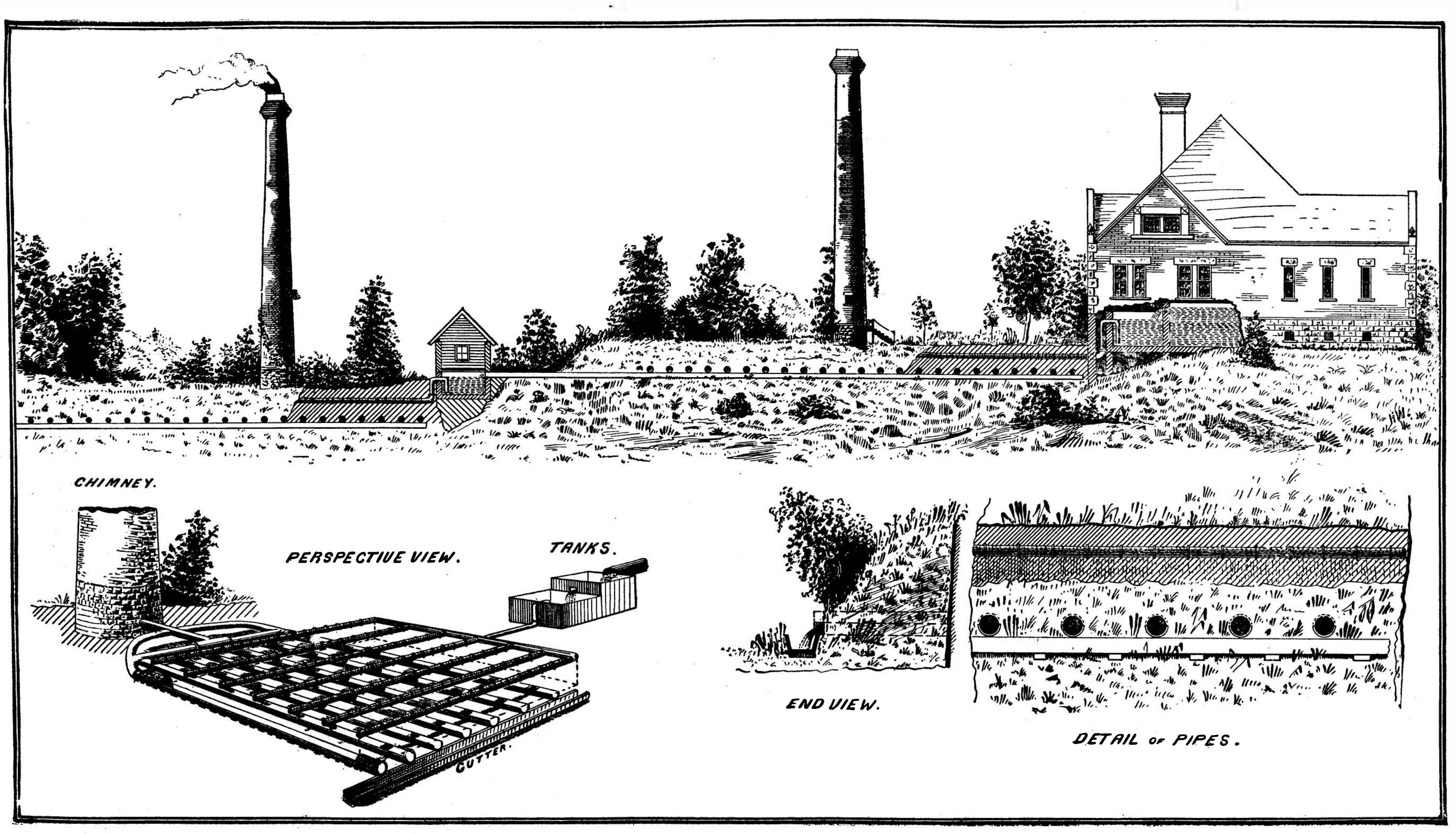
There are 24 lands and grooves, the rifling being of a modified ratchet system. The projectile is fitted with a soft copper band near its base, of a diameter greater than that of the bore across grooves. When the gun is fired, the band is forced into the rifling as the projectile moves down the bore, and thus the necessary spin is given the shell. The projectiles were the common cast iron shells, cored for a bursting charge of five pounds of powder; but in tests of this kind at the proving ground the shells are not filled with powder, being brought up to the standard weight (100 pounds) with sand.

The powder used in the trial was the regular naval 6 inch gunpowder, manufactured by Messrs. Du Pont, at Wilmington. It is known as brown prismatic or cocoa powder, from its color, and is pressed in hexagonal prisms one inch high, each prism pierced with a quarter inch hole in its axis for ignition. Ten grains weigh one pound, the specific gravity being about 1·825. One of these grains, if ignited in the open air, will burn for eight or ten seconds before being consumed; but when under pressure, as in a gun, its rate of combustion is very rapid, although slow compared to that of ordinary black powder, which is not used for high powered guns, being far too violent and irregular in its action.

The charge of 48¼ pounds is known as the full service charge for naval 6 inch guns, and from a long record of firing at the proving ground can be depended upon to give a 100 pound shell a velocity of 2,000 feet per second, with a pressure in the gun chamber of about 15 tons to the square inch. The test ordered by act of Congress was to include ten of these full charges, delivered from the gun as rapidly as possible. Preparatory to the firing trial, the gun was mounted on an old-fashioned wooden carriage, with the slide inclined upward to the rear, so that the piece would run to battery again after its recoil. Recoil was controlled by friction compressors on the sides of the carriage, set up with screws, and a stout hemp breeching, with rubber buffers in rear. Bomb proofs were provided for officers and gun servants, and heavy bulkheads or traverses of timber and sand bags protected the other guns and carriages on the platform from injury from flying fragments.

The trial took place on February 7, 1889, and was under the direction of Lieutenant-Commander J. H. Dayton, Inspector of Ordnance in charge of the Proving Ground, assisted by Lieutenants F. A. Wilner and V. S. Nelson and Ensign R. B. Dashiell. Many naval officers from the Academy and representatives of the steel casting company and of the press were present.

Before the rapid fire test with ten rounds, two rounds with reduced charges of 36 pounds were fired



TERRACED IRRIGATION PROCESS OF SEWAGE DISPOSAL.

to set the gas check and warm the gun. These charges gave pressures from previous records of about 11 tons to the square inch. When all was ready, ten rounds, with full charges and projectiles, were fired rapidly, the ten shots being delivered in 19 minutes and 8 seconds.

The gun stood the ordeal without rupture, being the first American high-powered cast steel gun that has endured a full charge firing test of ten rounds. Whether the piece has been injuriously enlarged or strained in the trial, extended experiment alone can show.

TERRACED IRRIGATION PROCESS OF SEWAGE DISPOSAL.

T. O'CONOR SLOANE, PH.D.

The problem of sewage disposal cannot as yet be said to be adequately solved. In England, sanitarians propose new methods of treatment continually. Disinfection by chemical treatment, precipitation of the solid matter by mechanical deposition, or its removal by filtration have all been tried in every conceivable modification. Even electricity has been called in, and the electrolytic treatment is now exciting considerable attention. It is possible that a wrong conception underlies these attempts. A perfect method seems hardly realizable. Different circumstances make each case individual, and exact individual treatment.

For small systems, the subsoil irrigation method has, up to the present, met with perhaps the greatest success. Under proper conditions, it is quite inoffensive, and can dispose of large quantities of fluid. Its general principle involves the sudden and periodical delivery of the more liquid portions of sewage over a large area of ground about eighteen inches beneath the surface. The liquid matter is disposed of in three ways. A part is absorbed by the roots of the vegetation covering the soil. This portion naturally varies in amount, and in summer is far greater than in winter. A second part evaporates, after penetrating the overlying soil. A third part sinks into the subsoil.

To make the system work well, a piece of ground not too depressed must be chosen, in order that this drainage of the third portion, as specified above, may be effectual. If the soil is saturated with natural moisture, it will not answer as a filter bed. In such a case, subsoil drainage pipes must be put in below the irrigation system. The water collected by the subsoil lines will be more or less purified by the downward filtration. It will be diluted by natural water so as to be less offensive, and in many cases it can be delivered to the natural overground water courses without perceptibly polluting them. If the stream or river ultimately receiving the outflow should be in some degree polluted, it will, sooner or later, become pure again from the effects of aeration. Simple contact of running water with the air tends to purify it from offensive matter. The more broken the course of the water, and the thinner the sheet in which it is exposed to the air, the more effectual will be its purification for a given distance or time.

All these principles and methods are utilized in the arrangement here illustrated. The Waring or subsoil irrigation disposal is the basis of the work. The system is represented as applied to providing a sewage works for a small village or community.

For the sewage farm and disposal works, a piece of ground should be chosen that is lower than any of the area included in the sewer or drainage system. The field or farm must vary in level; one portion must be at least five feet lower than the other, a greater difference being desirable. This is easily secured by having a reasonably large piece of ground devoted to the work. Some kind of surface drainage—a stream or river is best—should be obtainable near at hand.

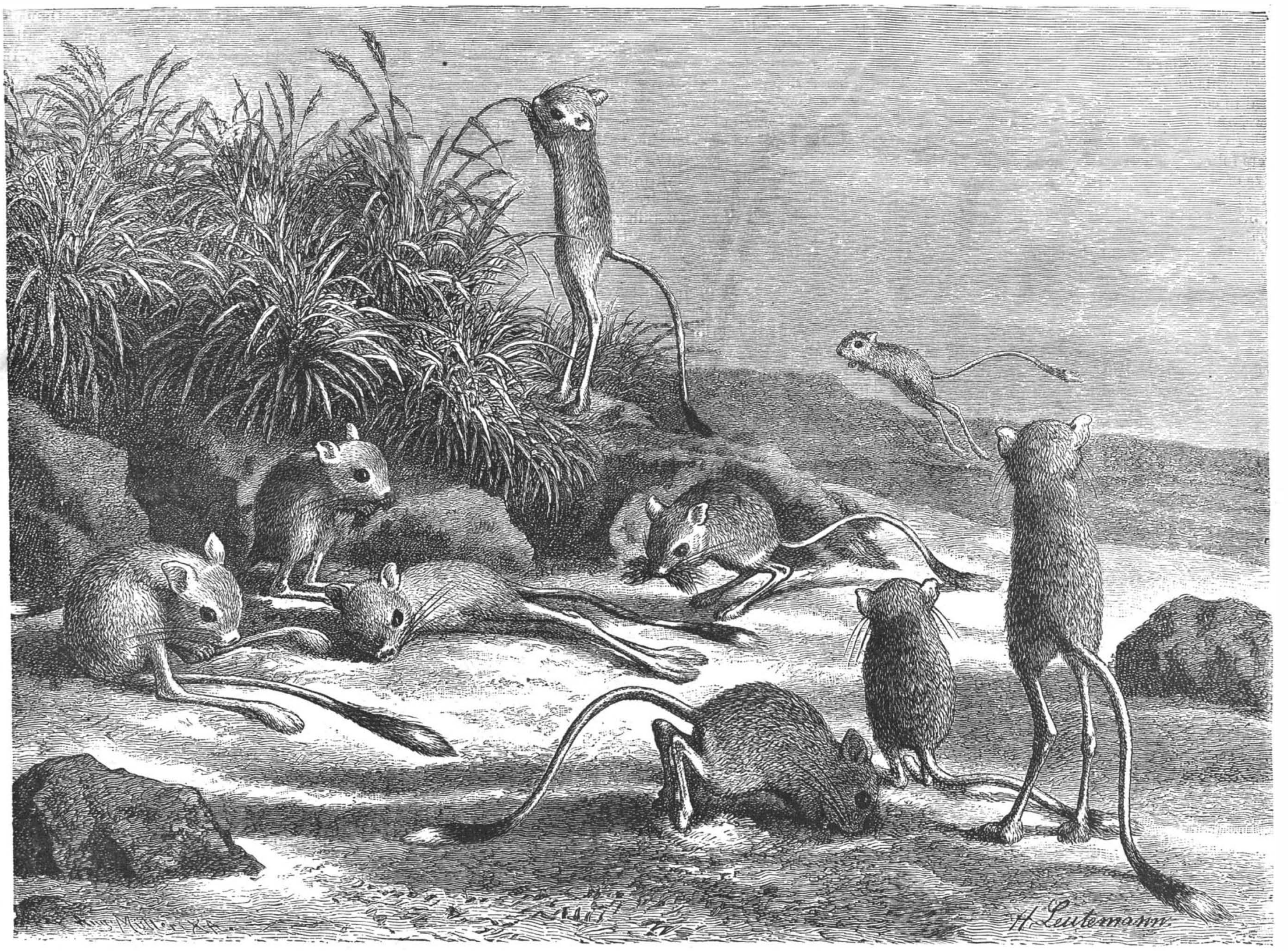
The sewage is received in a settling tank. In this receptacle it may be treated with chemicals, or it may receive them before entering. If in an isolated locality, the natural precipitation may suffice, the chamber containing the tank being properly ventilated. The principal object of chemicals would be to deodorize it. From the settling tank it overflows into the siphoning tank. From this it is periodically discharged by a siphon of any of the well known types. The liquid matter runs into the sub-surface perforated irrigation pipes, and is distributed through the soil.

Where a systematic sewage disposal is the whole function of the area, plants can be selected for cultivation upon the sewage bed that have the greatest power of assimilating water. Red clover is a good instance, as its roots penetrate very deeply. Perennial or hardy crops might exercise a good effect, even in winter. No attempt should be made to obtain a paying result. The disposal works should be treated as a subject of expense, not of profit.

Three to five or more feet under the sub-surface pipes, a set of regular subsoil drainage pipes are placed. These are represented in the illustration as crossing the others at right angles, though the relative disposition is really immaterial. At one or more places the higher ends of these pipes are connected to a high chimney. This maintains a continual aeration of the pipes and water flowing through them. If necessary, a fire may be maintained in the base of the chimney to increase the draught. The lower ends of the drain pipes deliver their flow to a conduit. These ends must be unobstructed and open, and in laying the lines care should be taken to preserve an even pitch of considerable degree, so as to prevent the possibility of the formation of traps. The air which the chimney will draw through the pipes will play an important part in purifying the drainage water.

The diluted and filtered and partly aerated sewage water collected in the conduit is conducted to a low level siphoning tank, which delivers it to a second irrigation bed. There it is subjected to a repetition of the treatment just described, including the three purifying elements of filtration, aeration, and dilution. The water finally delivered to the low level conduit will be comparatively innocuous. It will have been twice filtered, aerated, diluted, and acted on by vegetation and humus. Its purification will have progressed in something like a geometrical proportion.

It will be observed that the above description refers to the disposal of the liquid matter. The removal of solid matter is the simplest part of the problem, and can be effected in any of the well known ways. When the aqueous portions of sewage are disposed of, nine tenths of the problem is solved.



THE JERBOA—[DIPUS ÆGYPTIUS LICHTST.]

THE JERBOA.

In the diluvial strata of clay at Thiede, near Wolfenbuttel and Westeregeln in the peat district of Magdeburg, Nehring found many fossil remains of the jerboa among other rodents of the plain, and also, as comparison with modern skeletons proves, of a kind of jumping rabbit which is identical with the *Alactaga jaculus Brdt.*, still found in the steppes of southwest Siberia and Central Asia. This proves that in the so-called post-glacial period the North German plain, as far back as the mountains of Central Germany, presented the same general character as the steppes, and had a Continental climate; that is, a hotter summer and a colder winter than at the present time. But it is not probable that the coast of the European continent then had its present form, to which the North German plain owes its moist and mild climate. Europe, especially the western part, must then have been connected with the northern part of Africa, forming a compact continent. Later changes in the divisions of land and water were caused by upheavals and sinkings of the surface of the earth, the sea making a deep impression in the European-African continent. The result of this was a change of climate and, consequently, of vegetation, particularly in southern and western Europe. The steppes were changed into woods and swamps, and Germany assumed the characteristic features described to us by Cæsar and Tacitus. Under these circumstances the little rodents of the steppes could not exist, so they fled from the encroaching swamp back into the steppes of Eastern Europe and Asia, where they are still found.

The accompanying illustrations will give our readers an excellent idea of the habits of the jerboa, the roguish gnome of the desert; the manner in which they steal out of their holes at twilight, when the shadows are lengthening; their ways of cleaning themselves, of eating, resting, carrying building materials, of standing upright on their toes so as to nibble the tender tops of the grass, of supporting themselves by their long tails when sitting upright, of digging, etc. These excellent drawings were made by the well known animal painter L. Leutemann.

The coat of the jerboa is a grayish-yellow, a real sand color, on the back; the belly is white, and the two rows of hair on the end of the tail are first dark brown and then white.

The species shown in our cuts is the North African, desert jerboa (*Dipus aegyptius Lichtst.*), which is scattered over the northern part of Arabia, Egypt, and Tripoli, living gregariously in this dry, barren ground, which is covered with sharp reed grass. There they make their burrows, which are provided with many branches, and are used in common. They have their entrances, their burrows, and an escape, which extends nearly to the surface, so that they can break through in case their pursuers follow them into their holes, as the naja, also a native of this region, often does. Sometimes the lynx, or fox of the desert, surprises a jerboa far from its home, or the owl in its noiseless flight seizes one; but, as usual, man is its worst enemy. The Arabs hunt them for their flesh, catching them dead or alive in a simple manner: they break up their burrows with long poles. Many jerboas are kept in captivity, to which they soon accustom themselves. It is easy to make a nest for them. A common wooden box, the larger the better, of course, lined with sheet metal, filled a foot high with closely packed earth, and covered with wire netting, will answer perfectly. They are such neat little animals that they can be kept in a warm room without causing any annoyance. They will thrive if fed on grain, with some bread and carrots, and their funny, merry little ways at evening, the noiseless running back and forth, will richly reward the owner for the little trouble they cause.

We have taken the accompanying illustrations from "Die Natur," with the consent of the publisher.—*Illustrirte Zeitung.*

Proposed Ship Canal between Bristol and English Channels.

A scheme for connecting the Bristol and English Channels will be brought prominently before the public in the course of a few months. The route fixed upon by the engineers who have recently surveyed the district is from Stolford, in Bridgewater Bay, passing through the towns of Bridgewater, Langport, Ilminster, and Chard, to Seaton, on the English Channel. The total length of the canal will be about 45 miles, and, with the exception of the Chard range of hills, the work of excavating, etc., for the whole distance will be comparatively easy, no engineering difficulties presenting themselves. The Chard district is formed of lias, so that in excavating through the high ground an ample supply of lime will be obtained, which will be useful for the other portions of the work. The canal is intended to be in every way capable of admitting the largest mercantile steamers afloat, as well as the ships of war. From a national point of view, therefore, this new canal will be of immense importance, as our ironclads would be able to steam across from channel to channel in a couple of hours, instead of having, as at present, to go round the Land's End. The greatest benefit would also accrue to the trade of South Wales, for, when shipping to London and the Continent, by using this canal a distance of 300 miles would be saved, to say nothing of avoiding the great risks to which vessels are liable while sailing around this part of our coast.—*London Times.*

Trade Mark Infringement.

In the case of Keller *vs.* Goodrich Company, recently decided by the Supreme Court of Indiana, it appeared that the appellee had long been engaged in the manufacture of an article used in dentistry, and had printed on each box containing the same the trade mark "The Akron Dental Rubber." The appellant sold a similar article put up in boxes of a different shape and material from those used by the appellee. Upon these boxes it had printed the words "Non-Secret Dental Vulcanite, made according to our analysis of the Akron Dental Rubber." The words preceding "Akron Dental Rubber" were printed in black ink, but the words "Akron Dental Rubber" were printed in red ink, the type being large, so as to readily and quickly catch the eye. The court held that this constituted an infringement of the appellee's trade mark.

Weakness of Short Columns.

Cast iron pillars with flat ends uniformly bear about three times as much as those of the same dimensions with rounded ends, and this was found by experiment to apply to all pillars from 121 times the diameter down to 30 times. In flat-ended cast iron pillars shorter than this, there was observed to be a falling off in the strength, and the same was found to be the case in pillars of other materials, on which many experiments were made, to ascertain whether the results, as obtained from the cast iron pillars, were general. The cause of the shorter pillars falling off in strength was rendered very probable by the experiments upon wrought iron, for in that metal a pressure of from 10 to 12 tons per square inch produced a change in and reduced the length of short cylinders subjected to it; and about the same pressure per square inch of section, when required to break by flexure a wrought iron pillar with flat ends, produced a similar falling off in strength to that which was experienced when a weight per square inch not widely different from this was required to break a cast iron pillar with flat ends. The fact of cast iron pillars sustaining a marked diminution of their breaking strength by a weight nearly the same as that which produced incipient crushing in wrought iron, and a falling off in strength of wrought iron pillars, rendered it extremely probable that the same cause (incipient crushing or derangement of the parts) produced the same change on both these species of iron. The pressure which produced the change mentioned above in the breaking of cast iron pillars was about one-fourth of that which crushed the materials. I shall therefore assume here that one-fourth of the crushing weight is as great a pressure as these cast iron pillars could be loaded with, without their ultimate strength being decreased by incipient crushing, and that the length of such a pillar, if solid and with flat ends, would be about thirty times its diameter.—*E. Hodgkinson, in the Architect, London.*

18,000 or 20,000 H. P.

The great experiment of the past year has been the Inman and International Company's steamer City of New York. She was intended to make the run to New York in six days. The Etruria has crossed the Atlantic in six days and one hour, but this was an exceptional run, and the average performance of the Etruria is more like six and a half days. Consequently the City of New York must be somewhat faster than the Cunard boats. Up to the present she has failed to attain the expected speed, but she is an extremely fast ship, and it is worth notice that in stormy weather she has twice beaten the Etruria by some hours as a consequence of her great size. The City of New York has been taken off the line for the purpose of undergoing some modifications, which, it is expected, will bring up her speed to the required point.

Calculation shows that certainly not less than 18,000 indicated horse power will be needed to drive the ship at 20 knots an hour. It is possible that more will be needed, because of the way in which the hull has been put together with vertical butt straps outside. Taking, however, as a basis 18,000 horse power, we find that nine boilers have been provided to supply it. These boilers are double-ended, with six furnaces in each; the boilers are about 19 ft. long, and the grates 6 ft. 6 in.; the boilers stand fore and aft, in groups of three; there are in all 54 furnaces. The Etruria, to indicate 14,000 horse power, has 72 furnaces; but she has only compound engines, while the City of New York has triple expansion engines. The area of her grates is approximately 1,250 square feet to produce 18,000 horse power. Then each square foot of grate must represent nearly 15 horse power.

It is a very easy matter to talk of 18,000 or 20,000 horse power; but few people, we think, realize what it means. The following figures may help them to form a conception of what the much despised practical engineer has to do and does. It is more than probable that the White Star boats being built by Messrs. Harland & Woolf will develop 20,000 horse power. At least, so rumor says; for rightly or wrongly, it is asserted that they will have each 12 boilers and 72 furnaces, worked with forced draught on Howden's system. Assuming that the engines will require 18 pounds of steam per horse per hour, then 160 tons of feed water must be pumped into the boilers every hour, and 160 tons of steam will pass through the engines in the same time. In twenty-four hours the feed water will amount to 3,840 tons, occupying 138,240 cubic feet. A tank measuring 52 ft. on the side would hold one day's consumption, or it would fill a length of 493 ft. of a canal 40 ft. wide and 7 ft. deep. Taking the condensing water at thirty times the feed water, it will amount to 4,800 tons per hour—115,200 tons in twenty-four hours; or, for a six days' run across the Atlantic, to not less than 691,200 tons, or 24,883,000 cubic feet. This would fill a cubical tank 295 ft. on the side—a tank into which the biggest church in London, steeple and all, could be put and covered up. The coal consumed will be 400 tons per day, which would fill forty wagons. This will require for its combustion 8,600 tons of air, occupying a space of 222,336,000 cubic feet. It is impossible for the mind to take in the significance of these latter figures. It may help if we say that if this air was supplied to the ship through a pipe 20 ft. in diameter, the air would traverse that pipe at the rate of about 5·6 miles per hour. It will be seen that the circulating pumps and fan engines of such a ship have no sinecure.—*The Engineer.*

The Planning of Foliage.*

There are certain natural principles and forms running through both leaves and flowers; they follow a regular geometrical distribution of parts, and the form of leaf or flower follows naturally from the principle—or, if I may so say, from the anatomy—upon which it is set out. Thus flowers radiate in threes, as the lily; leaves grow in threes from the same point in the stem, and are in perfect harmony with the flower, as the anemone; leaves divide in threes, as in the water avens, clover, and wood sorrel; doubly triple, as in the columbine; and further carried on to the greatest intricacy, as we see in the parsley. Flowers again are cruciform, as in the wallflower; leaves also grow with the same arrangement, as we see in the lilac and the maple. It should be noticed, too, that that arrangement of the leaves in pairs (called "opposite leaved") extends through the whole anatomy of the plant or tree—the leaf buds being formed at the base of the leaves, they also are in pairs; the leaf buds become branches, all of which are arranged to grow in an opposite manner, the same as the leaves.

But there are many accidental circumstances (such as the leaf bud being destroyed by insects) which, in the case of branches, prevent the opposite principle from being too strictly carried out, which, if it were, would give the tree too stiff and formal an appearance. So also in alternate-leaved plants or trees it follows through the whole system, and all the branches are alternate. But to pass on from what I have called the cruciform arrangement. We next come to flowers which are divided into five petals, or set out on the pentagonal principle, and this division is again seen in the leaves. They are first divided into five lobes, with a semi-radiation, simply cut out as in the ivy, divided with deep eyes as in the vine, which we again see in the flower of the hollyhock. The lobes again subdivided, as in the maple and bryony, or separated into distinct leaflets, as in the Virginian creeper, and running again into intricacy in the field geranium and other plants. Then we have the seven lobes in the hollyhock, seven leaflets in the horse chestnut, eight petals in the coreopsis, ten divisions as in the campanula and stellaria, until we arrive at multiplicity in radiation, as we see in the daisy and sunflower and in the leaf of the lupin. Further, we see leaves and flowers take leave of radiation altogether.

Flowers run into a vast variety of forms (far too numerous for me to attempt to go into), such as the pea and bean tribe, and many others. Leaves branch in pairs from a central leaf stalk, as in the elder and rose leaf, which is carried further in the acacia and ash, and is again subdivided and carried into the greatest intricacy in the ferns. In the leaflets of the acacia we see also the heart-shape form which we observed in the petals of the strawberry and the primrose; also again in the violet leaf, but formed the contrary way.

All these facts show that there are certain natural laws, by studying which the artist can produce what form of leaf or flower may best suit his purpose, upon perfectly natural principles, but without following any one leaf or flower in particular, thus giving him such a vast field to work in that there need be no limit to genius or invention.

A Plague of Tigers in Java.

According to the administration report of Java recently laid before the Dutch Chambers, portions of that island are being depopulated through tigers. In 1882, the population of a village in the southwest of the Bantam province was removed and transferred to an island off the coast in consequence of the trouble caused to the people by tigers. These animals have now become an intolerable pest in parts of the same province. The total population is about 600,000, and in 1887, 61 were killed by tigers, and in consequence of the dread existing among the people, it has been proposed to deport the inhabitants of the villages most threatened to other parts of the country where tigers are not so common, and where they can pursue their agricultural occupations with a greater degree of safety. At present they fear to go anywhere near the borders of the forest. The people at present seem disinclined, or they lack the means and courage, to attack and destroy their enemy, although considerable rewards are offered by government for the destruction of beasts of prey. In 1888 the reward for killing a royal tiger was raised to 200 florins. It appears also that the immunity of the tiger is in part due to superstition, for it is considered wrong to kill one unless he attacks first or otherwise does injury. Moreover, guns were always very rare in this particular district, and, since a rising a few years ago, have been taken away by the authorities altogether.

* J. K. Colling, in the *Architect*, London.

SIMPLE EXPERIMENTS IN PHYSICS.

BY GEO. M. HOPKINS.

The experiment illustrated in Fig. 1 shows the great elasticity of certain solid bodies, and the almost total want of elasticity in other solid bodies. This experiment is introduced here mainly on account of its adaptability to projection with a lantern. A thick plate of glass, a small slab of marble, or better a bar of tempered steel, is supported so that its upper surface appears in the field of the lantern. A small glass ball, or a ⅜ or ½ inch hardened, ground, and polished steel ball, such as is made by the Simonds Manufacturing Company for ball bearings, is dropped upon the glass or steel from a measured height within the field of the lantern. The impact compresses the ball and the plate. At the instant following the stopping of the ball, the ball and the plate, by their own elasticity, return to their normal condition, and the force stored by the impact is given out instantaneously, forcing the ball back toward the point of starting. If undisturbed, the ball will fall and rebound again and again, losing a little of its force each time until it finally comes to rest.

By substituting a lead plate for the glass or steel plate, or by substituting a lead ball for the glass or steel one, it is found that the force acquired by the ball in its descent is expended mainly in changing the form of the plate or ball, and that as the inelastic nature of the material prevents it regaining its former shape, there can be no rebound, as in the other case.

The property of elasticity is also shown by the collision balls illustrated in Fig. 2. This well known ex-

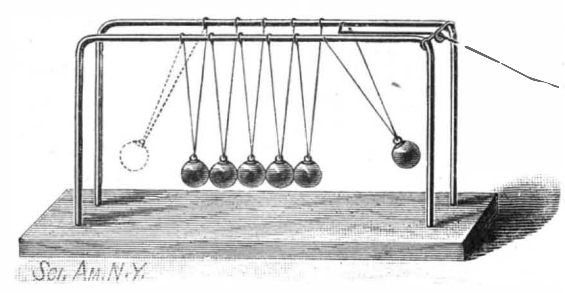


Fig. 2.–COLLISION BALLS.

periment is adapted to the lantern and shows well on the screen. Six of the steel balls already referred to or six small glass balls or marbles are required. Each ball is provided with a small metallic eye, which is attached by means of cement or fusible metal used as a solder. Five of the balls are suspended from the two wire supports by fine silk threads, so that they all hang in line and touch each other very lightly. The sixth ball is suspended by a wire, which is bent down between the supports to receive a thread which extends through an eye attached to the supports and serves to draw back the sixth ball. The thread by which the ball is moved is not noticeable, as it is partly or wholly concealed by the supports. By drawing back this ball in the manner indicated, and then allowing it to fall, its impact will slightly flatten the ball with which it comes into contact, and each ball in turn transmits its momentum to the next, and so on through the entire series. The last of the series is thrown out as indicated in dotted lines, and upon its return its impact produces the same result as that already described, but the effects are in a reverse order.

In Fig. 3 is shown a method of forming magnetic curves for projection, in which the iron particles slowly arrange themselves under the influence of the magnet,

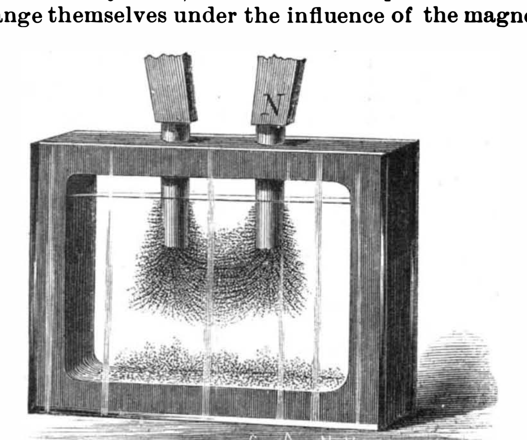


Fig. 3.–MAGNETIC FIELD.

giving the appearance of crystallization. In a closed cell is placed a quantity of glycerine, into which is introduced a quantity of fine iron filings. In the top of the cell are inserted two soft iron pole pieces, arranged to receive the poles of a permanent magnet. The glycerine is thoroughly agitated, so as to distribute the filings as evenly as possible throughout the cell. The cell is then placed in the lantern, and the magnet applied to the pole pieces. The iron particles will be drawn slowly toward the pole pieces, arranging themselves in symmetric curves.

In Fig. 4 is shown apparatus for the projection of the static discharge. It consists of a stand having two vulcanite columns, in the upper ends of which are inserted adjustable brass rods, provided with brass balls at opposite ends. The adjacent balls are adjusted to the striking distance and focused on the screen. The light for projection should be only strong enough to show an image of the balls. When the conductors of a static machine or induction coil are connected with the brass rods, the path of the spark will appear as a brilliant white line on the screen. The discharge of a Leyden jar is still more brilliant.

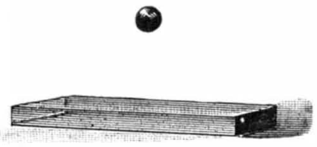


Fig. 1.–ELASTICITY OF SOLID BODIES.

The apparatus shown in Fig. 5 is designed to show upon the screen the experiment known as the electric fountain. A small glass vessel provided with a capillary tubulure at the bottom is supported above a tumbler. The vessel is filled with water and the capillary aperture allows the water to drop slowly when acted upon by gravity only, but when the water is electrified by connection with a static machine or induction coil, it issues in a fine stream, the change in the character of the discharge being caused by the mutual repulsion of the particles of water.

In all these experiments an erecting prism is required.

Changes in the English Patent Law.

The total number of applications for patents in England was larger in the year just completed than ever before, being 19,070, as compared with 18,051 in 1887, or more than three times as numerous as in any year before the passing of the patent act in 1883. That this upward tendency indicates a real amount of industrial progress it would be impossible to deny, though there is, combined with the rise in numbers, a slight fall in the average value of the inventions, as indicated by the smaller proportion which pass beyond the earliest stage. Very little more than half the applications become completed patents, and the percentage has been gradually though slowly declining as the total numbers have increased. Judging from the experience of the previous law, not a quarter of these completed patents will outlast the first period of four years. Under the old system about 30 per cent were not completed, and of those that were completed about 70 per cent dropped at the end of the first stage (then three years).

The principal event during the past year of importance to patentees has been the passing of the patents, designs, and trade marks act, 1888. This is an amending act on the principal act of 1883, and is the result of the recommendations of the Board of Trade Committee on the Patent Office, which, after sitting for two years, reported in January, 1888. This act, which has just been printed, and came into force with the year, establishes for the first time a register of patent agents. The rules by which the practice of patent agents will in future be regulated are to be made and issued by the Board of Trade, the act only providing that from next July no unregistered person shall be allowed to describe himself as a patent agent. The proposal, when it was before the House, met with a certain amount of criticism from the technical papers, but was accepted.

Another provision of importance is the abolition of what are known as "notices of interference." It has hitherto (since the passing of the 1883 act) been the practice for the office to send notice to an applicant of any subsequent application received at the office which appeared to interfere with his, in order to give him an opportunity of opposing the granting of a patent. This provision has never worked satisfactorily, the officials not having been able to make up their minds as to what constituted a "similar invention," and has therefore probably been of little practical value to patentees. The idea of informing inventors that others were on the same track was an excellent one, and the exercise of a little judgment on the part of the officials would have made it useful, and enabled it to have been carried out to the great benefit of the public. As, however, they were incapable of turning the rule to the advantage of inventors, it was perhaps as well that it should be dropped.

The remainder of the act refers principally to designs and trade marks. There is a new definition of a trade mark which does not appear much easier to construe than the old, and there are other modifications of procedure, the result of experience in the working of the act of 1883.—*London Times.*

Coasting without Snow.

Many of the streets of Astoria, Oregon, are as precipitous as those of our rugged New England towns, and furnish ample grades for the prosecution of that old pastime, sliding down hill.

Snow seldom if ever falls, but the climate is so moist that, at the freezing point, nights and mornings, a thick coat of white frost covers the planked roadways, which are turned into extempore toboggan slides. The amusement is so enjoyable that it is kept up into the small hours of the morning by old and young, the speed attained frequently exceeding that of the ordinary railway train.

The Compressibility of Sea Water.

An important contribution was made to the discussion of the subject of the compressibility of sea water, at a recent meeting of the Royal Society of Edinburgh, by Professor Tait, a scientist, says *Engineering*, well entitled to speak on the question by virtue of his experiments to ascertain the effects of the sea pressure on the Challenger deep-sea thermometers. The address, which was given at the request of the council, dealt with the historical as well as experimental phase of the subject. Until about ten years ago little that was positive and complete was known of the properties of water as regards compressibility. Lord Bacon and others had in vain attempted to compress water, but in this case the water was in a metal shell, completely filled, sealed, and exposed to blows with a hammer. Professor Tait said he encountered difficulties in his experiments, and the principal of these was that water got heated by compression much more rapidly when vulcanite was immersed in it than when there was no vulcanite. By means of a galvanometer he showed to what extent the heating was observable. In trying to overcome the difficulty he ascertained the remarkable fact that the heat evolved increased in a greater proportion than the pressure. This, then, established the fact that water is more expansible when the pressure is greater. A practical test with the thermometer at a depth of a mile and a half of sea confirms this fact. Difference in the results attained from those got in the laboratory was due to the differences in the temperatures in which the tests were made. He had therefore confirmed the contentions of Perkins in 1823 that the more water was compressed, the less compressible it

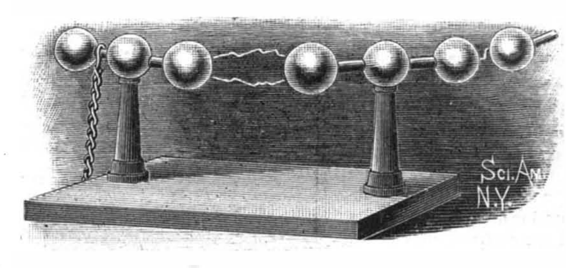


Fig. 4.–PROJECTION OF ELECTRIC SPARK.

became. He also showed theoretically that by the application of infinite pressure water would be compressed to about three-quarters of its natural bulk, but no further. The compressibility of sea water was 0·92 of that of fresh water. The maximum density point of water went down three degrees for every additional ton of pressure applied. Regarding the effect of pressure on the ocean, Canton, 120 years ago, showed that in a depth of two miles of sea the increasing compression of water under the above condition would be diminished by 69 ft.—a statement which Professor Tait had verified. In a depth of six miles the decrease in depth would be 620 ft. If the water of the ocean were to suddenly cease being compressible, the result would be that 4 per cent of the habitable land on the globe would be submerged, because the mean depth of water would be raised by 116 ft.

Henderson Steel.

The experiment of making steel from the pig iron of Alabama at a very reasonable cost has at last been practically solved by the Henderson process. To test the process, during the spring of 1888 a company erected a small furnace, lining it with the best ordinary fire-brick. The result of the iron made was, first, that steel of the finest quality as well as soft steel could be made, but the test demonstrated also that the fire-brick used could not withstand the heat. The company was not discouraged, but doubled its capital to $40,000. With this it imported magnesia brick from Germany, and made a furnace of about 14 tons capacity a day. This new furnace was put into blast on November 26, 1888, and has since been running continuously and without any injury to the magnesia brick. The cost of making the finest steel by this process and by this company, limited as its plant is, will not exceed $22 per ton. Heretofore steel could not be made out of the low grade iron of the Birmingham and St. Louis districts by any process known which did not cost too much; but it looks now as if there would be a great revolution in Southern iron, and also in the steel business of Pennsylvania, as its iron will have energetic competition from Alabama. There is ore and coal enough, however, in the latter State to absorb all the Pennsylvania manufactories which desire to change their base of operation.

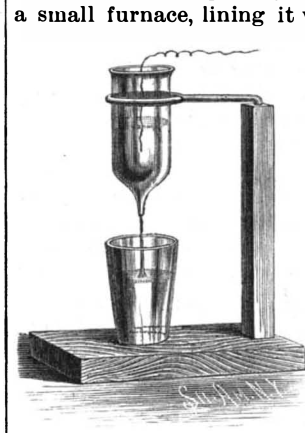


Fig. 5.
ELECTRICAL REPULSION.

RECENTLY PATENTED INVENTIONS.

Engineering.

ELECTRIC STOP VALVE. — Robert Wellens, Pittsburg, Pa. This is an oscillating valve, whose stem has a weighted arm to drop and close the valve, with a catch and electro-magnets for operating it, the magnets being in the circuit of a battery whose wires extend throughout the building, with push buttons for closing contact and operating the valve.

Mechanical.

SEWING MACHINE SHUTTLE.—Charles H. Benoit, San Jose, Cal. The shuttle is enlarged at special points to receive a large bobbin and a large quantity of thread, and is of a form to pass readily through the loop, while in connection therewith a novel form of tension spring is employed.

HOISTING MACHINE.—Volney W. Mason, Providence, R. I. The hoisting drum is mounted upon eccentrics, which are operated by a lever to throw the drum alternately in and out of contact with the driving pulley and the brake shoe, the invention covering novel parts, details, and combinations, making a simple and durable machine designed to be very effective in operation.

STONE SAWING.—Ludwig Melchior and Friedrich Meyer, Wilmington, Del. This invention covers an attachment with cross bar, guides, and clamps of novel form, for machines in which a gang of saws is secured in a reciprocating frame, whereby the saws will be braced and may be operated rapidly and under considerable weight, while causing the saws to make a cleaner cut.

RASP CUTTING MACHINE.—Philip S. Stokes, Tennent, N. J. In this machine springs and cams operate upon two hammers, one preceding the other, in combination with a punch stock and punch held in the anvil frame and pivoted at or about its center, one of the hammers delivering a light blow preceding the heavy blow of the other, whereby the point of each tooth is made perfect and sharp, the invention also covering various other novel details.

LACING DRIVING BELTS. — Geo. W. Southwick, Stamford, Conn. This invention covers an eyelet or re-enforce for the lace holes, consisting of a flat U-shaped metal piece, with prongs formed on its two branches to penetrate the leather back of the eyelet, and a flange on the inner side of the bend, to form a flat bearing at one side of the eyelet hole, to prevent the lacing cord from pulling out the leather.

PRINTERS' GALLEY. — J. Hatfield Youmans, Asbury Park, N. J. This galley has a movable bar or stick therein, in combination with disks or plates pivoted eccentrically to the frame, and with curved slots and pins, whereby the bar or stick will be automatically locked against a standard measurement of type, the device being adaptable by thumb screws for different measurements.

Railway Appliances.

RAIL JOINT. — Ives and Walter T. Lynd, Troy, N. Y. A key plate is constructed to lie lengthwise between the abutting ends of a pair of rails held in a bed plate and an inclined flange of the bed plate, the key plate being wedge-shaped laterally and vertically, whereby the rails may be tightly clamped and held in their bed plate by a lateral and downward pressure of the key plate.

COUPLER ATTACHMENT.—William L. Dwyre, Albany, N. Y. This is a simple device for attachment to the ordinary pin and link car coupler, by which it can be easily set for coupling and uncoupling without the operator going between the cars, and by which it will then couple automatically, the invention covering various novel features of construction and combinations of parts.

Agricultural.

COTTON PICKER.—James W. Wallis, Birmingham, Ala. This machine is an improvement in that class of cotton harvesters in which the pickers or devices for removing the cotton from the bolls have a reciprocating movement, whereby they are caused to swing into and out of the cotton plants, the invention covering various novel features and combinations of parts.

Miscellaneous.

DISINTEGRATING FIBERS.—Sidney S. Boyce, New York City. This invention covers a process of disintegrating fibrous substances, to separate the natural fiber of the straw from gummy and resinous matters, etc., the straw being first broken and subjected to a boiling neutral soapy solution, after which the fibers are dried, rolled, and finished.

BEE HIVE. — Jonathan Beeson and John H. Hirschfeld, Saline City, Ind. This hive is made with a comb chamber having a hopper shaped bottom, formed of inclined boards having a space between them, below which is a section with sirup trough from which the bees may feed, and a reversible section with screen doors for closing the chambers formed by the bottoms, so that rain or snow cannot beat into the hive.

STOPPER FASTENER. — Charles P. Maiser, Allegheny, Pa. This fastener is also designed to serve as a guard to protect the upper edge of a bottle or jar to which it is applied, and consists of a wire bail with eyes or loops, and a cross bar to protect one side of the bottle neck, while a lever, in connection with the stopper and eyes and loops, protects the opposite side.

BOOK SHELF. — John M. D. France, St. Joseph, Mo. This invention covers a casing with metallic horizontal mortises therein, in combination with a sliding board having metallic tongs on its ends, whereby the board will slide in the casing, making an improved shelf for the protection of record books.

TOOTH BRUSH.—William H. Smith, Florence, Mass. This brush is made with a hollow handle, in two parts hinged together and adapted to receive the brush, which is pivoted in one half the handle, whereby the brush may be inclosed when not in use and rendered readily portable.

VEHICLE WHEEL.—Horatio F. Hicks, Ashland, Oregon. Combined with the hub and rim of the wheel are two sections of curved spring spokes, the curves of the two series being oppositely arranged with respect to each other, whereby the spokes will have elasticity enough to yield when the wheel passes over a rough, uneven road.

SLEIGH BRAKE.—William R. Wilcox, Portland, Col. This is a brake which may be put on or taken off by throwing the shaft lever either forward or back with the foot or hand, while it is light and durable, and designed to yield to any obstruction encountered, but yet return to its gripping position, without communicating strain or shock to the operator.

TRICYCLE.—Francis W. Pool, Norwich, Conn. This vehicle has a right and left hand spirally grooved axle, at right angles to which is a rock shaft, while a sleeve loosely holding rings travels upon the axle, the rings having lugs entering the grooves, and a link connects the rock shaft and sleeve, whereby it is designed that the machine may be propelled at a high speed with but little exertion.

NAPHTHALINE PAPER. — Adolph Tsheppe, New York City. This is a paper having a coating of naphthaline in two or more superposed layers, the first presenting a rough appearance, while the second fills up the interstices, presenting a hard, compact, smooth surface, made by immersing paper in melted naphthaline of different temperatures.

FIBER FROM PINE NEEDLES. — William Latimer, Wilmington, N. C. The process of making the fiber is by first briefly boiling in an alkaline solution, then lowering the temperature and slowly digesting the mass for a number of hours, after which the solution is drawn off and the mass washed with pure water by successive steepings and soakings.

Business and Personal.

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

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(368) T. H. T. writes: Two years ago I had a present of a very fine cane with a buck-horn handle. From constant use, the white part of the handle became dirty, and after trying several methods to clean it, scraped it with a knife, which of course made it look worse than ever in a few weeks. A. A very perfect surface is given by scraping; the scraper may be of a razor blade, the edge of which should be rubbed upon an oil stone, holding the blade nearly upright, so as to form an edge like that of a currier's knife, and which, like it, may be sharpened by burnishing. Work, when properly scraped, is prepared for polishing. To effect this, it is first to be rubbed with a buff made of woolen cloth *perfectly free from grease;* the cloth may be fixed upon a stick, to be used by hand; but what the workmen call a *bob,* which is a wheel running in the lathe, and covered with the cloth, is much to be preferred, on account of the rapidity of the operation. The buff is to be covered either with powdered charcoal and water, or fine brick dust and water; after the work has been made as smooth as possible with this, it is followed by another buff, or *bob,* on which washed chalk or dry whiting is rubbed; the article to be polished is moistened slightly with vinegar, and the buff and whiting will produce a fine gloss, which may be completed by rubbing it with the palm of the hand and a small portion of dry whiting or rotten stone.

(369) P. H. W. asks: If the compact battery described in SCIENTIFIC AMERICAN of September 3, 1881, would be suitable for the simple electric motor, and if so, please designate the number of couples or cells that would be required? A. Yes. Use ten to twenty cells.

(370) J. C. W. asks: What kind, size, and amount of wire should I use in making electro-magnets? A. We refer you for a very full article on electro-magnets to SCIENTIFIC AMERICAN SUPPLEMENT, No. 182. The size and amount of wire depends on your requirements.

(371) D. & H. ask if it would injure a watch in any way to ride on an electric motor street car? A. It may injure it, but probably will not.

(372) G. B. writes: The fishermen of this city are discussing the question, "Does water form ice on the top or on the bottom?" and cannot agree. A. Ice forms on the surface of water. Fine crystals may form and be carried down by currents and eddies, so as to become packed together into a solid mass at or near the bottom, but water forms ice on the top.

(373) W. W. V. writes: 1. In making an electro motor like the one described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641, but only one-half the dimensions, what size wire should I use on armature and field, when the motor is to be run by gravity battery? A. Use wire three or four numbers smaller than specified for regular size. 2. How many cells of 5 × 7 crow-foot battery will be needed, and how coupled? A. The gravity battery is entirely unsuited for such work, owing to its high resistance. You will find suitable batteries described in the SCIENTIFIC AMERICAN of September 3, 1881; August 20 and December 17, 1887; and a good method of making carbon plates, issue of October 27, 1888. Use six or eight cells of large bichromate battery, or thirty of gravity arranged in five series. 3. Could soft iron wire be used for field magnets instead of sheet iron? A. Yes. 4. Does a person making a patented article for his own use infringe on the patent? And is he liable to prosecution? A. You have no right to do this, and will infringe, and be liable to prosecution if you do. 5. Would ordinary glass fruit jars do to make Leyden jars out of? A. It is doubtful, as some cheap glass is a very poor dielectric. You can determine its quality by testing it roughly for insulation.

(374) "Gold" writes: 1. I tried etching on 14 carat gold, which was rolled on silver, using muriatic acid two parts, nitric one part, and three parts of water. It etched a very little, and then a black skin seemed to spread over the unprotected gold, and it would not etch any farther. Could you explain it? A. The acid dissolved the gold, but refused to dissolve the silver, as the latter metal forms an insoluble chloride in the presence of muriatic acid, or refuses to dissolve at all. After the mixed acids act no longer, wash the metal and treat with nitric acid, when the silver will be dissolved. The acid will probably under-cut the gold. You cannot dissolve gold and silver by the same acid. Cyanide of potassium, especially if assisted by the battery, might answer your purpose. 2. Do you know of any book which treats of the action of different acids and chemicals on metals? A. Manuals of chemistry contain this information scattered through them. We can supply any you desire.

(375) F. W. asks: 1. How can indelible ink be removed from linen? A. Chloride of mercury is the best eradicator of indelible ink. 2. What size wire to wind fields and armature with, of the small dynamo described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161, so it can be run as a motor from an Edison incandescent circuit, 110 volts; want to run from an Edison lamp socket. A. For motor see SUPPLEMENT, No. 641, which we can send you for 10 cents. Place in shunt; do not attempt to use a full Edison current on it. 3. Would the above motor run a sewing machine? A. The simple motor would run a sewing machine.

(376) A. B. M. writes: Will you inform me of the ingredients used, and how applied to canvas, as prepared by manufacturers for artist's use? A. Size it first with thin glue size, then apply moderately thick white lead paint with a palette knife and allow to dry.

(377) J. P. M. asks for a conductor for an electric current that will stand in cyanide of potassium; he often has articles to spot gild, and has been unable to find anything that would resist corrosion. A. We recommend lead wire; this will be little affected by a true cyanide solution.

(378) C. E. E. says: Will you please tell me what the liquid is that is used with bronze powder? A. Try ½ lb. linseed oil, mixed with 2 oz. gum animi, the latter powdered and gradually added to the heated oil; then boil, strain, and dilute with turpentine.

(379) T. L. C. writes: Please tell us the precise time from new moon to new moon, or is there any regular time? Comstock's Philosophy says 29 days 12 hours and 44 minutes, but almanacs differ as much as three hours. A. The mean solar revolution of the moon is 29 days 12 hours and 44 minutes. The ellipticity of its orbit makes a variation of nearly one hour. The time of new moon also varies with the geographical distances in longitude from the meridian at the moment of the new moon. For instance, if new moon should take place at the meridian of Washington at noon, all places west would have morning time, and all places east would have afternoon time, according to their difference of longitude, allowing one hour for each 15 degrees; to which a correction must be made for the moon's orbital variation.

(380) L. F. L. asks: 1. How to filter wintergreen, cedar, and like essential oils to effectually cleanse them? And how to reclean the filter without a waste of oil? A. You may use any filtering material, such as cotton wool, and wash it out afterward with benzine. You will inevitably lose some of the oil, unless it is a non-volatile oil, when it can be recovered. If volatile, you may save most of it by forcing steam through the filter. 2. Is there such an oil as laurel oil? If so, is it an expensive oil? And what is it used for?

A. There are several laurel oils; one is made by distilling with water the berries of the sweet laurel (*Laurus nobilis*); the product is often called bay oil, and is used for making toilet preparations. It is expensive. The specimen you speak of did not reach us with your letter. 3. What effectual means can I use to cleanse a flue which cannot be reached by a sweeper? Have always burnt wood. A. Explode a small amount of gunpowder at the bottom, and if there is danger of the chimney catching fire, burn a little sulphur held well within it.

(381) A. K. asks how to make the modeling wax that is used by artists. A. Melt carefully 100 parts yellow wax, add 13 parts Venetian turpentine, 6¼ parts lard, and 72⅛ parts elutriated bole or other inert powder; mix thoroughly, pour off, and knead as it cools. The wax must be melted at a low temperature.

(382) W. C. B. writes: Please inform me how to find the exact focus of my camera lens. The focus of a camera lens and the distance from that lens to the object to be photographed being known, is there any rule by which I can tell what distance the negative plate should be from the lens, thereby substituting instrumental focusing for visual focusing? A. The focus of a camera lens depends upon the distance of the object from the camera, there being an exact focus for every given distance. If the camera has a solid box or a fixed position for the plate, the focus can be adjusted for varying distances and marked upon the slide. This would be reliable for the distance, but would not take in the variation for effect with various kinds of objects, as between landscapes and portraits or other objects. In portraiture there is a little variation required for different faces that the eye only can appreciate. We do not think that index focusing will give the best results, except for copying, by which the focus and distance of the object become exact exponents.

(383) F. D. P. writes: I inclose herewith a problem for your correspondence column. It was given by a man at our school and there was quite a diversity of opinion in regard to it. A solution from you will greatly oblige. I would also like a little information on another matter which I also inclose. Have been greatly entertained by some of the questions in your paper. 1. A tank 10 feet inside diameter, 232 feet high, made of 4 inch staves, is hooped with 6 inch iron hoops 12 inches apart. What is the pressure per square inch on third hoop from bottom, allowing 2·03 feet to equal one pound? A. The pressure against the sides of the tank at the third hoop is equal to 230 feet hydrostatic pressure, or 100 pounds per square inch. To get the pressure or strain on the third hoop, multiply the pressure by one-half the diameter in inches, which we make 6,000 pounds for one inch height. Now, as you say that the hoops are 1 foot apart and 6 inches wide, this makes 18 inches in height between the centers of the spaces for each hoop to hold—6,000×18=108,000 pounds strain upon the hoop. Now if the hoops are half an inch thick, there will be but three square inches of metal, and as iron hoops should not be trusted for more than 20,000 to the square inch in any case, you have 3×20,000=60,000 pounds safe resistance against 108,000 pounds strain. Such a tank could not be filled with safety. 2. What metal possesses the quality of expanding and contracting in the greatest degree with temperature from 40° to 80° Fah.? A. Zinc has the greatest range of expansion and contraction of the solid metals, being eight-tenths of an inch in 100 feet for a difference of 40° Fah. 3. How much does an iron rod ½ inch by ¼ inch, 2 feet long, expand in length for a change of temperature from 40° to 80° Fah.? A. For the iron rod 2 feet long, the change of length would be equal to 64 ten thousandths of an inch for a change of temperature of 40° Fah.

(384) W. L. S. writes: Please state through the columns of your paper. 1. The cause of shooting stars and velocity of same. A. You will find complete illustrated articles on meteors or shooting stars—history, theory, speed, and distances, as far as known—in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 532 and 667. 2. The simplest way of boring a hole in glass, excluding the use of a drill? A. The simplest and safest way to bore holes in glass is to use a copper or brass tube, quite thin, of the size of the hole. Bore a hole in a small block of wood about ¼ inch thick. Hole to fit the tube loosely. Fasten the block to the glass with beeswax, so that the hole corresponds with the required hole in the glass. Insert the tube in the hole and pour emery (No. 90) and water into the tube with a spoon and turn the tube back and forth with the fingers, or a little grooved pulley may be put on the tube to work with a string, in which case a center should be placed at upper end to guide the tube. In this way a hole of any size from ⅛ inch to an inch or more may be cut through ordinary window glass in a few minutes.

(385) J. B., Fire Department, writes: Will you please answer the following: What should be the size of the steam ports for whistles with cylinders 9 inches by 18 inches, 6 inches by 18 inches, 6 inches by 24 inches, pressure 60 to 80 pounds? Must ports be increased according to size of cylinder? What distance should cylinder be from port to give a deep vibrating tone? Should port be exactly the same diameter as the inside of cylinder? Are whistles sounded any other way than a circular groove or port? If so, which gives best results for fire alarm? A. The opening in the ports of steam whistles of cylindrical form or bell for the sizes above should be one thirty-second of an inch for the 6 inch cylinders and a sixty-fourth of an inch wider for a 9 inch whistle, for the above pressure. As a general rule, the ports should increase in width with the diameter of the cylinder and be made of the same diameter as inside of cylinder or bell. The thickness and length of the bell controls the tone and the distance of the edge of the bell from the ports generally fixes the volume of tone. The distance of the rim from the ports is adjustable, and may vary from 1¼ to 2½ inches in large whistles, and is the only adjustment in the hands of the engineer for bringing out the full volume to meet variable pressures of steam and any imperfection of the workmen in sizing the ports. The cylindrical whistles with annular ports are the most powerful and compact, and are in general use.

(386) G. F. M. writes: Please inform us, through your valuable paper, the most economical lacquer for chandelier work. What is the best mixture to apply to the ends of metal spinners' wooden chucks to keep them for cracking? A. Lacquers are generally made with shellac and alcohol, with a little gum coloring from dragon's blood or turmeric. See "Techno-Chemical Receipt Book," which has a variety of receipts or processes for lacquering, varnishing, and bronzing of metals. We can mail it for the price, $2.00. Chucks for spinning should be thoroughly seasoned before use. Dipping in hot linseed oil and drying in a warm oven after the chuck has been shaped may answer your purpose.

(387) E. J. S. asks (1) for the component parts of the Disque Leclanche battery. A. The porous cup contains a carbon prism embedded in clear graphite and binoxide of manganese mixed in about equal parts. The outer cell contains an unamalgamated zinc rod. Sal-ammoniac dissolved in water is the exciting fluid. 2. How to make a battery of uncoppered electric light carbons, using sal-ammoniac for the exciting fluid? A. See SCIENTIFIC AMERICAN, December 17, 1887, and October 27, 1888. 3. How to make an electric gas lighting coil for two or three burners? A. Wind 5 pounds No. 18 wire on a bundle of iron wires, the bundle to be 6 inches long and 1 inch thick. 4. What kind of battery is best to use in connection with it? A. A Leclanche battery is excellent or the battery shown in first named SCIENTIFIC AMERICAN, using only one zinc rod, and using sal-ammoniac and water as the solution.

(388) P. W. W. asks for the ingredients used in the making of British gum. A. British gum or dextrine is prepared by the artificial roasting of dry starch at a temperature between 413° and 482° Fah. It is also made by an acid process, in which the dry starch is moistened with dilute nitric or hydrochloric acid and heated to a temperature between 212° and 248° Fah., and may also be made direct from potatoes. For the illustrated details of its manufacture see Spons' "Encyclopedia of the Industrial Arts."

(389) E. F. L. writes: Please give a simple and practical way to purify resin and precipitate its impurities. A. Melt and allow to settle, and if necessary, strain through sacking.

(390) P. L. M. writes: I am in search of a recipe to make what is called "compressed Chinese sheet bluing." It is a very nice article of bluing, that is sold to families by agents in small sheets of about the size of playing cards. A. The preparation may be paper saturated with a strong solution of Prussian blue in water containing ferrocyanide of potassium.

(391) A. H. S. writes: What can I use to rub upon or cover a bony substance so that it will become a conductor of electricity, that will enable me to plate it with gold, silver, or nickel, etc., so that it will adhere to the surface with tenacity and durability? A. Coat it with plumbago of good quality, applying it with a brush, as polishing a stone. The adherence to the surface will not be very great, but the model, if under cut, will hold it with great tenacity.

(392) G. E. W. asks for the surface of the zinc and copper and the number of cells of gravity sufficient to run a Sawyer-Man 19 volt 12 candle power incandescent lamp. A. Use carbon zinc couples excited by electropoion (bichromate and sulphuric acid) fluid. Twenty cells, each having eight square inches of zinc and copper facing each other, will answer.

(393) D. E. W. asks how to prepare the surface of glass so that it may be drawn on with India ink (the purpose being to make lantern slides). A. Try the following: Shake white of egg with twice its volume of water, and ten drops of ammonia, pour off the froth, and flow the plate with the clear solution and allow to dry, and heat slightly in an oven. Mix a little ox gall with your pigment. You can use thick India ink directly upon the glass.

(394) R. H. S. asks: Please tell me how to construct a glass melting apparatus, such as is used by amateur glass blowers. A. We refer you to Shenstone on Glass Blowing, which we can supply for 80 cents, for full description of glass blowing processes.

(395) B. A. asks: 1. What preparation would be the best to fasten cue tips to cues? A. Use carpenter's glue. 2. Please let me also know the way to make pool balls. A. The best are turned out of ivory, various compositions are used for inferior ones, into which celluloid or analogous substances enter. 3. The balls I now have are more or less disfigured by use. Will you please let me know what compound I can use to repair them? A. Have them turned down. We doubt if you can repair them.

(396) G. I. writes: Can you tell me through your paper how water can be sucked up a hill, 50 or 60 rods long with an elevation of 60 feet by the use of a windmill, without triangles and have the mill above the spring? A. You cannot draw the water higher than from 20 to 25 feet with certainty. You may place a windmill and pump above the spring so as not to lift over 25 feet and force the water to the required height. This, with a windmill of moderate height, should give a fair working power for ordinary uses, and is preferable to the bell crank connections for any considerable distance.

(397) A. G., Patras, Greece, writes: As a subscriber I take the liberty of asking you to reply through the columns of your paper as to which is the best method of polishing hippopotamus hide? I have a strip of the said hide which I wish to convert into a riding switch, and am told that it admits of a very high polish. A. Hippopotamus hide, if tanned, can be polished by preparing the surface by planing or cutting to the required shape and scraping with broken glass, so as to obtain as smooth and fine surface as possible. Then rub the surface with paraffine and polish with a woolen cloth or wool buff.

(398) E. U. asks: Can you give me directions for making porous cups for battery purposes? A. They are made of porous clay, baked in a kiln. You may have to mix a little sand with the clay to prevent it from cracking, and you should have enough heat in an ordinary stove for firing them.

(399) J. J. B. asks (1) if the motor described in your paper can be made so as to run by a Westinghouse alternating current. If so, please inform me what change should be made? A. It is not adapted. 2. What is the easiest way to make a storage battery? A. There is no easy way. Consult our index to SUPPLEMENTS. 3. Can the field magnet in the motor be cast out of brass? A. No.

(400) M. A. N. asks: How many Bunsen cells would be required to produce a light to study by, and illuminate a room 14 ft. square? What would be the cost of getting cells and light ready and the running expenses? A. Twenty or thirty quart cells; they will cost about $1.50 each; the lamps and connections, $2; they will cost to run not far from 25 cents an hour.

(401) H. E. M. asks: Does resistance of wire decrease the number of volts or amperes of current? A. It decreases the amperes only, and does not necessarily affect the volts.

(402) Inquirer writes: 1. Will a current of electricity instantly applied to and instantly broken from a very tightly stretched wire make it vibrate enough to produce sound? A. No. 2. Can it be said of a battery that it collects electricity or that it sets it free by chemical action? A. The second statement approaches the truth. In a battery, chemical energy is transformed into electric energy. 3. Is the present open winter accounted for upon any astronomical basis? If so, what is it, and how does it affect the earth's atmosphere? A. No tangible basis can be assigned.

Enquiries to be Answered.

The following enquiries have been sent in by some of our subscribers, and doubtless others of our readers will take pleasure in answering them. The *number* of the enquiry should head the reply.

(403) T. H. DeS. writes: 1. Is a steam radiator more effective under 15 pounds of steam than under, say 2 pounds, or is the temperature of the radiator unaffected by the rise in the temperature of the steam due to the increased pressure? I have seen it stated that the pipes of a radiator could not be made hotter than 212°, and cannot help thinking that it must be a mistake. 2. What is the relative efficiency of the following coals for making steam under the ordinary return tubular boiler, without blast? (*a*) The bituminous coal mined from Jelico Mountain, Tenn., having streaks of cannel through it occasionally. (*b*) Pure cannel mined in North Alabama. (*c*) Semi-cannel mined in North Alabama. (*d*) Semi-anthracite mined in North Alabama. If you are not familiar with these special coals, give values generally, based upon the kinds of coals named. 3. For deep well pumping, which is the best, in your judgment, to have, a vertical steam cylinder, etc., such as Knowles steam pump works make, and the Deanes also, placed over the mill with the piston rod in direct connection with the sucker rods, or to have an ordinary horizontal engine with a small pulley on a shaft belted to a large wheel, pulley say 8 feet in diameter, having a crank pin 2 feet from center, said crank pin to be connected to the sucker rods through a cross head and connecting rod? Which will work the smoothest over the ends of the stroke? 4. Will bones thrown in the retort with coal enrich the candle power of gas? If so, why?

(404) H. R. writes: 1. What is the rule for estimating the horse power of water powers? 2. Which will last the longer, a post set top or butt down? 3. With bark on or off, dry or green? 4. What is the difference in the lasting of posts charred and uncharred? 5. Does the time of year in which a post is cut make any difference in its lasting qualities?

(405) C. A. A. writes: Is water collected from a galvanized iron roof in a cistern safe to use for drinking, and is it safe to use galvanized pipes to convey drinking water? Which makes the best roof, tin or galvanized iron? Will water from a painted roof be fit and safe for drinking?

NEW BOOKS AND PUBLICATIONS.

LES INDUSTRIES D'AMATEURS. Le Papier et la Toile. La Terre, la Cire, le Verre et la Porcelaine. Le Bois, les Metaux. By Henry de Graffigny. 395 drawings. Bailliere et Fils, Paris.

A field which seems to be expanding more and more and which is constantly growing in popularity is the subject of amateur mechanics. Every few months brings out some new work on the subject. It is a refreshing symptom that there are large classes whose recreations are improving in their nature and who find that labor and pleasure may be combined. The above work, which is in French, is the latest production of this character. It treats of the various subjects mentioned in the sub-title. For instance, under the head paper it treats of filtering and tracing paper, impermeable and luminous paper and the methods of preparing them. Then it shows a number of toys, boxes, etc., that may be made of paper. Then the subject of binding is taken up. Then paper flowers, kites, and fireworks made of paper are treated of. The other subjects mentioned are treated in the same manner, the course taken being the steps necessary in progressing from the simplest to more advanced stages of the arts.

TO INVENTORS.

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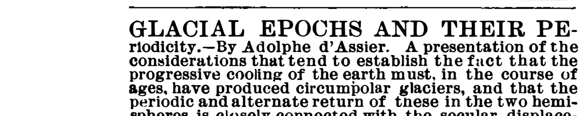

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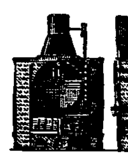

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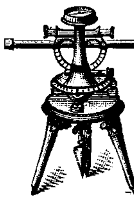

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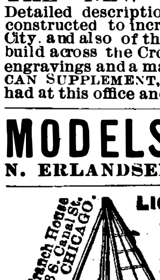

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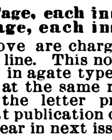

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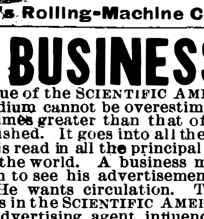

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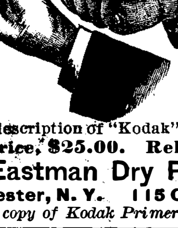

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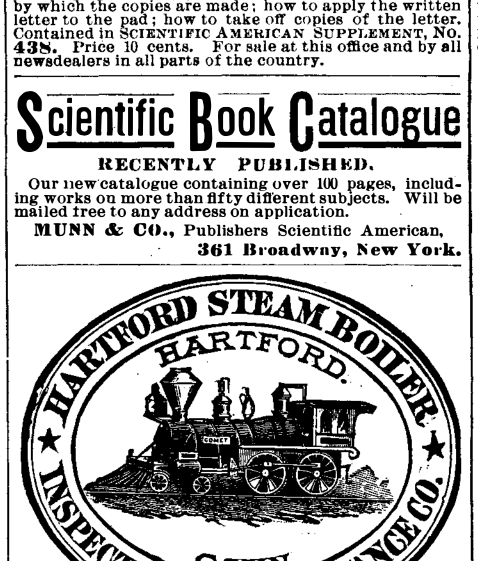

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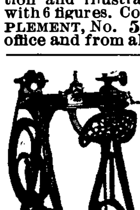

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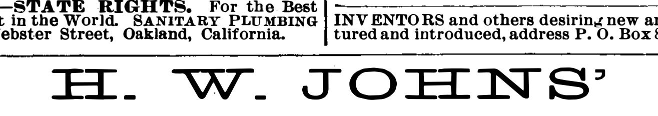

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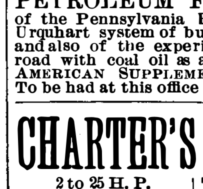

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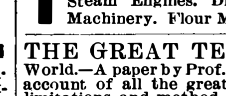

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