SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XLIX.—No. 23. [NEW SERIES.] NEW YORK, DECEMBER 8, 1883. [$3.20 per Annum. [POSTAGE PREPAID.]

THE NEW YORK, WEST SHORE, AND BUFFALO RAILWAY TERMINUS.

In the SCIENTIFIC AMERICAN of October 6 was published a ground plan showing the terminal facilities of the New York, West Shore, and Buffalo and the New York, Ontario, and Western Railways, with statistics showing the immense dockage, warehouse, ferryhouse, and cattle yard room that would be provided. The plan and figures represent five and three-quarter miles as the length of the dock room, on a water front of 6,790 feet, 275 acres being devoted to the terminæ and 175 acres as sites for building lots.

In the picture as here given our artist has shown the scene of the terminus as it now appears, looking down thereon from Weehawken Heights at the back, and across the river to New York. The view shows that, although a great deal yet remains to be done, the following has thus far been accomplished: The round house, milk depot, main depot and ferry buildings are completed, as are the sheds on piers 2 and 3. The pier for elevator A—the first on the south—is being rapidly pushed toward completion. The main crib bulkhead is finished with the exception of a few hundred feet. This bulkhead is the dividing line between the land and water, and on the water side of it are now being driven the piles upon which will rest the contemplated structures. The coal transfer piers will be at such a height that coal can be dumped direct from the cars into the hold of a vessel moored alongside. These piers will rest upon pile foundations, and will consist of wooden trestles of ample strength to support the great load. In order to approach these piers at an easy grade it became necessary to excavate a roadbed along the side of the hill, parallel with the river and at a point back of the tracks, over which it passes on bridges.

There are two lines of ferries, one running to Forty-second Street and the other to Harrison Street, this city.

From the point of view taken by our artist, the rugged beauty of the site, in its present aspect, is faithfully portrayed; it is a locality which will always be memorable from its association with the Hamilton-Burr duel and its importance in old New York history.

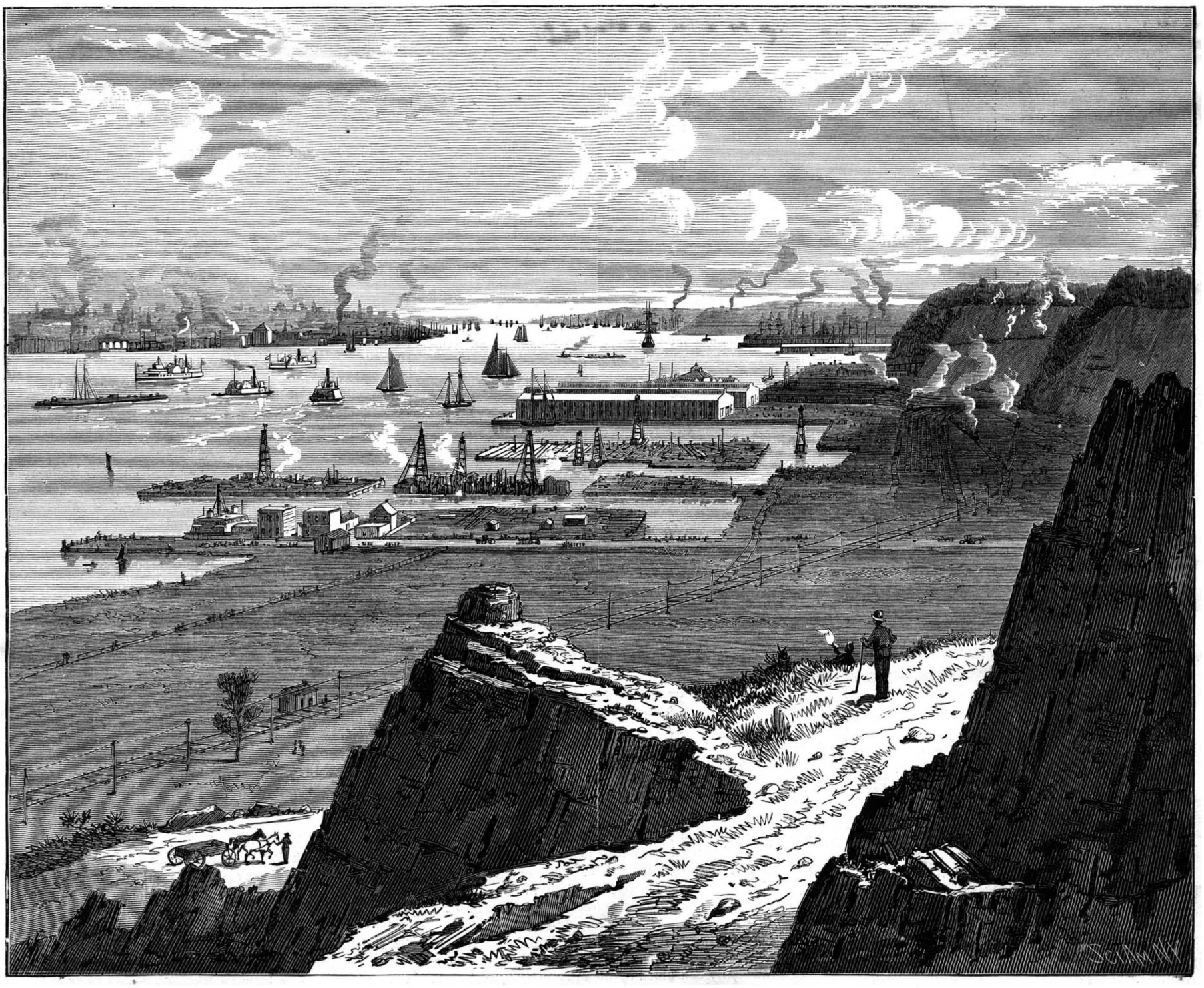
Ancient English Canoe.

An interesting relic of the past has just been unearthed in the parish of Pulborough, Sussex, in the shape of a canoe, which was partly embedded under the River Arun, and partly in land on the south side of that river. The boat is, says *Nature*, of solid oak, and hewn from a single massive trunk. That it was made before the knowledge of metal is evident, as there is not a trace of building or planking. It must have been hollowed by means of the stone ax and of fire. Further evidence in favor of the antiquity of this boat appears to be afforded by the various accumulations which had formed over that portion of it which was embedded in the earth. These strata, to the depth of nine feet, have been ascertained to be loam, yellow clay, a thin layer of leaves, followed by a stratum of blue mud, beneath which lay the boat embedded in drift sand. The prow portion of the boat lay in the river, and this is by far the most dilapidated. The stern is comparatively intact. The present dimensions of the boat are fifteen feet by four feet, but originally it was probably eighteen feet long.

Coal Gas—Water Gas—Electric Light.

The illuminating folks have grown very quarrelsome; and at present there is a triangular fight going on with the water gas, the coal gas, and electric light advocates as mutual antagonists. It is amusing to read in the gas journals the horrible tales of accidents and of destruction to health, eyesight, and complexion resulting from the use of either the rival gas or the electrical system of lighting. The prices, too, seem to bother them very much. The complaint made against Edison by the gas makers is, first, that his light costs too much, and, second, that he charges too little for it. But if this complaint is true they ought to possess their souls in patience, for he cannot be expected to stand it very long. The coal gas representatives having been beaten by water gas in cost, attack it as extremely dangerous, and the cause of most of the accidents by suffocation. This is "important if true," but it must be confessed that the water gas advocates have just as pretty tables of figures the other way, and between them all these lighting companies manage to leave us as much in the dark as ever. There is room for all of them, however, if they will be content with moderate profits. It is the charging of too high prices that attracts rivals into the field.—*Philadelphia Ledger.*

A RECENT official report says that the mercury in South Australia often rises in summer to 115° in the shade, and this has been exceeded on several occasions. In January, 1862, it reached 116°, and in January, 1882, it was 180°—only 32° below boiling—in the sun. New Yorkers will after this fell quite cool in what they call hot weather.



PRESENT CONDITION OF TERMINUS OF N. Y., W. S., & B. R. R.—VIEW FROM WEEHAWKEN HEIGHTS.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 261 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, DECEMBER 8, 1883.

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MECHANICAL EXACTNESS.

The practice of roughing out and then dressing by grinding, scraping, and paring to exactness must give way to that of accurate measurements and accurate tools to work to those measurements. It is evidently of little value to produce by expensive processes accurate gauges for screws, interiors, exteriors (for diameters), and scales for linear measurements, if there are not sufficiently accurate tools to work up to these gauges. Hand skill, unaided by mechanical exactness in machine tools, is not always sufficient to begin a job *ab novo* with exactness, or to carry it to completion without variation from the standard. In many instances an error multiplies itself and makes an insignificant divergence a serious fault. This may be particularly the case when the leading screw of a screw cutting lathe is faulty, and a longer screw than that of the lathe is to be cut by sections. If there is an error in the working portion of the leading screw it will reproduce itself, sometimes with aggravated quantity, until the end of the produced screw is reached, ruining the screw for exact work.

There has been recently started, in Hartford, Conn., a new company formed for the purpose of producing exact leading screws for lathes, racks, and pinions for longitudinal and lateral movements, and the closest gauged rules, or bars, for measurements to be applied to fine mechanical work, with or without the aid of the microscope.

These results are obtained by simple mechanical contrivances, which are patented. So close is the guided action of the device that a leading screw of a screw-cutting lathe 36 inches long was detected as lacking in one-twentieth of an inch in the three feet of thread, and quite important variations were noticed in that length. In fact, the leading screw of a screw cutting lathe made by one of the well known manufacturers of machine tools was so faulty in a distance of six feet that differently threaded screws could be cut by it at different portions of its length. More than this, it was discovered that a variation of one fifteen-thousandth of an inch was discovered—and rectified—which extended through only four inches in length of the screw. The result of the tests proved that in six feet of a leading serew there were three grades, only one of which was the pitch desired.

These variations in the leading screws of lathes are not uncommon, in fact there are many worse ones. No amount of judicious grinding will rectify an initial wrong in the cutting of the thread; it may reduce its irregularities, but it is impossible to move a thread bodily on its core, and whatever is ground off on one side leaves so much opportunity of backlash on the other.

It is evident that any device that can produce absolutely true threads running over inches and feet is an advance in the direction of exactness in machines and consequently in the perfection of their productions.

Remarkable Colors in the Sky.

Shortly after sunset, on November 27, 28, and 29, the western sky presented a most peculiar and striking appearance, the red light being intensely bright, almost dazzling, and reaching nearly to the zenith. The phenomenon was visible over a large part of the Northeastern States.

One supposition is that the color resulted from vaporous strata in the higher regions of the atmosphere. Another is that it was due to reflections from meteoric dust. The New York *Sun* gives the following:

A remarkable observation was made by Prof. Brooks, an industrious astronomer of western New York, on the evening of Nov. 28. While searching with his telescope for comets, he saw what he describes as a shower of telescopic meteors "near the sun." This, of course, means that they were near the apparent place of the sun in the sky, and not literally near to that body, for the sun had already set at the time, and if what Prof. Brooks saw was really a meteor swarm, the meteors must have been in the upper regions of our atmosphere. Supposed flights of meteors seen through telescopes have occasionally turned out to be flocks of birds, but an observer as careful and experienced as Prof. Brooks seems to be would not be likely to make such a mistake as that.

Assuming, then, that he really did see an extraordinary swarm of meteors, and remembering that meteors large enough to be visible without telescopes, and some of great size and brilliancy, have recently been unusually numerous, the suggestion that the red light seen in the sky for several evenings past long after sunset may be caused by reflection from clouds of meteoric dust in the upper portion of the atmosphere is not unnatural. There are several reasons for thinking that the strange light is the result of some such cause as the presence of meteoric dust rather than of differences of density in the atmosphere leading to extraordinary refraction.

In the first place, the phenomenon has not only been visible over an immense extent of territory, but it has lasted several days, and has been seen in the east before sunrise as well as in the west after sunset, so that any abnormal refraction in the atmosphere would have to be of almost incredible persistence in order to account for the observed appearances. Besides, during this time there have been considerable atmospheric changes, especially in respect to temperature. These remarkable sunset displays have also been accompanied by a notably hazy appearance of the sky.

It is well known that the earth is daily and nightly pelted with millions of meteors, the vast majority of which are almost instantly consumed by the intense heat developed as they dash into our atmosphere. The products of the combustion of these meteors filter slowly down through the air, and have been found in the shape of metallic dust on the snow fields in the Arctic regions, on mountain peaks in Europe, and in other similar localities, being recognizable by their peculiar chemical composition. It is also known that the solar system abounds with swarms of meteors revolving around the sun, and that the earth crosses the paths of a number of these, occasionally encountering the swarms themselves.

The vast majority of these meteors are very small, those that are seen weighing on an average probably only a few grains; and since the telescope reveals millions which escape the naked eye, it is reasonable to conclude that millions more are too small to be seen even with telescopes—mere meteoric dust. There are historic instances of supposed falls of meteoric dust, the most remarkable, perhaps, being that of 1783, when Europe, part of Asia, and part of North America were covered for months with a dry fog or haze, which excited the greatest alarm. Prof. Brooks' suggestion that the earth has encountered a cloud of meteoric dust is not, therefore, without foundation in probability.

If the recent blazing sunsets have really resulted from such a cause, they are likely to continue, in a modified form, for some time, gradually disappearing as the dust sinks lower in the atmosphere. But, although so many reasons can be advanced which give probability to the theory that meteoric dust is concerned in the production of these strange sunset effects, yet it cannot be considered as proved, and some better explanation may be offered. Whatever the true explanation may turn out to be, however, everybody seems to agree in the opinion that the red glare in the west during the last three or four evenings has been one of the most singular spectacles beheld in the sky for many years.

Electric Railway.

A trial of the Daft Electro Motor for propelling railway cars took place at Saratoga, N. Y., on 24th November last.

In the Siemens Berlin electric roads, the current to operate through the motor is sent through wires overhead, it having been found inconvenient to so insulate the track as to use the rails therefor, and also that, unless properly covered and insulated, the rails would be highly dangerous to other travel. Mr. Daft, by a subdivision of his dynamo, claims to obtain a current of such low tension that all danger from contact is avoided, but the insulation was by no means thoroughly effected by his sending the current through a third rail in the center, of which the fastening spikes were removed from the rail by a strip of vulcanized rubber. Then, although one could touch the rails without feeling any unpleasant shock, it was very evident that many were temporarily "excited" in crossing the tracks on the occasion referred to, while no less than four horses fell on the track from the effect of the current, and had to be helped off.

The actual performance consisted in the hauling by a two-ton motor of a five-ton car, with probably five tons more in weight of passengers, a distance of a mile and an eighth. This was up a grade of 70 feet to a mile, with one sharp curve, and was effected in eleven minutes. On the return the motor was thrown from the track, and several who were on it had narrow escapes, but the accident was due to a make-shift rope coupling, and did not involve Mr. Daft's principle at all. The dynamos at the factory for generating the current were 500 feet from the track, and were operated by a 30 horse power engine. The motor itself seemed entirely too small and light for the work expected from it, the dynamos thereof and connections occupying a box only about four by six feet. The current for these is taken up from the central track by a contact wheel, which transmits it to a receiving dynamo, and thence by connection with a steel belt through the axles to the outside rails causes the revolutions. The apparatus is easily operated, and evidently was entirely under control. Mr. Daft was warmly congratulated on the degree of success obtained, and the most of the numerous party present were confident that the trial was a proof of the practical success of the system.

A Stone Bridge over the Mississippi.

The first stone bridge across the Mississippi River has just been completed at a point a little below the Falls of St. Anthony. It is a massive stone structure, stretching to the east across the river, curving at first slightly to the left in a graceful sweep, and then running at right angles to the stream directly to the east side landing, the whole course being 2,100 feet. The upper surface of the bridge presents to the view a smooth stone roadway, carrying two tracks on four lines of steel rails and walled in on either side by heavy blocks of stone, high enough and strong enough to prevent a train from leaving the bridge, even should it be thrown from the rail. The viaduct crosses the river with twenty-three arches and sixteen spans of 80 feet each. The material is granite and magnesian limestone. The width is 28 feet over all, and the height from the springing point of the arches to the top is 50 feet 6 inches. One caisson required six months' work before stone laying could begin. Two hundred men have been employed on the bridge, and three lives have been lost in its construction. The cost was $990,000. The bridge was built for passenger traffic, and is to be used by the Manitoba, the Northern Pacific, the Omaha, and the St. Louis lines, and possibly by the Milwaukee. The possibility of running at full speed over it will result in reducing the time between Minneapolis and St. Paul from thirty to twenty minutes.

STORING WIND POWER FOR SMALL MOTORS.

Recently (November 3), in attempting to show a practicable method of utilizing a part of the wind power by storage, we based our calculations on such an amount of power for daily use as might drive the machinery of a shop or a mill or factory of moderate size, that is, a twenty horse engine. There are multitudes of purposes for which a very much less amount of power is needed, and attention has been turned of late to small motors and with a good degree of success.

But as long as these must have their energy dependent on steam they fail to be as fully useful as is desired, for under every condition a steam boiler with its heating arrangement is a necessary adjunct. Now, here is exactly where wind power comes in to give us what we want, and this is what we have had in mind, the point we wished to reach in treating of the storing of wind power. The large engines are perhaps beyond us as yet, the small ones are not, and we propose to give a few illustrations here of what seem to us entirely practicable.

Our direct agent for transmission will, of course, be compressed air, as before, for we have nothing else as convenient, and as our basis we lay down one or two statements of bulk from which to make our estimates. We assume compression to 3,000 pounds, say 200 atmospheres. This, in receivers of moderate size, is perfectly practicable and perfectly safe. We have under observation at this moment one designed for a street car motor, in which a pressure of 1,500 pounds has been reposing quietly for the last eighteen months. At the pressure stated 1·5 cubic feet will yield one horse power one hour. We will reckon one horse power as equal to that of six men.

As our first illustration we take a common rowboat of 14 feet. A 2 inch pipe, placed along the gunwale of the boat, will contain sufficient air to give the power of one man for five consecutive hours. Made of 16th inch iron, the entire pipe will weigh 35 pounds; of 12th inch, it will weigh 47 pounds; while its buoyant effect, in case of accident to the boat, will be 93 pounds. At the boat house, or wherever is convenient, a small wind wheel is built, for only a small one is needed; a very few dollars will do the work. The boat is brought to her place, connection is made from the air pump to the pipe lining or encircling her gunwale, and she is left. The windmill turns whenever the wind blows, and at every revolution air is forced into the pipe. Such a boat is used only at intervals, and the amount of actual rowing service is commonly but small. When she is out all day she is rowed out and rowed in, lying at anchor the greater part of the time. When she is needed again, say the next day, her reservoir is fully charged, she is detached by a single turn from the windmill connection, and away she goes. The mode of using the compressed air may be at the choice of the owner—screw, paddles, whatever is preferred.

Once more let us look at the same agency for light vehicles, buggies, phaetons, road wagons, etc. A drive of five hours is a long one, and, in fact, five hours' use within twenty-fours is more than the average. The power that is employed, though we use a horse for it, is commonly not half a "horse power." A reservoir containing eight cubic feet will run the vehicle, year in and year out. Such a box is a very small matter to suspend below the wagon, and it need not weigh over 190 pounds, counting thus for resistance as one additional passenger. No complicated machinery is required; the air chest is connected directly with a crank on the hind axle for the driving wheels, and the forward wheels are used in directing the course. This is applicable to vehicles of every form, and may be made as ornamental as the carriage.

This has referred to light work only; but there is really no reason why it should not be applied to wagons of heavier draught. A reservoir, to give the full power of two horses for a day of ten hours, need not weigh over 800 pounds.

These statements are not made at random; there is nothing visionary in them; they involve nothing except what is entirely practical and practicable. The first cost of such an arrangement will be less than the cost of horse and harness; the cost of maintaining the horse is saved.

One more item may be mentioned—the sewing machine. The power here required is so small that a box six inches cubic would answer every purpose for driving power. A motive agent would be constantly at command. The pressure of a lever with the foot would start the machine or stop it as readily as the treadle does now.

These are but a few illustrations; they might be multiplied indefinitely. Surely, we have here an indication of the advisabilty of storing the wind power. A.

Cheap Winter Quarters.

In anticipation of winter the Italians employed in building a Maine railroad have made a little village. Two forked sticks were driven into the ground and a pole laid across, against which other poles were leaned on either side, thus making an A-tent. On these rods were laid, beginning at the bottom and going to the top. Between the roof of poles and the turf a layer of boughs was placed. The ends were constructed in the same manner. A hole answers the double purpose of door and window. A singularly constructed furnace and chimney warms the hut, dries the macaroni, cooks their food, and carries off a part of the smoke. Some of the structures are of good size, while others are not much larger than a dog kennel, which they much resemble.

[SPECIAL CORRESPONDENCE.]

Patent Office Matters.

WASHINGTON, D. C., Nov. 26.

The new Commissioner of Patents is beginning to get into the harness and to gather up all the details of the various divisions of the office. "If I could attend solely to the judicial portion of my duties, which are in consonance with my tastes and previous study," he said the other day, "I should find the position a very pleasant one. But as I am responsible for the conduct of the entire office, I must make myself thoroughly familiar with the minor details in order to properly perform the executive functions which devolve upon me."

"You find the various heads of division efficient, don't you?"

"Yes, so far as I know, they are fully competent for the positions they fill. Of course, I have not yet had time to thoroughly understand each one and take his mental gauge, but I think they are all good men."

In reference to the issuing of patents, a falling off is apparent during the present quarter. This is considered rather singular, as there has been a steady increase from quarter to quarter of from 12 to 15 per cent during the past three years. The falling off from the past quarter is about 6 per cent.

Perhaps few have an idea of the number of patents that go through all the stages of examination and then, when they reach the point of issue, are held up for non-payment of the final fee. There are at least 100,000 of such applications now in the division of issues, and probably that is largely under the actual amount. That sum represents 5,000 distinctive patents, and at least 200 are returned to the files as forfeited each month, and the total number of forfeited, rejected, and abandoned applications is upward of 60,000.

Yet applications are being received in great numbers daily, for the inventive genius of the country is still on the alert, and over 2,000 applications for patents were filed in the month of October.

The class of inventions receiving the greatest number of applications, and the one which seems to be receiving the special attention of the inventive genius, is that of electricity —its application and appliances.

This class is subdivided in the Patent Office into 70 subclasses, and prior to July 1, 1881, there were issued in class 36—electricity—3,890 patents. From July, 1881, to July, 1882, 1,001 patents were granted in this class, and from July, 1882, to July, 1883, 1,326 patents were granted. The increase in the number of patents shows that the increase in the applications of electricity must also be very great.

For convenience of reference an index has been published, arranged alphabetically, numerically, and by sub-classes of inventions. This index consists of two volumes, the first containing a list of all patents to July, 1882, and an appendix from July, 1882, to July, 1883.

The exchange of publications with foreign countries, under the international patent system, and the depositing in the different capitols and district courts of such copies, under the seal of the Patent Office, is a means of great service to inventors in cases of litigation.

In the Patent Office inventions are classified into 170 classes and 3,344 sub-classes, and as an item of interest, and to show the great labor in an examination for a patent, a few lines of inventions representing different industries, with the number of patents in each, have been looked up. There are 466 patents for potato diggers, 581 for wheel plows, 218 for cotton planters, 3,151 for fences, 751 for fire escapes, 667 for jewelry, 82 for aerial navigation, 925 for wind wheels, 571 for velocipedes, 2,667 for car couplings, 3,524 for harness, 5,098 for packing and storing vessels, 80 for billiard tables, 330 air and gas engines, 569 gridirons, 414 burglar alarms, 161 apple parers, 1,242 spinning wheels, and 3,047 sewing machines.

The work of the various divisions of the Patent Office is not in so advanced a condition as it was a year ago, when Commissioner Marble reported that with the exception of one or two divisions the work was practically up to date. The large increase in the number of applications for the first three-quarters of the year is probably the cause of the delay in bringing the work up. The largest number of cases on hand is in the division of textiles, which show us a record of 451, while the smallest number is in the division of packing and metal working, which has only 47. FRANKLIN.

Matches.

At Jonkoping, Sweden, is the oldest and largest match factory in the world. It was established 100 years ago, and there are now to be seen specimens of the matches used at the beginning of the present century, consisting of big fagots of wood furnished with a handle and a tip to dip in a bath of sulphur. The wood from which the present kind of matches is made is taken from the adjacent forests, which are divided into fifty sections. Every year one section is cut and then replanted with young trees. The trees are hewn into planks in the forest and cut into slivers in the factory. The boxes are made of the outside of the trees. The factories are on the banks of lakes which are connected with one another by wide canals.

Millions of matches are turned out each day. Some idea of where they all go to may be obtained from the statement that there are at least 280,000,000 of matches burned each day in the United States, or an average of five matches for each person.

The Advantages of Light Draught for Vessels.

Some years ago, standing on a point in the Bay of Fundy, we saw an Indian paddle a birch canoe up against a fierce rush of the tide, which no six men could have stemmed with an ordinary row boat, but the Indian shot up with ease, because his birch went *over* the water and scarcely at all through it. The fact was suggestive.

When we speak of light draught we refer to vessels whose breadth of beam shall equal nearly three-fourths of their length, with this breadth carried well forward and aft. To the buoyancy resulting from such a form we called attention in our paper of Aug. 18, and that buoyancy will surely promote safety in rough weather. The power of a heavy sea to strain, twist, or crush a ship depends absolutely on the power which that sea exerts upon her by reason of resistance which it meets when it strikes her. The deeper she is buried in the water the more this resistance is increased. The fury of the rushing surface movement is driven violently against her hull, which is held by the relatively less fiercely impelled water of which her deep draught takes hold. This lower stratum, though itself tossed by the storm, is less moved than that above, and it is to just that extent a solid body against which she is forced, and resultantly the less her draught the less there is of resistance and the less of strain.

Another item is the increased stability of the craft consequent on the increased breadth of beam. In passenger carrying vessels this is a matter of no small moment, because of the great gain in personal comfort to those who suffer from sea sickness, as is the case with the great majority of persons. But, independently of this, a saving of motion is also a saving of wear and tear upon the vessel's frame; and if she is a sailing craft, increased stability gives in addition increased power of carrying sail with safety, and less liability to suffer from violence of wind or sudden changes.

The question of speed is for future consideration. But all these points, which pertain to the vessel herself, are of very small consequence compared to the advantages to be derived from her shallow draught by reason of the facilities for navigation which will be caused by it. Harbors in almost endless numbers will become available for active commercial service, which are now relegated to dependence on small and poor coasters, and imperfectly served at that. As all the world knows, the characteristic of all our Eastern coast, south of Cape Cod, is shallow water; scarcely a port can be found to which our largest vessels can have free access at all times of the tide, and into by far the greater majority large ships cannot enter at all. Even New York, with its immense and overshadowing commerce, is sadly deficient, and as our ships are now built, the addition of a few feet of permanently clear depth of water at Sandy Hook would count by millions of dollars in added wealth to the city.

In the whole extent of Long Island Sound, west of New London, not a single harbor exists which can float our seagoing craft. The growth of New Haven within the last twenty years in business importance, admirably extended as it has been, would have been at least twice as great had her harbor been competent to allow her capitalists to enter the field of foreign commerce.

Sweep on southward from Sandy Hook and you find the same state of things existing down the Atlantic, in through the Gulf, along Central America, and even on the Spanish main. And throughout all this extent, besides the obstruction of commerce, what multitudes of vessels are driven on shore, and wrecked because no harbors are under their lee into which they may run. The harbors are there in abundance, but the depth of water is too small.

If now we can devise any means by which ships of such size as the exigencies of modern commerce demand can be so constructed as to draw a relatively small amount of water and yet be just as thorough craft as now, as ready to keep the open sea, the world over, a ship of 3,000 tons, for instance, to draw but six or seven feet, we shall have opened a new and wide range for commerce and for navigation.

C. O. Sandford.

Colonel C. O. Sandford, one of the oldest civil engineers in the South, died at Petersburg, Va., Nov. 29, at the age of seventy-three years. He was born in New York State in 1811, but had lived in Virginia for many years. Under his direction that portion of the Norfolk and Western Railroad running from Petersburg to Lynchburg was built. He also supervised the building of the Augusta (Ga.) Canal, and the railroad running from Chatham, Va., now a part of the Raleigh and Augusta Air Line. In 1856 Colonel Sandford was elected Superintendent of the Petersburg and Weldon Railroad, and in 1863 he was elected president of the company, which office he afterward resigned.

A Double Parachute Flying Machine.

A Wisconsin correspondent, believing that steam must eventually be used for flying machines, suggests that a sufficient lifting hold upon the air to carry a small engine and boiler might be obtained with two parachutes. He would place them one above the other, with valves similar to those in a bird's wing to retard downward motion, while the lifting and propelling power would be obtained from the upper parachute; the lower parachute, from which would be worked a long rudder, also to form a check valve to the upper one, the tilting of the latter to furnish the propelling power.

The Oroya Railroad.

This road was originally intended to connect the Peruvian seacoast with the headwaters of the Amazon and establish communication with the rich silver mines of Cerro de Pasca, but only 86½ miles have been completed, and the object is still some hundred miles from attainment. The work already accomplished is by far the most difficult, and during the four and a half years it took to build it many thousands of people lost their lives. The difficulties may be imagined when it is known that forty tunnels occur in as many miles, and the highest elevation is Chicla, about 12,220 feet above sea level. The longest tunnel is 500 feet, and in one place the road zigzags up the mountain for two miles to reach an elevation of 700 feet. In some places the traveler can see three lines of road, one above the other. The bridges, in some cases spanning almost fathomless abysses and in others skirting precipices towering to great heights, are built mostly of iron, one of them being 575 feet long and 252 feet high at its center. The road is well built, but in some places is unprotected from land slides. On the up trip the speed averages about three and a half minutes to the mile, but on coming down the rate is very rapid, and steam is only used on the brakes.

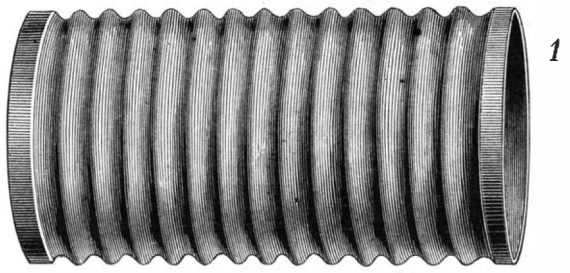
Deaf-Mutes Increasing.

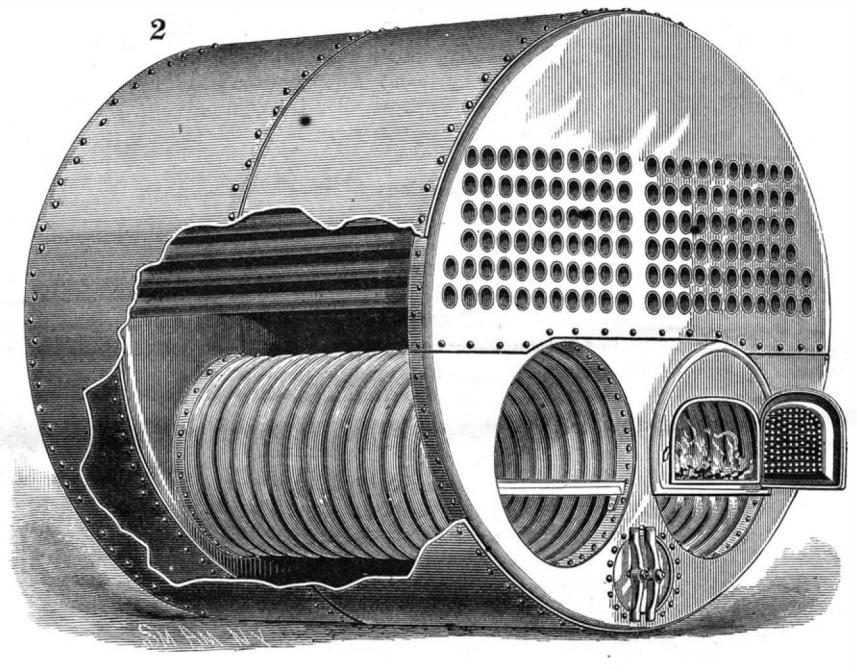
In a paper read before the National Academy of Sciences, at New Haven, November 13, Prof. A. Graham Bell contends that something striking and abnormal is going on among deaf-mutes, something that is tending to create a new variety of the human race. He quoted reports of various asylums and institutions for deaf-mutes, showing that in 82 cases out of 100 deaf-mutes were married to deaf-mutes. These reports did not give the information whether the marriage in each case was between persons congenitally deaf, or between those who had become deaf by disease, or between one of each kind. He believed that those who, being congenitally deaf, married congenitally deaf persons were likely to have deaf-mute children. The professor presented diagrams showing that the probabilities were that those who were congenitally deaf had in almost every instance relatives who were deaf-mutes also. The total number of deaf-mutes in the United States were 34,000, or one out of every 1,500.

CORRUGATED BOILER FURNACES.

Since the use of steam at high pressure has been put into practice, the economy derived thereby has been so manifest that it is a clearly marked out departure for the future in all uses of steam. This and the fact that most boiler explosions are caused by the collapse of furnaces have led to the introduction of the corrugated furnace, the manufacture of which, though attempted previously, was never carried into practice owing to the mechanical difficulties and want of the right material. These obstacles were overcome by Mr. Samson Fox, of Leeds, who, using a high class of Siemens steel which in every instance is tested by Government inspectors, and must have a tensile strength of about 23 tons per square inch with an elongation of 30 per cent in ten inches, besides a chemical test of the material in the smelting furnace just before it is tapped as to the right proportion of carbon, has brought the manufacture to such a success that the corrugated furnace is universally adopted by all leading engineers. At the Leeds Forge 1,300 men are kept fully busy. The plain plate is welded into a cylindrical form and while hot put into the corrugating mill. The resulting corrugated cylinder has the following qualities and advantages:

They are made of a single plate of steel, welded along the bottom, and no joint is in contact with the flame. They give 50 per cent more evaporative power, their elasticity enabling them to throw off all scale. Variations of temperature do not have a hurtful influence upon them, and as they contract and expand like an accordion they do not work against the boiler heads. In order to comply with the rules of the Board of Trade in England, they require only one-half the thickness of plate of plain furnaces for equal working pressure. In tests of two furnaces of the same length, diameter, and thickness, the plain collapsed at a pressure of 225 pounds while the corrugated stood 1,020 pounds per square inch. During the past five years some 700 steamers have been fitted with these furnaces, among them being the City of Rome, Alaska, Oregon, Servia, Elbe, Fulda, etc.





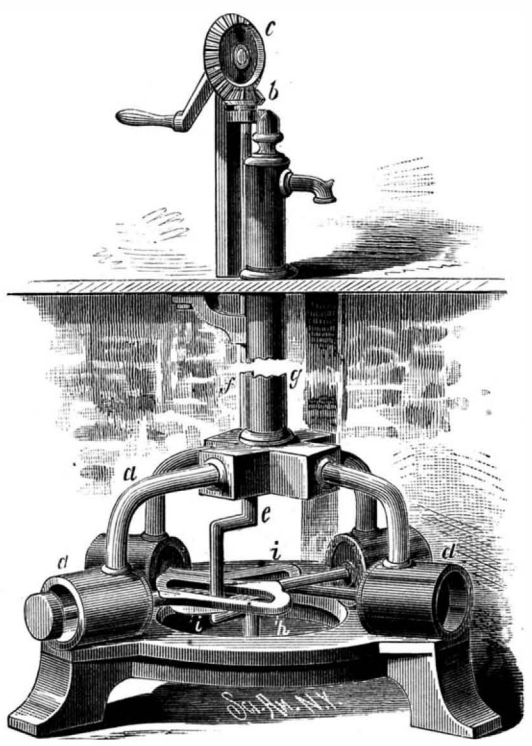
FOX'S CORRUGATED BOILER FURNACES.

These furnaces are now being introduced in this country by Messrs. Hartmann, Le Doux & Maecker, of 134 Pearl Street, this city, who are the sole agents and assignees of the United States patents. In the engravings Fig. 1 represents the corrugated furnace and Fig. 2 an ordinary marine boiler fitted with the furnaces.

SHANGHAI is already China's chief commercial emporium, and is destined, it is thought, to become eventually its greatest city.

A NOVEL FORCE PUMP.

The accompanying illustration represents a novel style of force pump recently patented by Mr. Timothy Calver, of Portsmouth, Ohio. On the base plate which rests on the bottom of the well or cistern are four horizontally placed pumps, *d*, at right angles to each other, and the axes of opposite cylinders being in the same straight line, the two lines crossing each other at right angles. The cylinders are open at the outer ends and closed at the inner. The piston rods pass through the closed ends, and opposite rods are attached to plates, *h i*, provided with slots at right angles to the rods. A vertical shaft, *f*, is journaled at its upper end in a cross piece in the well cover, and at its lower end in the base plate below the cylinder lines. At the lower end of the shaft is a crank, *e*, passing through the slots in the plates. A bevel pinion, *b*, mounted on the top of the shaft, engages with a bevel wheel, *c*, on a transverse shaft furnished with a crank. The pump barrel, *g*, is closed at the top, where a spout projects, and at its lower end is branched into four tubes, *a*, each containing a check valve and leading to the four cylinders. The piston rods are of such length that the pistons will be moved out of the open ends of the cylinders, into which the water enters. Each revolution of the shaft moves each piston backward and forward, each cylinder is filled and emptied, and the contents of the four cylinders discharged.



CALVER'S FORCE PUMP.

TEN years ago iron rails were manufactured by all rail makers, and steel rails by comparatively few; the latter now form 95 per cent. of the total output.

Imitating Expensive Leather.

Transforming cheap leathers to imitate the more expensive grades, by giving them the outward appearance of superior quality, has become an industry of some importance. This is accomplished by a process that is simple, economical, and effective, consisting of two principal operations.

The leather which it is desired to imitate is thoroughly cleaned and carefully coated with graphite, the work being similar to that necessary in preparing a smaller article for electroplating. It is then placed in a copper bath, the tank of which is large enough to easily receive a skin of any size. A dynamo-electric machine, generating a powerful current, furnishes the electricity. The copper is deposited upon the coated surface of the hide to a thickness of from one-sixteenth to one-eighth of an inch. The plate thus formed reproduces, but reversed, every mark and minute vein of the leather, so that a print taken from it is an exact copy of the original in every detail.

A hide of cheap leather is laid upon the bed of a machine much resembling the ordinary iron planer. Extending across the bed is a large iron roll journaled at either end in boxes which slide between two vertical standards. Strong screw bolts regulate the distance between the bed and the bottom of the roll. The copper plate is laid upon the leather, and two or three thicknesses of felt cloth placed on the copper. By the aid of long levers the bolts are screwed down until the iron roll bears upon the copper and leather with a pressure of many tons. The bed being moved forward until all the plate has passed under the roll, the hide is removed and is found to have been raised, in looks, to grain leather of the finest grade, or to alligator, as the case may be. The copper plate, being extremely hard, will print many hides. In some instances the plates are engraved, but as this method is more expensive and the reproduction not so faultless, it is but seldom resorted to.

Temperance and Longevity.

Mr. H. B. Robinson, at the British Association, has been urging, from the experience of life assurance offices, the value of abstinence from strong drinks as a means of prolonging human life and reducing the premiums for life insurance. He said:

"There were several mutual life assurance societies which kept quite separate the statistics of the lives of the general section and of those persons who abstained from strong drinks. At present many difficulties presented themselves in the inquiry, which would no doubt be eliminated in future years. The most valuable facts were furnished by the United Kingdom Temperance and General Provident Institution, showing that in seventeen years the claims in the temperance section were only a little over 70 per cent of the expectancy, while in the general section they were but slightly below the expectancy. The experience of the Whittington Life Assurance Company was not yet enough to form any exact opinion upon, but the company said that 'teetotalism seems to be favorable to longevity.' The Sceptre Life Association stated that during the eighteen years of their history ended in 1882 they had 116 deaths in their temperance section against 270 expected deaths, and in 1883 the same disproportion prevailed, as they had had 51 deaths, and only seven of them were the lives of abstainers, whereas to be equal with non-abstainers there should have been 19. In the Emperor Life Assurance office lives in the temperance branch were assured at a less rate than moderate drinkers. In some accidental offices the assumed superior lives of abstainers was recognized by a charge of 20 per cent less to teetotalers than to moderate drinkers."

Such statements are not new, but they are very interesting. They will have to be based on a longer and larger experience before any very positive conclusions can be drawn from them; but, taken in connection with the higher premiums exacted of publicans, and their early deaths, they show temperance to great advantage. As one of the speakers in the discussion observed, it is difficult to know how the offices guarantee the abstinence of those whom they insure. There is a considerable temptation to fraud in offering a premium of 20 per cent less to teetotalers. We do not in any way wish to imply doubt as to the advantages of the strictest temperance. We are constantly expressing our conviction that many people who regard themselves as moderate drinkers are unconsciously laying the foundation of disease. But we want strict facts on both sides, believing that there is a great amount of drinking due to ignorance, and that there are numbers of persons to be reached by intelligent and moderate statements who cannot be converted by sensational ones.—*Lancet.*

CHEWING gum is now made from wax obtained from petroleum. Two hundred pounds of wax, thirty pounds of sugar, and some flavoring will make about ten thousand penny cakes.

Dangerous Pottery.

Having had occasion to examine some common pieces of pottery which were suspected of having led to accidents of lead poisoning, I have been able to demonstrate that a great number of these objects are, despite assertions to the contrary, glazed with lead salt, and that their glazing contains a quantity of lead which is a menace to health, since I was able to detect in 100 grammes of milk, which was allowed to ferment or sour in one of these vessels, the large amount of 0·22 gramme of sulphate of lead.

It is also well known that M. Constantin has discovered a process more economical and entirely harmless, for glazing by means of the borosilicate of lime, and that chemist, who has been honored by the Academy, has generously given his discovery to the public.

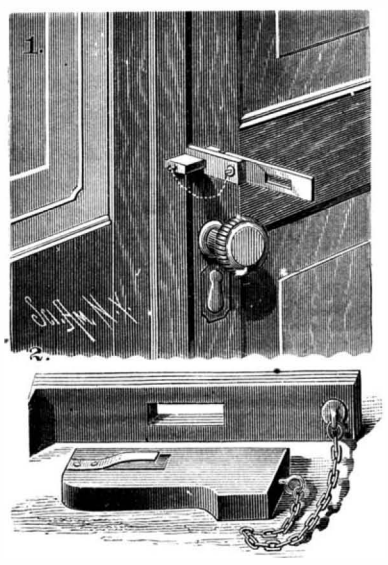
The glazing of fine earthenware, both French and English, has been greatly helped by the addition of boric acid and borate of lime, which permits a large reduction in the amount of carbonate of lead used, which formerly was considerable. These latter vessels give to fermented milk or soup but a small percentage of lead; but, it being granted that this metal is the most dangerous of the common metals, it is beyond doubt that if these vessels are incapable of producing as acute poisoning as those glazed with lead salt, they nevertheless can by constant use cause accidents which are so much the more alarming, as the elimination of this poison requires a long time, during which time also small doses can accumulate to dangerous proportions.

In my experiments I noticed that the vessels in which I had at first permitted the milk or soup to ferment brought this fermentation on much more rapidly when I repeated the experiment, even after they had been carefully cleaned. I then thought that perhaps the cracks and chinks which always occur in the glazing of earthenware which has been used for some time had something to do with it. I thought that these small crevices, in spite of repeated washing, retained a certain number of the germs, which started the fermentation of the new liquids I inclosed in the vessels.

It seems to result from my experiments that the cracks can screen the germs, and from analogy it is quite possible that such vessels, being used for the sick suffering the attacks of contagious diseases, can spread the disease of the patients whose food they contain. The report of M. De Mussy on the epidemics of 1880 mentions the fact that 23 men contracted typhoid fever at the hospital where they had been received for quite different complaints. I should not be surprised that the disease was conveyed by just such vessels, etc., under the conditions I have indicated above. It seems prudent therefore in hospitals not to use the earthenware, at least for patients with contagious diseases upon them. Glass and porcelain are the only entirely safe materials to use in the sick room. Metal itself presents unevenness, where the germs may settle and remain attached, although washed and cleaned with boiling water.—*E. Peyrusson in Cosmos Les Mondes.*

DOOR SECURER.

A strip of steel is provided at one end with a sharp edged prong, and on the opposite side of the other end is a series of flat strips, shown in Fig. 2, fastened by a pintle, which terminates in a ring on the side of the plate from which the prong projects. To the ring is fastened a chain or cord, at whose free end is a bolt of such size as to pass through the slots in the strips. The bolt is retained in place by a spring.



LEAMING'S DOOR SECURER.

By means of the strips the device can be made to fill the space between the free edge of the door and the jamb. The prong is placed against the jamb and the door is closed, thereby forcing the prong into the wood; passing the bolt through the slots secures the door.

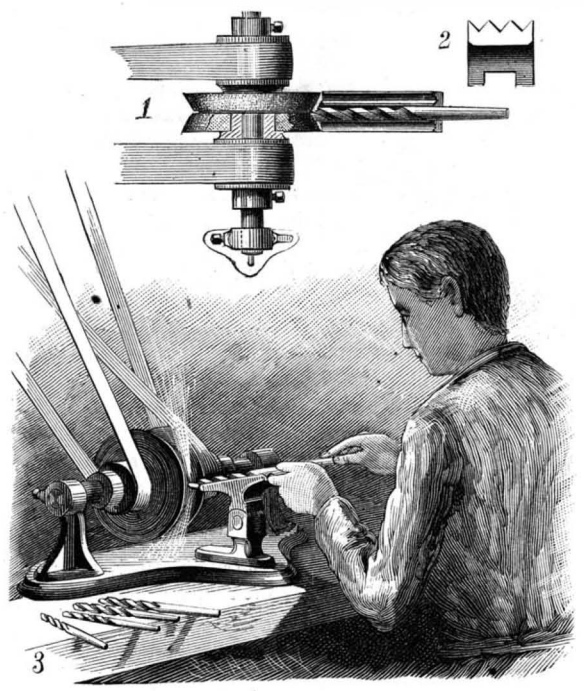
This invention has been patented by Mr. Christopher Leaming, and has been assigned to Mr. W. H. Carlson, of Newhall, California, who is the present owner.

French Shoe Dressing.

Vinegar, 2 pints; soft water, 1 pint; glue (fine), 4 ounces; logwood chips, 8 ounces; powdered indigo, 2 drachms; bichromate potass., 4 drachms; gum tragacanth, 4 drachms; glycerine, 4 ounces. Boil, strain, and bottle.

EMERY WHEEL.

The accompanying engraving represents an improved emery wheel for grinding twist drills and other tools, Fig. 1 being a plan view with part of the wheel shown in section, Fig. 2 a sectional elevation of the tool rest, and Fig. 3 showing the way the wheel is used. Two standards support the two ends of a shaft upon which revolve two pulleys, kept in place by collars and set screws, and having the inner ends of their hubs squared to fit into apertures in the centers of two emery wheels. The inner sides of the emery wheels are close together, and the faces are inclined inward at such an angle as will give the required inclination to the edge of the tool. The pulleys are driven in contrary directions. On the forward part of the bed plate is a standard to which is



LANDERS' EMERY WHEEL.

hinged a lug formed upon the lower side of the tool rest. Upon the upper side of the rest are formed grooves for receiving the tools to be ground, the central groove being intended for tools requiring a conical face, and the others being for tools having an inclined face. The tool to be ground is placed upon the rest, which is then turned upon the hinge to bring the forward part of the tool into proper position against the beveled faces of the emery wheels.

This invention has recently been patented by Mr. Francis Landers, of Stroudsburg, Pa.

How a Union Soldier Made a Fiddle.

It was at the "Brandy Station," Va., in the winter of 1863–64, says the Westfield (Mass.) *Times*, that George M. Colt, Company C, Second Vermont Volunteers, proposed to make the cheer-giving instrument; and with a hatchet, jack knife, file, and a piece of a junk bottle as his only tools, he cut a piece of maple from a stump that grew on the bank of the Rappahannock River, and set to work. The back and sides of the fiddle are made of one piece—a "regular dug out." The top is of hemlock taken from a box which brought some "goodies" from their friends in "Varmount." The bow is of maple. The keys were made from the horns of some Confederate cattle that fell into our hands and were devoured by our carnivorous soldiery, so that the poor brutes contributed to our mental as well as physical welfare. The hairs were pulled from the tail of the Colonel's horse, who was fond of music and never raised a foot in resistance. It is said he even signified his willingness to furnish enough of his hoofs for glue, but that was found elsewhere, and the instrument was completed, and in the hands of a modern "Paganini," who rose for the occasion, gave forth its soul-stirring strains. It conjured up "stag dances," serenaded headquarters, and was admired and cherished by the officers and men of the "Green Mountain Boys." The rest must be left to imagination, as far as its army record is concerned. Suffice it to say, it was "honorably discharged," and has been the hero of several occasions since the war, receiving the first premium at the Vermont State Fair. Rude as is its origin, its tone is remarkably sweet and expressive, especially in the rendering of "Old John Brown" and other airs that were offsprings of the war, which seem to revive in it the memory of the exciting scenes of its early existence. Its maker and owner still lives, though he received wounds after the production of his instrument that have nearly disabled him for active duty.

The Deepest Well in the World.

The McGuigan gas well, the light from which can be plainly seen from the top of Wheeling Hill, is the pioneer gas well of this vicinity. It led to all of the others now making such a turmoil in this valley. It was sunk for oil, not gas, and the great gaseous reservoir was tapped unawares. Just three miles nearer us the Buchanan well was sunk, and is now the deepest well in the world, having reached 4,300 feet, and is still going down. When a depth of about 3,000 feet was reached the tools broke and were left there, and for some time the well was deserted. Then a new concern took hold of it, and is now vigorously drilling for the greasy fluid. The rope broke in March, and the cable, between 4,000 and 5,000 feet in length, and weighing several tons, parted seven hundred feet from the top, and all efforts to catch hold of it and draw it out with the great iron shaft, or drill, at the lower end failed.

The workmen were then discharged and the public supposed the well abandoned. Superintendent Crocker had no thought of quitting the work. Additional tools were procured, and at a recent date work was resumed. The well, which was dry, was filled with water to assist in floating the cable, a proper instrument was inserted, and the rope was caught and lifted out. It was supposed that after getting the rope taut a "sucker rod" would have to be sent down to loosen it from the drill at the bottom, as that was fast and could not be lifted with the weakened rope. Fortunately the rope cut itself off where it was attached to the shaft, and thus saved a great deal of trouble. The next thing to do was to remove the water from the well, and pumping was resorted to, when nearly a barrel of very fine crude oil was obtained. The well is cased to the depth of 1,200 or 1,400 feet, and is dry. When the water is removed, which will be done in a day or two, a "spear" will be sent down after the drill, and no difficulty is anticipated in bringing it to the surface. When this is accomplished, the work of deepening the well will be recommenced. Mr. Crocker states that the machinery he has on the ground will enable him to go 500 feet deeper, and by increasing its power he could go to the depth of 7,000 feet, but he hopes to reach oil in paying quantities at a small additional depth.—*Wheeling (W. Va.) Register.*

Milk and Infectious Diseases.

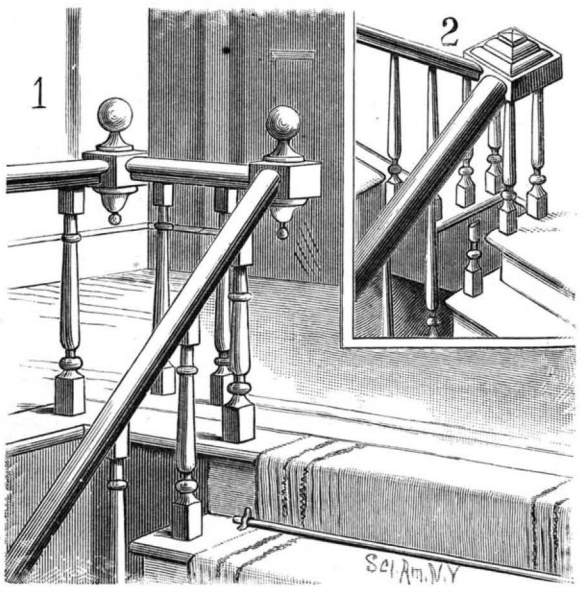
The sanitary inspector who investigated an outbreak of typhoid fever in a populous London district traced the epidemic to a dairy farm where the vessels used for milk were washed with water from a well that had been contaminated by the drainage from a cesspool. In the houses of those who worked on the farm there had been cases of the fever, and the theory was that the milk had been infected with disease germs. Wooden pails are used in England for milking, and naturally furnish a better lodgment for germs than the tin pails used in this country.

It is reported that a similar outbreak has occurred at Port Jervis, N. Y., and the milk from a certain farm is supposed to be the spreading cause, since 56 out of the 75 persons attacked were supplied with it. How it became infected is being studied by chemists and sanitarians.

Proper sanitary precautions at all times and extreme vigilance during the prevalence of disease on the farm would banish such outbreaks. Too much care cannot be exercised in the disposal of the excreta from persons suffering from typhoid fever. Under favorable conditions the germs are washed by water, which will carry them along with it; if allowed to dry, they permeate the air; in both cases endangering health. Burying deep in the earth is not a sure way, since they will not lose their power in years. Burning seems the most reliable method of destroying them.

HAND RAIL FOR STAIRWAYS.

The engraving represents a hand rail consisting of blocks or caps, provided at each bend of the rail, and against which the ends of the rail sections abut, thus doing away with



SIMONSON'S HAND RAIL FOR STAIRWAYS.

posts and curved rails. In open stairways composed of several successive sections the sections of the stair rail are arranged in such a manner that they run out at the same height, the risers of the stairway being arranged accordingly. Between the abutting ends of the rail sections are placed blocks, to which the ends of the rails are secured, the blocks being more or less ornamental. These blocks are supported entirely by the rails which they unite. No part of the hand rail need be twisted, its section is not changed, less material is required, no posts are needed, and the cost of the stairway is much reduced. The engraving shows the construction very clearly.

This invention has been patented by Mr. Theodore Simonson, whose address is Chicago, Ill.

Brooks as Sewers.

When a natural watercourse traverses a town, and its banks become built upon, the easiest way of getting rid of filth and house wastes is to throw them into the stream. Every man's instinctive impulse is to get rid of what annoys him, and not to mind how his neighbor will be affected. After a while, when the watercourse has become sufficiently nasty, the people come to a realizing sense of what they have brought upon themselves, and then they try to devise a remedy. In this they begin usually at the wrong end. They look on the stream as creating the nuisance, and don't consider that it is their abuse of the stream that is the source of the trouble. So they go to work and cover the stream up and call it a sewer. What is the result? Simply that the stench of the foul matter in the old channel is bottled up somewhat, to be vented through every manhole, every inlet, and every house drain, and probably do more real injury than when the rotting filth was exposed to the air and the sun, and diffused its aroma through the whole atmosphere.

The channel of a small natural stream through a town or village ought never to be converted into a sewer for house wastes. This will strike a good many people as an odd doctrine, but still it is sound doctrine. The functions of a natural stream and of a sewer are so diverse that one cannot be made to do duty for the other.

A natural watercourse serves for the drainage of the land all along its course. Its banks cannot be made water-tight without obstructing the natural progress of the water in the soil and backing it up and retaining it where it ought not to be retained. A sewer, on the other hand, is intended to carry off foul matters which must be gotten rid of as quickly as possible, and the channel for conveying them must be absolutely impervious, so that nothing can soak through it to the soil. As the level of the water in the soil rises and falls with the season and the amount of rain, an open jointed or pervious channel would sometimes admit water from the soil and sometimes permit fluids flowing in the channel above the level of the ground water to flow out, and thus pollute the soil and the air in the soil.

Again, a natural stream draining a considerable territory is subject to great variations in its volume. A channel to carry its extreme discharge in floods must be many times larger than can ever be necessary for the carriage of the greatest amount of sewage that can be brought to it. A large channel is not suited to the rapid removal of a small flow of filthy fluids, and, moreover, costs a great deal more than a sewer of the proper size. Even if the large channel for a fluctuating stream is built through a village, the sewage from the houses should not be turned into it, unless the minimum volume of the natural flow in the driest seasons is large enough to keep the channel thoroughly scoured. There are a good many small towns which have for years gotten along without sewers and have arched over natural watercourses running through the heart of the town, but are now impelled by the "sanitary revival" to construct sewers for removing household wastes. The first impulse is to utilize the covered streams to save the expense of constructing a few hundred feet of sewer. They should be very careful how they proceed. It is better to spend a little more money and be safe than to economize in first cost and spend ten times the saving in doctor's fees and undertaker's bills.—*The Sanitary Engineer.*

The Heating Power of Gas.

During the famous electric light scare which occurred some five years ago, holders of gas shares comforted themselves with the reflection that if at an early period electricity was to oust gas from its time-honored place as an illuminant, yet a new field was opening in the demand for gaseous fuel for heating, cooking, and power purposes, and that this would probably find employment for all their vested capital.

What the practical heating value of gas was, few people could tell, and even to-day little is known except that for domestic purposes gas is much more expensive than coal. The report issued by the judges at the late Gas Exhibition at Stockport endeavors to supply some information upon this point, and marks an early stage in the scientific investigation of the fuel value of gas for domestic purposes.

In testing cooking apparatus it has hitherto been usual to try them with actual viands, but at Stockport the judges substituted vessels of water for these, noting the rise of temperature in Centigrade degrees in a given interval, and from this they calculated the units of heat imparted to the supposititious joint in that time. The average result of seven "gas cookers for workingmen's houses" gave 53·1 units of heat for each cubic foot of gas, the rate of consumption being about 12 feet per hour. In more elaborate stoves the efficiency fell to 43 units per cubic foot. As a means of comparison a boiling apparatus was shown by Messrs. S. Leoni & Co., in which the consumed gases came away nearly cold, and in this each cubic foot of gas gave 262·5 units of heat to the water, and this may be assumed to be the maximum result it is possible to attain. The ordinary stoves for boiling kettles utilized 144 units of heat per foot, thus demonstrating the economical advantage of boiling over baking.

There were four gas engines entered for competition; two by Messrs. Crossley Brothers, and two of the Bisschop type. A six horse power Otto engine, when developing 10·6 indicated horse power, consumed a cubic foot of gas in 0·283 minute, or 212 feet an hour, and the units of work (1 pound of water raised 1° C.) done by each cubic foot of gas in the cylinder were 70·17. A half horse power engine gave 1·8 indicated horse power and 1·074 brake horse power, the corresponding units of work being 59·35 and 37·48. The Bisschop engines developed 0·27 and 0·52 brake horse power respectively, corresponding to 13·20 and 13·96 units per cubic foot of gas.

The apparatus for warming rooms by radiant heat were not so easy to test, and the judges had to use an arbitrary standard. This they fixed as the number of units of heat transmitted through a blackened surface 1 foot square, situated 18 inches from the source of heat. It is evident that the results thus obtained are not comparable with those quoted above, and it would need measurements to be made of coal fires in order to give them any exact value. The modern gas fires are mostly semicircular blocks of fireclay with tufts of asbestos fixed in them, and covered with iron gratings. The average of the results gave 6·9 units of heat absorbed by the testing apparatus per cubic foot of gas, while the consumption was about 13 feet per hour. Metal fires consisting of coils or cones of iron wire gave very poor results, while the asbestos fires formerly in vogue never became hot enough to radiate much. The medal in this section was awarded to Messrs. John Wright & Co., Birmingham. Stoves which acted by convection, delivering their products of combustion out of doors, produced very unsatisfactory effects, the average being 2 4 units of heat per cubic foot. For heating purposes what appears to be wanted is a gas stove which will give a comparatively small mass of intensely heated matter, so that the heat radiated from it may be large.

Thus, assuming that the best practical effect which can be obtained from a cubic foot of gas equals 262·5 units of heat, then the best gas cooking apparatus in the market utilize about 20 per cent of this, the boiling apparatus 55 per cent, the six horse power Otto engine 26·7 per cent, the half horse power Otto engine 22·6 per cent, the Bisschop engines about 5·2 per cent, the convection heating apparatus less than one per cent, while the efficiency of the radiating apparatus cannot be exactly determined, but may be assumed to be over 15 per cent. As the greater part of the coal burnt in our houses is employed for heating purposes only, it is evident that there is here a great field for inventors; and if they can produce a vividly glowing surface having a very much higher temperature than that of the stoves already in use, there is a prospect of gas fires being maintained at a reasonable cost. If the present consumption of fuel could be halved only, the great advantages of absence of dust and smoke, and the saving of labor in carrying coal and ashes, would in many instances turn the scale in their favor.—*Engineering.*

Sheltered and Unsheltered Pigs.

Experiments made by Prof. E. M. Shelton, of the Kansas State Agricultural College, show that it pays to protect pigs. Ten animals as nearly alike as possible were kept, during the last two winters, in separate pens, five in the basement of a barn and five in the yard without covering save straw for beds. They were fed with Indian corn twice a day, each mess being carefully weighed. The result was as follows:

Pigs in the barn, 1 lb. of pork cost $4\frac{9}{10}$ lb. of corn.
Pigs outside, " " " $5\frac{7}{10}$ " "

Or expressed in other words, each bushel of corn:

Fed in the barn, made $11\frac{3}{10}$ lb. of pork.
Fed outside, " $9\frac{7}{10}$ " "

This shows that of every bushel of corn fed to the unsheltered pigs, an amount capable of making 1·6 pounds of pork was used in keeping the pigs warm.

According to these figures, if the sheltered pig gained 100 pounds in weight during the season, it was by the expenditure of 4·9 pounds of corn for each pound of pork, or 490 pounds of corn for the whole increase. The unsheltered pig required 570 pounds of corn for 100 pounds of pork. This shows a saving of 80 pounds of corn, about 1½ bushels, in favor of each sheltered pig; but if the pigs are as healthy in one case as in the other, and the gain is only in the saving of corn, it will hardly amount to the interest on the cost of the shelter and the wear and tear.

A Premium to American Millers.

Canada has a tariff on American flour of 50 cents a barrel, but on wheat the duty is 15 cents a bushel, or about 72 cents on enough wheat with which to make a barrel of flour. In ordinary years this would not attract attention, but, now that they have a very short wheat crop there, the Dominion Millers' Association claims that this is a distinction in favor of American millers. The Association want the duty equalized by the Canadian government, and claim that they will be compelled to shut down their mills and import flour from the United States unless such action is taken. Well, we exported wheat flour to the value of $33,855,090 the first eight months of this year, against $25,598,235 for the like period last year, and shall probably have enough to supply our Canadian friends.

Carbolic Acid.

From the results of a series of experiments, W. Meyke arrives at the following conclusions: 1. Pure carbolic acid should be colorless, have the proper boiling point, and be entirely volatilized by heat. 2. The congealing point is of secondary importance. 3. Carbolic acid is colored red when kept in glass vessels containing lead. 4. The best vessels for keeping carbolic acid are made of tinned sheet iron.—*Phar. Zeit. Russl.*

Peroxide of Lead as an Insulator.

BY M. C. WIDEMANN.

Having had occasion for a year to apply, for the decoration of articles of jewelry, the procedures pointed out by Nobili and Becquerel for obtaining coloration by means of baths of alkaline plumbates and ferrates, I observed that the articles thus colored became absolutely proof against all galvanic action; that is, their surfaces when once coated with peroxide of lead or of iron were insulated, and no longer conducted the electric current. A wire of copper, brass, or even iron, may thus be coated with an insulating layer like a stratum of resin or gutta-percha.

This principle, I believe, admits of easy utilization in preparing wires and cables for use in telephony and telegraphy

The method of obtaining this insulating stratum is, from an industrial point of view, very practicable, and the cost trifling. The hardness of this coating, which resists all atmospheric action, is a guarantee of its durability. The insulation is absolute.

The method of preparation is very simple. A bath of plumbate of potash is prepared by dissolving 10 parts of litharge in 1,000 parts of water, to which have been added 200 parts of caustic potash, and boiled for about half an hour. It is allowed to settle, decanted, and is then ready for use. The wire to be coated with peroxide of lead is attached to the positive pole, and a small platinum anode to the negative. Finely divided metallic lead is precipitated upon the negative pole, and the wire is coated with peroxide of lead, which passes successively through all the colors of the spectrum. The insulation is complete when it takes a brownish black color.

The wire thus covered is perfectly insensible to electric action. Articles perfectly cleaned may be attached to it, and connected with the negative pole of a gilding, silvering, or nickeling bath without the current, however powerful, producing any action upon the objects to be coated. Such a wire, if placed in a circuit, and brought in contact with another wire in connection with a galvanometer, leaves the latter entirely unaffected.—*Comptes Rendus.*

The Tallest Trees in the World.

It is usually considered that this epithet belongs, *par excellence*, to the famous "Big Trees" in California, variously known by the names of Wellingtonia or Sequoia. These are, however, far surpassed in height, and probably also in the total amount of timber in a single tree, by the real giants of the vegetable kingdom, the noble gum trees of the genus *Eucalyptus*, which grow in the Victorian State Forest, on the slopes of the mountains dividing Gipps Land from the rest of the colony of Victoria, and also in the mountain ranges north of Cape Otway, the first land which is usually "made" by any vessel bound from England for Melbourne direct. As will presently be shown, there are only four of the Californian treees known to be above 300 feet high, the tallest being 325 feet, and only about sixty have been measured that exceed 200 feet in height.

In the large tracts near the sources of the Watts River, however (a northern branch of Yarra-yarra, at the mouth of which Melbourne is built), all the trees average from 250 to 300 feet in height, mostly straight as an arrow, and with very few branches. Many fallen trees measure 350 feet in length, and one huge specimen was discovered lately which was found, by actual measurement with a tape, to be 435 feet long from its roots to where the trunk had been broken off by the fall; and at that point it was 3 feet in diameter, so that the entire tree could not have been less than 500 feet in total height. It was 18 feet in diameter at 5 feet from the ground, and was a Eucalyptus of either of the species *E. oblique* or *E. amygdalina.* It should be noted that these gigantic trees do not, like their California prototypes, grow in small and isolated groves, towering above smaller specimens of the same or of closely allied kinds, but that, both in the Dandenong and Otway ranges, nearly every tree in the forest, over a large area, is on this enormous scale.—*World of Wonders.*

Plating Metals with Aluminum.

In a certain sense, says Winkler, it is possible to plate other metals with aluminum, but, unfortunately, the product is useless, because aluminum is unable to endure the necessary heating nearly to fusion of the two metals and subsequent rolling out. Very slight contaminations seriously affect the quality of aluminum in tenacity, ductility, and strength. A moderate quantity of iron renders the metal quite brittle, a small per cent of copper makes it as brittle as glass. But in plating any metal there must of course be a layer between the two metals which consists of this alloy with all its bad qualities and want of tenacity, which is crushed to a powder under the rolls. The result is that the aluminum cracks off from the other metal.

But even if it were possible to put a thin film of aluminum upon any metal by rolling, it seems questionable whether anything would be accomplished thereby. For although aluminum, when in a compact mass, offers a great resistance to oxidation and sulphur, it is not so in a thin state. In powder or thin foil it oxidizes easily, and the amalgam becomes heated in the air, and separates into mercury and aluminum if rubbed between the fingers.

If we suppose, for example, that copper is plated with aluminum and rolled out in sheets, the layer of the latter would soon be made very thin, and it is probable that a metal, otherwise so permanent, would lose its durability when so thin.—*Industrie-blatter.*

Correspondence.

The Arlberg Tunnel.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of June 2, I find an article headed "The Arlberg Tunnel," which gives a short description of the installations on both sides of the mountain. You give as a source the *Revue Generale des Chemins de Fer*. Allow me to state that the statements given by that paper are not quite correct, for all the plans on the west side of the tunnel were made by Sulzer Brothers, of Winterthur, and the perforators used on that side were of the Brandt system (patented in the United States also), actuated by hydraulic pressure and being of the turning (boring) and not of the percussion type. The system was in use at the Pfaffensprung tunnel of the St. Gothard line.

HERMAN ZOLLIKOFFER.

Winterthur, Switzerland, Sept. 13, 1883.

Changing the Track of Tornadoes.

To the Editor of the Scientific American:

For the above purpose I propose the following: Take one keg or barrel of common rifle or cannon powder to the limit of your city or town where it is approached by a tornado. Fix to it an artillery priming tube, having a string to it about 100 yards long. Take your position at the end of the string, holding it taut. Wait till the tornado seems to be precisely over the powder, then fire the powder by pulling the string, and if the charge is large enough, that gyrating, whirling tornado will be effectually blasted out of existence; at least, made harmless till blown beyond your town, where perhaps it will reform itself.

JOHN F. SCHULTZ.

New York City, 1883.

White Fillings.

A dentist wishes to know the formula for the white cement used for filling decayed teeth, which contains neither mercury nor silver in its composition.

There are several white fillings in use by dental surgeons which contain neither mercury nor silver. They are made by mixing oxide of zinc with impalpable glass powder in small proportion, and just before using, when the cavity of the tooth is prepared, a small quantity of deliquesced chloride of zinc is placed on a glass slab, and enough powder added to make a thick paste, mixed rapidly. It "sets" very quickly, and forms a good temporary stopping. It is slightly irritating to the "nerve" of a tooth, and should not be inserted directly in a cavity in which caries has far advanced without placing a little solution of gutta-percha in chloroform over the region of the pulp. But a less irritating filling, according to the London *Lancet*, is made by mixing the same powder of oxide of zinc with pyrophosphoric acid; this is a more permanent white stopping.

Varnishes made with Borax.

It is well known that shellac dissolves in borax solution, and this solution is often utilized for various purposes, both as varnish and cement. The following are the proportions employed: Ten parts of borax, thirty parts of coarsely pulverized shellac, and two hundred of water. It is dissolved by warming on a steam bath for a few hours. When cold it may be filtered. To make it more pliable add a few drops of glycerine. It may be given various colors by introducing soluble pigments: for black it is recommended to use soluble nigrosine; red varnishes are obtained by adding eosine or fuchsine; for blue, either methyline blue, alkali blue, or marine blue; for green, use malachite green or brilliant green; and for violet, methyl violet.

The black borax varnish colored with logwood, etc., is used for polishing ladies' boots and shoes, being cheaper than alcoholic varnishes.

Borax varnish can be employed for dry-plate photographic negatives, as it may be flowed on while wet.

Can Chemists Help the Planters in Improving the Sugar Manufacture?

We are in receipt of an earnest appeal from a West India cane planter and sugar manufacturer for the help of American chemists in improving on the present methods of making sugar from the cane. He asks: "Cannot the chemist, with the aid of non-injurious chemicals, assist us to improve on present methods for the clarification of raw and cold cane juice, and so that it can be done without the aid of fire heat?" He suggests that the subject is of sufficient importance to our own Southern planters to make it an object for them to call for a general consultation of our chemists in regard to the matter.

A VERY complete catalogue of American machinery and tools has recently been issued by Messrs. Charles Churchill & Co., of 21 Cross Street, Finsbury, London, whose aim is to place on the English market the best standards of American implements. It is impossible to begin to enumerate the various specialties in regard to which the catalogue undertakes to enlighten British manufacturers, but the fact that an elaborate volume of this kind is required by foreigners, who, less than a generation ago, scouted the idea of American producers competing with them, affords the best possible indication of the lead which our mechanics and artisans are now taking in the world's industries.

Colored Sheet Glass.

The most beautiful colored sheet glass is made by the French and Belgian manufacturers, such as sheets composed of two layers or coats of glass, white and colored, and in some instances sheets made of white glass and covered over with as many as four different layers of colored glass, put on very thin and equal in thickness on the whole of the surface. For the coloration of this glass, as for all colored glass in general, the oxides of the different metals are used. For blues the oxide of cobalt, or zaffer. For the different shades of blue, different proportions of cobalt. For a very light shade of blue for spectacles, a mixture of cobalt and red oxide of iron. London smoke is obtained by a mixture of the oxides of copper, iron, and manganese. A black is produced by increasing the proportions of these three oxides. Purple glass has for coloring element oxide of manganese. A glass so colored and made with soda gives a purple shade, edging on the red, while a potash glass will give a bluish purple. This color is made of a deeper blue by the addition of cobalt. The brown purple is made with a mixture of oxide of manganese and oxide of iron. The purple of the ancients can be perfectly imitated with a mixture of oxide of manganese and red oxide of iron.

Yellow.—A mixture of oxides of iron and manganese is used. To get this color with more facility charcoal in the shape of wood sawdust is substituted. By increasing the quantity of sawdust an orange color is produced; with still larger proportions it may turn to brown and sometimes even red or black. All books state that antimony gives a yellow coloration to glass, but it would seem that this is erroneous, for pure antimony does not color glass at all. The sulphur contained in the antimony is supposed to be the coloring agent. Glass is also tinted yellow by applying to its surface a mixture of ocher and sulphate of silver, and baking it in an oven.

Green.—For grass green a mixture of black oxide of copper and oxide of iron is used. The same color may be obtained by replacing a part of these oxides by one-third of their weight of bichromate of potash. By using these substances and adding an oxide of cobalt a blue green is obtained. Yellow oxide of uranium added to the oxides of iron and copper gives a yellow green.

Red or Ruby.—This color is always used as a coating upon white glass, and is obtained with the brown oxide of copper, the oxides of lead and tin, scales of iron, and borax introduced into the batch and melted. The glass when melted is dipped out with a spoon and broken or ground; brown oxide of copper, oxide of lead, oxide of tin, and borax are again added and melted anew. The color of this glass is not developed until it has been repeatedly heated; in cooling it becomes perceptible. This glass requires particular care in its preparation and blowing, and but little of it is made successfully in this country.

Opal.—This glass is produced by adding calcined bones to the metal or batch; it is much used for gas and lamp globes, clock dials, etc. Pure cryolite has also been used for the manufacture of opal glass, and a factory was started a few years ago in Philadelphia to make this glass, under the name of hot cast porcelain. The name was unfortunate, as the glass was not cast, but was pressed and blown. This misnomer, with other reasons—the principal one, perhaps, there being no economy in the use of cryolite—carried the establishment under. Our manufacturers, however, still continue to use it with good effect, but principally in the making of hollow ware. The Philadelphia factory used the following ingredients:

Cryolite	10 pounds.
White sand	20 "
Oxide of zinc	20 "

The dirty, discolored oxide answers very well for this purpose. Fluorspar has also been employed for making opal glass.—*Glassware Reporter.*

Care of the Teeth.—Duty of Dentists.

There is, perhaps, as much oversight or neglect by the average dentist, in the matter of the cleansing teeth, in the ordinary cases that come to his care, as in any other particular in practice. How often is it that teeth that have been recently filled will exhibit upon their surfaces more or less of foreign matter, usually salivary calculus? This is sometimes removed from the exposed surfaces, while it is permitted to remain in considerable quantities beneath the margin of the gums.

When the care of a set of teeth and the mouth is committed to the dentist, the first step, so far as treatment and manipulation is concerned, is to render all the teeth thoroughly clean, removing every particle of foreign matter, and polishing the surfaces as perfectly as possible; giving particular attention to all rough and abraded places. The gums should be rendered healthy and freed from all irritants. In proper and systematic treatment this should precede the operation of filling. Still, in some cases, it will be necessary that all go on together, but the rule should be that thorough cleansing precede the operation of filling.

Cleaning the teeth and making the mouth healthy is as important as, and, indeed, more so in some respects than, the operation of filling decayed teeth.

A writer in the *Dental Register* says: If the profession could feel the full importance of this, better success would attend the operation of filling.

He who neglects the condition of the mouth in respect to health and purity, and simply fills teeth, irrespective of these conditions, does both himself and patient great injustice. Such operations, however well performed, are far less efficient than they would be, if the mouth were kept clean and free from disease. Nor is it enough that the mouth be made healthy and pure, but it must be *kept* so, if the work of the dentist is to be of permanent service. And in order that this good condition of the mouth be maintained the patient should have a clear understanding of its importance, and of the means by which it is accomplished, and be made to feel that it is mainly dependent upon himself. It is the duty of the dentist, not only to fully impress this fact upon the mind of his patient, but also to give him all needed information as to the means to be used.

In order that the mouth be kept in proper condition, it should be examined thoroughly, once in from four to twelve months; with some as often as every four months; with others once in twelve months will suffice. The dentist who has the best interest of his patients at heart, and a just appreciation of his own reputation, cannot afford to dismiss them indefinitely, or until the patient finds something breaking down, or is admonished by the pain of some active disease.

It is very often that quite faulty fillings in mouths, kept healthy and clean, seem entirely to arrest decay of the teeth in which they are; while in mouths that are neglected, impure and diseased, the most perfect fillings utterly fail to save the teeth for any considerable time.

Were dentists as careful in this matter as they ought to be, there would be far less of failure in operating upon the natural teeth than is at present realized; and the appreciation of the service of the dentist would be much greater, and his reputation of a higher order than at present, a result to be greatly desired.

Progress of Sorghum Sugar Manufacture.

The Champaign Sugar Works, Champaign, Ill., were the first large sorghum sugar works ever started in the United States. They have ground the cane this season raised on about 1,000 acres of land, and the result is a perfect success in the way of making a first class quality of sugar that polarizes 97 degrees, and much sweeter than sugar made from cane or beet roots. For years experiments have been made to find out some way to change sorghum sirup into sugar. The attempt was unsuccessful up to last year, when the State of Illinois offered a bounty to any one who would succeed in granulating the sirup into sugar. Experiments made at the State University of Illinois, in Champaign, by Professors Weber and Scovell, succeeded in accomplishing the result. A ready sale is found for all the sugar and sirup made, and the success here will cause a large number of sugar works to be erected all over the West, for sorghum cane will grow where corn can be raised, and where farmers can make $15 an acre in raising corn they can realize $30 an acre in raising sorghum cane to sell to these factories.

The result of this discovery is likely to make as great a change in this country as the making of beet sugar has in Europe, where to-day two-thirds of all the sugar in the world is made. Out of a total production of three million tons, France, Belgium, and Germany produce two million tons. The Champaign Sugar Works have introduced all the modern improvements. The machinery, boiler, and vacuum pans were made by the Atlantic Works in Brooklyn, N. Y. They use both the Weston and Hepworth centrifugals. The sugar cane trash called "bagasse" is carried on conductors directly from the grinding mill and dropped into the furnaces in its green, wet state. The boilers are set with the Jarvis patent furnace, and hot air is discharged directly over the fires, igniting the gases generated by the burning fuel. The intense heat made by joining the gases with hot air is said to cause the green crushed cane or bagasse to burn very well, on something the same principle as tanners burn their wet bark from the leaches.

The Jarvis furnace is now in successful operation in the islands of Cuba and Santo Domingo, Guatemala, and the Sandwich Islands. In the West Indies the bagasse has to be dried on the "batey" before using. With free labor this is a costly job; and as the slaves are being gradually emancipated, every possible means will have to be used to burn the bagasse without drying. In the United States, at New Orleans and the West much of this material has heretofore been thrown away, and coal or wood used for fuel, because, although the wet bagasse could be burned, but few of the sugar manufacturers would use the improved furnaces necessary.

A Steamer Struck by Lightning.

Some months ago, when entering the Bay, the Pacific Steam Navigation Company's steamship Colombia was struck by lightning. The vessel was not injured, as the conductor on the foremast conveyed the flash into the sea, but the forward part of the vessel was so powerfully magnetized by the current that alterations have to be effected. When running on certain courses the compasses are untrustworthy, and the movement of the wheel is sufficient to deflect them. Capt. Bass, who is now in command of the Colombia, believes the steering chains and the wheels they travel on have been magnetized by the electric current, and when the vessel reaches Callao they will be changed. The magnets on board were all demagnetized and reduced to the condition of ordinary iron. The circumstance is rare, if not entirely new, and will attract the attention of seamen.—*Panama Star and Herald.*

SIEMENS' BELL FOR THE TRANSMISSION OF SIGNALS ON RAILROADS.

At the Munich Exhibition of Electricity the exhibit of the General Direction of the Railroads of the Kingdom of Bavaria consisted of three stations—two terminal and one intermediate—containing various telegraphic apparatus, Siemens' bells with optical signal, a semaphore with maneuvering device, and a bell, likewise of the Siemens type, utilized for sending, from a point situated between two neighboring stations, telegraphic despatches in Morse characters, or demands for aid. The stations corresponded with each other by means of two Morse apparatus—one of them of the usual style and the other of the Frischen model. The first of these operated by continuous currents, and was provided with a Witwer call bell, so arranged that thestation with which it was desired to correspond might be called without bringing in any of the bells placed in the general circuit.

To effect this the bell of each station is, in its normal state, outside of the circuit, and can only enter it when the needle indicator, actuated by a clockwork movement, is in the definite position that corresponds with an order number. When it becomes necessary to call an intermediate station, the indicators of all the stations of a line are set in motion simultaneously by the station that desires to call; and, as soon as the needle has reached the order number corresponding with the station that is to answer, a simple maneuver of the Morse manipulator actuates the bell. The principle of this apparatus is based upon the graduated resistance of electro magnets in which a continuous current is circulating.

The second Morse apparatus is chiefly utilized for exchanging communications with the large bells installed on the open way. In ordinary times this apparatus is out of the line that connects two stations, and is interposed momentarily by means of a commutator set in motion by a pedal arranged under the table that supports the apparatus.

The call bells, which are placed upon the telegraphic tables of each office, are provided with a small disk, which, by making its appearance outside of the box, indicates the point whence the call emanated.

As these bells are alone interposed in the circuit, the agent must, in order to answer the call from a neighboring office, bring the Morse apparatus into the general circuit by means of a pedal commutator.

The large bells installed along the open way are likewise interposed in the general line. In order to transmit signals or telegrams from any station to a terminus, it suffices to produce interruptions, by means of a manipulator, in the permanent current circulating in the line. These same bells may be actuated from the stations by a powerful magnetic inductor, and are consequently so regulated that they cannot operate under the action of the continuous current of the line. These apparatus consist of a clockwork movement that actuates two hammers, which strike five double blows upon two concentric gongs of different tones. The number of series gives exactly the nature of the signals and the direction in which the train is moving. A series of five double strokes indicates that the train is running in one direction, and two series of strokes that it is running in the opposite direction.

The magnetic inductor that serves for actuating the bells is provided, for each direction, with a sort of Morse key, which permits of directing the current in one direction or the other. To control the signals transmitted by the large bells, there is interposed in the circuit, in one part or another of a station, a registering apparatus consisting of a clockwork movement, which, at every ungearing, acts upon a band of paper and a stylus. As each series of strokes is inscribed upon the paper through an aperture, it is easy to verify the order and signification of the signals. Finally, at each station there are arranged, for the public as well as for the agents of the road, small bells that repeat the signals transmitted by the large ones.

We have seen above that the bells installed along the open way permitted of transmitting signals or telegrams to the neighboring stations. To effect this the bell carries in the center, and in front of the mechanism, a Morse manipulator, which is placed in the circuit of the permanent current that is traversing the apparatus. When, on the contrary, it is a question of sending signals that have been agreed upon, copper disks are used, these being arranged under the mechanism, and carrying upon their periphery, in Morse characters, such phrases as "Way obstructed," "Relief engine," etc. Upon fixing one of these disks upon the prolonged axle of the principal wheel of the mechanism, and the bell being set in motion, the disk makes a complete revolution, and, during this, its teeth raise a spring which interrupts or sets up the circuit alternately. As the signal is repeated several times, the first interruption of the current ungears the bell at the neighboring station, and the employe, being thus notified, interposes his Morse receiver in the circuit by means of the pedal commutator that we have just mentioned. As soon as he has received the signal upon the band, he sends, by means of the inductor, four series of bell-strokes, which indicate to the guard that his request is understood.

When the service requires a longer telegraphic correspondence along the open way, a portable Morse apparatus is used, this being inclosed in a special box at the stations and connected by two wires with the general line.

SIEMENS' ELECTRICAL GONG FOR RAILWAYS.

Finally, in addition to the apparatus just mentioned, the Bavarian railroads employ a type of semaphore which can be maneuvered only by order of the stations; such order being given the guard by a bell actuated by an inductor. The maneuvering of the semaphore arm is controlled by a signal which appears at the station in a small box provided with a circular aperture.—*La Lumière Electrique.*

The Canal from St. Petersburg to Cronstadt.

The means of communication between St. Petersburg and Cronstadt are a matter of extreme importance to Russian commerce, since all goods from the interior of the empire intended for exportation are brought to the capital during the fine season, by rail and canal, transshipped into special barges, conveyed by the present narrow canal to Cronstadt, and there reshipped for sea transport. The converse is the case with imported goods for the north of Russia, and much expense and delay is the result. Communication is at present carried on, says *Engineering*, by means of a narrrow and sinuous canal, which crosses the vast delta of the Neva. Its depth is variable, the minimum being 9 feet 6 inches, and it is of course injuriously affected by the floods to which the basin of the Neva is so liable, when the river is full, and a strong westerly or northwesterly wind blows back its waters. It was therefore decided to construct another and larger canal, in a new line, instead of attempting to enlarge the old one; and in the year 1876 the works were commenced, and are now about two-thirds complete. The canal starts from the mouth of the Neva, where it will open into a large basin, and proceeds southward for nearly two miles. In this part of its course it will have a navigable width of 207 feet, and will be carefully embanked. Taking a wide curve, it will then join the canal which goes direct to Cronstadt; and from the same point a branch will proceed to meet the Neva above St. Petersburg. It will have a uniform depth of 22 feet. The soil is easy to work, consisting almost entirely of clay, sand, and gravel, and a total quantity of 47,737,000 cubic yards of ballast has been extracted, being about two-thirds of the whole. The remainder will be excavated by the end of next year. This material has been used in constructing the extensive embankments required. The foundations of the embankments were laid with a double row of timber pontoons filled with gravel; their internal faces were then covered with planking, and plastered with clay. The space thus formed and lined was filled with liquid mud by Burt and Freeman's mud pumping apparatus, and the contained water was allowed to escape by openings provided for the purpose. The sloping sides of the dike are protected only by unmortared masonry, resting on a bed of ballast. No provision has been made against sand. The dredgers employed were all English, except two small ones made at St. Petersburg, and one in Belgium; they number altogether ten, and are capable of excavating a total of 188,354 cubic yards in ten hours' work. Eighty-six barges and lighters are also in use, capable of transporting 153,038 cubic yards; twelve tugs, of a total force of 600 horse power; one steamboat and two steam launches, for purposes of inspection; two floating dredgers, one Gabert excavator, and seven locomotives with a centrifugal Neut and Dumont exhausting pump. Any deficiencies in this plant are supplied by hiring.

GROUND has been broken at Crystal Park, Col., for a railroad to the top of Pike's Peak, 14,200 feet above sea level.

USEFUL FURNITURE BY SHERATON.

These designs, executed entirely from the drawings of Sheraton, besides illustrating some exceedingly useful pieces of everyday furniture, exhibit a practical type of work which has a special character of its own; and not only so, but each example seems to answer its purpose fully without any endeavor after display or peculiar fancy. The corner cabinet washstand here drawn, although elegant in its outlines, is simply a useful cabinet, well adapted to an office or study, and without protruding its precise purpose, which in such a case is a distinct advantage, admirably fulfills its intentions. The water supply is drawn from a lead lined cistern, and after use is received by a movable vessel contained in the lower chamber. Its top is adapted for the display of a vase or sculptured bust.

The combination steps and reference desk for a library were executed to the order of Mr. Campbell, Upholsterer to the Prince of Wales, and were first made for King George III., who is said to have used and highly approved of them. The whole thing is made to fold at once into the table to which it is attached. The size of the table is 3 feet 10 inches long by 2 feet 9 inches high, and 2 feet 1 inch in width. When the steps are out they rise 33 inches above the top of the table frame, and the total height of the last step is 5 feet 5 inches from the ground. The hand-rail is 3 feet 1 inch above the last step, and the desk, or book rest, is constructed of iron, made to stand so firmly that a book may be referred to or a passage copied without obliging the user to descend into the room.

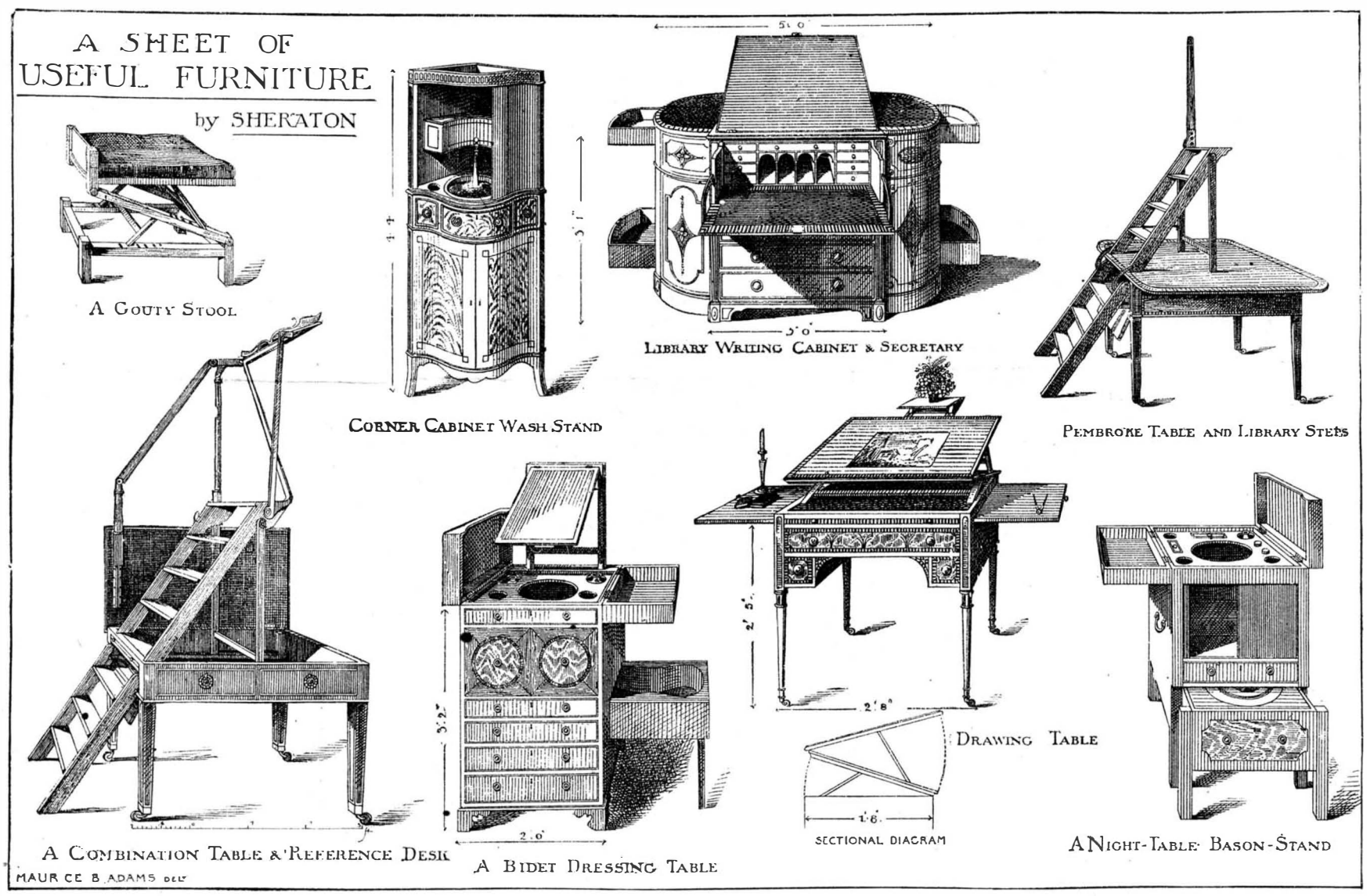
scratching the table top, their feet are shod with felt shoes or wads. The length of the table is 3 feet 6 inches by 22 inches wide. It is 30 inches high, and the steps, in total height, measure 5 feet. At the time these pieces of furniture were made (1793) they were protected under a patent.

Another piece of library furniture is the writing cabinet and secretary, so contrived to be used either sitting down or in a standing posture. The secretary drawer is adjusted for the first position, and is provided with a series of useful pigeon holes and drawers. Being intended for the use of an architect, the lower body of the piece is fitted with deep drawers for drawing papers and plans together, with tee-squares and straight edges. The table top is specially contrived for drawing purposes, while the semicircular ends extending beyond the rising desk afford suitable space for drawing instruments and color boxes; two drawers occur below these shelves, and give ready accommodation for materials not in use; below these at either end are more drawers with four cupboards, all being triangular on plan, but nevertheless very useful for upright articles. Beyond the paper drawers on the reverse side are a series of bookshelves completing a combination of utility seldom found in one piece of furniture. The piece is made in two parts, the joint being at the secretary slide level.

Below this cabinet we figure an elegant table, said to be "found highly useful to such as draw." It was designed by Sheraton for his own fancy use, but perhaps is more suitable for drawing-room purposes than for

The Chinch Bug in New York State.

Prof. J. A. Lintner, State Entomologist of New York, has been interviewed at length in the Albany *Argus*, of Oct. 10, on the subject of chinch bug injuries in northern New York. It appears that its destructive work was first discovered in June, 1882, by Mr. H. C. King, of Hammond, St. Lawrence County, and that the destruction has increased the present year, though confined to grasses. In this interview, in a communication to *Science*, of Oct. 19, and in a circular issued from the office of the State Entomologist, Oct. 18, Mr. Lintner draws attention to the rarity of the chinch bug in the State of New York heretofore, and to its persistent injury in St. Lawrence County, notwithstanding the past wet season, and finds in these facts reason for the greatest alarm on the supposition that this manifestation is due to an invasion and that the insect shows exceptional power of withstanding constant rains, which are well known to prove disastrous to it in the Mississippi Valley. We have not been able to read over these accounts without feeling that an undue amount of alarm is felt. Since the chinch bug was known to occur in New York in the time of Harris and Fitch, and is found further north both on the Atlantic seaboard and in the Northwest, we see no reason for considering that St. Lawrence County has been invaded from other parts, but should rather attribute the recent injury to undue increase of a species always there, albeit not generally noticed, and heretofore unrecorded. This increase may, in fact, be due to the excessively dry weather that characterized 1880 and 1881, and previous years, the reacting wet weather



USEFUL AND UNIQUE FURNITURE BY SHERATON.

To fold up the steps the following method has to be adopted: Unlock the book bracket, which is fixed by a catch at the end of the handrail, turn the flap over to the inside, and the whole comes forward and lies level upon the upper steps. The longer standard may then be lifted out of its socket, and, having a joint at its upper end, turns up level with the handrail. The short standard is then, by relieving a spring, pressed down below the edge of the table top, and the handrail with the long standard having been folded together as described, they both rest on an iron socket fastened to the front edge of the upper steps, as shown. The supporting frame, or horse, is then folded by the side of the upper steps, when they and the whole contrivance fall down within the table frame. The lower set of steps can now be turned up to a horizontal position, and being hinged to a slider which runs in a groove, slips in as a drawer, and is inclosed by the flap, which turns up and appears as the front of a drawer. When the steps are not in use, the table is furnished with a desk for writing purposes.

A similar, but more simple, arrangement of steps is shown in combination with a Pembroke table. Here the upper flight turns down upon the under one; both flights then rise up and slide into the drawer space, being inclosed, as before, with a fall down drawer fronted flap. The post and hand-standards are hinged, and so fold up by the side of the top steps, while, in order to prevent the legs of the horse from

the hard everyday work of a designer. A diagram section shows how the upper portion is regulated and adjusted by a double horse, and besides this contrivance, for model drawing or when studies are made from nature, a flap bracket is provided with much ingenuity on the upper edge of the drawing desk, so that any object, such as a vase or flower-pot, may stand level. The sliders at either end afford accommodation for drawing instruments, candle or lamp, etc. The long draw is deep and broad enough for Whatman's sheets of drawing paper, and the side drawers, forming the "knee-hole," are fitted up for colors.

The bidet dressing table at once bespeaks its several useful purposes, with its sunk water-bottles, sliding up looking-glass, folding flaps, and useful cupboard; while the same remark equally applies to the night table basin stand, also illustrated. Both are practical pieces of funiture intended for emergencies as well as for daily use, and, without any claim of beauty, perform their purposes in a modest and unaffected manner, which is more than can often be said of recent specimens of their kind. The Gouty stool, if not so much needed nowadays as in the port wine drinking times of George III., is certainly not a disused or unnecessary article. The upper part is furnished with a stuffed squab, covered with horsehair, and its level or inclination can be adjusted to almost any angle to suit the wants of the patient, while the whole thing stands well, square and firm.—*Building News, London.*

not having yet produced an injurious effect upon it. In this view of the matter, which seems to be the most reasonable, the outlook is rather encouraging than alarming, and we fully expect to see this view corroborated by subsequent events, *i. e.*, the pest will sink back to its state of harmlessness next year and probably perish in immense numbers during the coming winter. We would not, however, by any means have the farmers relent from the measures recommended by Mr. Lintner in the circular already alluded to, though he can scarcely expect them to carry out his advice without some obligatory law or some compensation from the State.—*C. V. Riley.*

How to Examine Water for Urea.

Into a tube 60 to 80 centimeters in length and 15 millimeters in width, and closed at one end, M. Balland pours a few c. c. of a solution of sodium hypobromite. He fills it up completely with the water to be examined, applies the thumb to the surface so as not to admit any air, inverts the tube, and places it in a large glass containing mercury. If urea is present, small bubbles of nitrogen gradually rise in the tube, and collect at the upper (closed) end.

THE largest locomotive ever built is now being made in Sacramento by the Central Pacific Railroad. The engine and tender will weigh 105 tons, and will be 65 feet 5 inches long.

History of the Alphabet.

How many of the millions that daily use the alphabet ever stop to think of its origin and long history? In the true spirit of a student, Isaac Taylor, a well known English writer on philosophical and philological subjects, has recently written and published, in London, two stout volumes under the title: "The Alphabet, an Account of the Origin and Development of Letters." It is only by help of recent discoveries of early inscriptions and the progress in the art of reading lost languages and deciphering hitherto unknown symbols, that such a well posted history has become possible. By careful study of the learned essays and scientific investigations of the latest philologists, Taylor has set forth in language within easy comprehension the origin of the alphabet, showing that our own "Roman" letters may be followed back to their very beginning, some twenty or more centuries ago, as he asserts. We have no better letters, according to this account, than those of the Italian printers of the fifteenth century. These were imitated from the beautiful manuscripts of the tenth and eleventh centuries, the lettering of these being derived from the Roman of the Augustan age. The Roman letters, in turn, are traced to those employed at Rome in the third century B. C., and these do not differ greatly from forms used in the earliest existing specimens of Latin writing, dating from the fifth century B. C. This primitive alphabet of Rome was derived from a local form of the Greek alphabet, in use about the sixth century B. C., and that was a variety of the earliest Greek alphabet belonging to the eighth, or even the ninth century B. C. The Greeks got their letters from the Phœnicians, and theirs are clearly traceable in the most ancient known form of the Semitic.

The most ancient of books, a papyrus found at Thebes, and now preserved in the French National Library, supplies the earliest forms of the letters used in the Semitic alphabet. The Stone Tables of the Law could have been possible to the Jews only because of their possession of an alphabet, and thus the Bible and modern philological science unite in ascribing a common origin to the alphabet which is in daily use throughout the world. The nineteenth century B. C. is held by Taylor to be the approximate date of the origin of alphabetic writing, and from that time it grew by slow degrees, while from Egypt, the home of the Jews during their long captivity, the knowledge of the alphabet was carried in all directions where alphabets are now found.

The Aryans are thought to have been the first to bring the primitive alphabet to perfection, and each letter and each sound may be traced, by Taylor's careful analysis, through all the changes that have marked the growth, progress, and, in some instances, the decay of different letters of various alphabets. It is an interesting fact that the oldest known "A B C" in existence is a child's alphabet, scratched on a little ink bottle of black ware, found in one of the oldest Greek settlements in Italy, attributed to the fifth century B. C. The earliest letters and many later ones are known only by inscriptions, and it is the rapid increase, by recent discoveries, of these precious fragments that has inspired more diligent research and quickened the zeal of learned students in mastering the elements of knowledge of their origin and history throughout the world. As late as 1876 there were found in Cyprus some bronze plates inscribed with Phœnician characters, dating back to the tenth, even the eleventh, century B. C. Each epoch has its fragments, and the industry of English explorers, the perseverance of German students, and the genius of French scholars have all contributed to group them in their chronological order. Coins, engraved gems, inscribed statues, and, last of all, the Siloam inscription, found in 1880 at Jerusalem, on the wall of an old tunnel, have supplied new material for the history. From the common mother of many alphabets, the Phœnician, are descended the Greek and other European systems on the one side, including that which we use and have the greatest interest in; and on the other, the alphabets of Asia, from which have sprung those of the East, Syriac, Arabic, and Hebrew.—*Phil. Ledger.*

Canals at Halifax and Minneapolis.

At a recent meeting in this city of the American Society of Civil Engineers, a paper by S. H. Keating, C.E., upon the "Shubenacadie Canal" was read.

This canal is located between the city of Halifax, Nova Scotia, and the Basin of Mines, an arm of the Bay of Fundy. It was commenced in 1826, and the intention was to build it so as to accommodate vessels drawing 8 feet of water, with the idea that at comparatively small additional expense it could be used by vessels drawing 11 feet. It was to have 15 locks, 87 feet in length and 22½ feet in width, with a lockage ascending from Halifax of 95 feet 10 inches, and descending to the Bay of Fundy of 95 feet 4 inches. The total length is about 54 miles, the greater portion of which was to be in the Shubenacadie River and in a chain of lakes exisiting along the line of the canal.

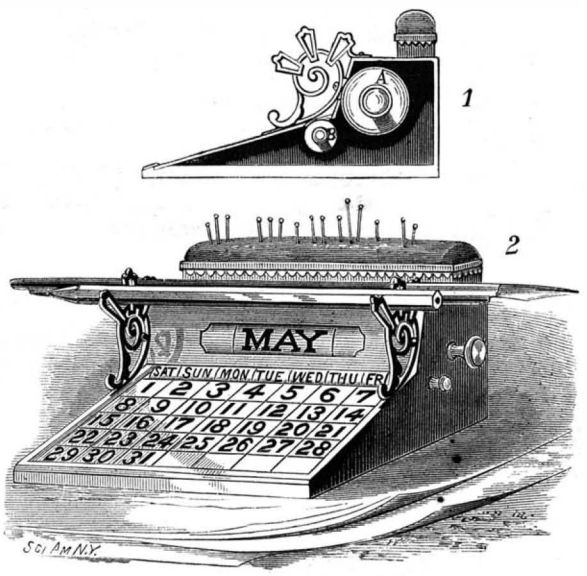
Mr. Thomas Telford, the celebrated engineer, made a very favorable report upon the proposed canal and its prospects. Up to the close of 1831, £72,000 had been expended upon the work, which was, however, in an entirely uncompleted state; some of the locks near Halifax had not been commenced, and large and expensive work remained to be done upon the line of the canal. All the available capital being exhausted, the works were abandoned, and fell into ruin, never having been completed on the original plan. In 1856 a report was made by Mr. W. H. Talcott, C.E., upon a scheme for completing the works upon a very much smaller scale than at first proposed, substituting for certain of the locks an inclined plane near Halifax, with a lift of 55 feet, and a similar plane with a lift of 33 feet at another point, the plants to be worked by hydraulic machinery. This report was adopted, and the work was completed in 1862, at a cost of $200,000. The diminished canal has, however, proved a failure as a commercial enterprise, and since 1870 no trade of any account has been carried on through it.

There was also presented a description by Charles C. Smith, C.E., of a hydraulic canal built at Minneapolis, Minn., during the severely cold winter of 1881. This canal is under Main Street, Minneapolis, its entrance being at right angles to the street. It is covered with a semicircular rubble stone arch of 17½ feet span, and where the line turns the angle of 90° the abutments of the arch were built of curved lines of the radius of 31¼ and 48¾ feet. The arch was built of rubble masonry of stone varying from 4 to 6 inches thick, and from 18 to 36 inches long; the joints at the soffit being slightly hammered off to approximately form beds conforming to the radial lines of the arch. The mortar was made of one part Louisville cement to two parts sand, and was mixed in hot water without salt. During its construction the weather was extremely cold, the frost having penetrated the ground to the depth of six feet. An examination of this work having been made quite recently, it was found to be perfectly sound and free from any indication of settlement or rupture two years after its construction.

A discussion followed by the members present, more particularly in reference to the best methods of laying masonry in very cold weather, the experience of a number of members being favorable to the use of a strong solution of salt in the water with which the mortar was made.

PAPER WEIGHT, CALENDAR, AND PEN RACK.

A combination paper weight, calendar, pen rack, and pin cushion has recently been patented by Mr. Josias R. King, of 231 Fort Street, St. Paul, Minn. The box is provided with a front board inclined upward and backward, on which a calendar sheet or table is laid, divided into squares con-



COMBINED PAPER WEIGHT, CALENDAR, AND PEN RACK.

taining numerals, as shown in the illustration, and covered with a pane of glass. Directly above the table, at its upper end, the sheet is furnished with a longitudinal slot, through which a roller, B, can be seen on whose surface the first syllables or initials of the seven days of the week are produced in seven longitudinal rows, the syllables being shifted one space for each following row. By turning the roll any day can be brought above the numeral 1. At the upper end of the incline is a second inclined board, extending to the top of the box, and also furnished with a slot and glass. Behind the slot is a larger roll, A, on whose surface the names of the months are arranged in twelve rows. Both these rolls are journaled in the sides of the box, and have knobs by which they may be turned. A cushion is fastened in a box extending across the top of the main box. At the front ends of the box are upwardly projecting arms for supporting pens and pencils. Fig. 1 is a sectional view, and Fig. 2 a perspective view.

THE London *Inventors' Record* says: It is not generally known that it once cost as much to take out a patent for inventions as to take out a patent of nobility. In 1623, when the Statute of Monopolies was passed, some advocate of protection for the rights of inventors was unfortunate enough to use the word "patent" in connection therewith, and as the only patent then known was one of nobility, some official wiseacre was struck at once with the brilliant idea of affixing the same charge to the one as to the other. There have been important differences, however, between the two classes holding letters patent, one of which could not secure them without conferring a boon on his fellowmen, while the other could obtain them by merely possessing a courtly tongue, a good leg, or a handsome person; yet, *mirabile dictu*, the latter ranks high in the estimation of his fellowmen, while it is often the fate of the former to remain unknown, even after his invention has benefited the entire human race.

Measuring the Intensity of Very Powerful Lights.

If any strong light, like the electric light, for example, is to be compared with a normal candle, the distance to which the former must be removed is inconveniently great. Dr. H. Hammerl has devised a very ingenious method of reducing the intensity of any light by purely mechanical means, cutting off one-half, three-fourths, or even nineteen-twentieths of the light, so that what remains is easily measured. It consists in placing in the path of the rays that fall upon the screen a revolving metallic disk from which are cut sectors that allow a portion of the light to pass through, but cut off and absorb the remainder. If the sum of the angles of all the sectors taken together equal 180 degrees, one-half of the light will be intercepted while the other half passes through. Experiments show that three sectors will suffice to give a uniform illumination with a moderate speed of revolution. The size of these sectors will, of course, depend upon the amount of light to be cut off. When it is desired to reduce the light to one-third, each sector must have an angle of 40°. If each sector have an angle of 12°, the light will be reduced to one-tenth, and so on.

When two disks are employed each having three sectors of 60° each, they can be so arranged on the axis as to give any desired result.

If a single disk is employed, the openings should not be true sectors having a definite angle at the center, but cut so that the angle decreases from the center toward the circumference in a definite ratio. This may be so chosen that the weakening shall regularly increase from center to circumference just as the distance from the center increases. When this form of disk is employed, the usual greased spot on the screen must be elongated instead of round, and as long as this opening. One end of this spot will be dark, the other light, and it must be noticed where this change occurs, and the amount of weakening read by a scale on the disk itself. —*Zeitsch. f. Instrumentenkunde.*

Decomposition of Feldspar by Humus.

A Russian named Meschtschersky has been experimenting upon the decomposition of common feldspar by humus both in the laboratory and in the garden. Finely ground orthoclase was sealed up in a glass tube with humus and water and heated for 9 or 12 hours daily to 115° C. (239° F.), for one or two months; he then filtered the contents of the tube and examined both residue and filtrate. Another experiment was conducted under ordinary conditions, the orthoclase and humus being placed in a tin box with double bottom and buried in a garden for six months.

In both cases the orthoclase was decomposed. The composition of the feldspar employed was as follows: Silica, 62·02; alumina and oxide of iron, 23·93; lime, 0·25; potash, 7·21; soda, 4·39.

The humus was obtained by the action of sulphuric acid upon racemic acid. When washed and dried at 120° C. it consisted of 57·17 per cent carbon, 4·59 hydrogen, 37·96 oxygen, and 0·28 ash.

He draws the following conclusions from his experiments: 1. Orthoclase is decomposed by humus in the presence of water, giving up its constituents to the humus and taking up water. The separation of silica, alumina, and soda are the easiest, that of potash the hardest. Hence there is an essential difference between this decomposition of orthoclase and weathering. 2. The humus is partially decomposed into carbonic acid and water, and partially converted into soluble and insoluble mineral compounds of humus. 3. The decomposition is directly proportional to the time and temperature.—*Berichte.*

The Folly of Anti-Vaccinators.

How any intelligent man can deliberately oppose vaccination in the face of the abundant testimony of its efficacy is truly a hard problem to solve. One of its most violent opponents in England, says the *Medical and Surgical Reporter*, was a certain William Scott, of Rotherhithe. Recently small pox broke out in his family, and carried off his wife and three children. Regret for what might have been prevented so preyed on this man's mind that he committed suicide.

When we realize what great publicity has been given to the facts concerning vaccination, we can hardly help but lay the deaths of this man's wife and children at his door. Of course, no doubt, he was conscientious in his opposition to vaccination; but still, facts do not admit of argument, and it is almost impossible to conceive of any intelligent man finding sufficient evidence to warrant him in opposing this beneficent discovery. This sad occurrence should be given all possible publicity, as a warning to other anti-vaccination agitators.

The Magnetic Pole.

Professor Thompson, in a lecture at Glasgow, stated that the magnetic pole is now near Boothia Felix, more than 1,000 miles west of the geographical pole. In 1657 the magnetic pole was due north, it having been eastward before that. Then it began to move westward until 1816, when the maximum was reached. This is now being steadily diminished, and in 1976 it will again point true north. Professor Thompson says that the changes which have been observed, not only in the direction but in the strength of the earth's magnetism, show that the same causes which originally magnetized the earth are still at work.

Star-Fish Destroying the Connecticut Oyster Beds.

The cultivation of oysters in beds in Long Island Sound, off the Connecticut shore, has been rapidly developing into a very considerable industry within a few years past. The water over these beds varies from 25 to 60 feet in depth, and the bottom is of gravel, free from mud. But an enemy of the oyster, the star-fish, has recently appeared in large numbers, and is said to be completely destroying the oysters in some localities. The fish is covered with a tough, leathery skin beset with prickles, and has the form of a star, with five rays or fingers radiating from a central disk, the size averaging six inches in diameter across the fingers, though some measure as much as twelve inches. In the middle of the under surface of the disk is situated the mouth, opening into a digestive system which sends prolongations into each ray. The prickly skin is supported by a series of plates beautifully jointed together, and the plates have perforations through which tubular feet can be protruded to effect locomotion. The star-fish can propel itself over rough surfaces and into all nooks and crevices, and is found generally near rocks, upon which they fasten. If one of its arms become broken in any way, as by getting it entangled in a crevice of a rock, or having it bitten off by a voracious fish determined upon making havoc of this particular star, the deficiency is soon remedied, as another arm grows which replaces the missing member. Some species of the star fish possess the power of demoralizing or breaking itself in pieces, and thus multiplying its kind, as each piece retains its vitality and grows into a perfect specimen of the tribe again. The star-fish generally travels in "schools;" when he is hungry he gets outside of his dinner by, as it were, turning himself inside out. He turns his stomach out of his mouth and envelops the morsel to be engulfed, ejecting a fluid between the shells which kills the oyster.

One oyster breeder has been at work with a small steamer dredging for these enemies of the oyster, and some idea may be formed of their ravages when it is known that in one day recently he captured over 300 bushels of them during seven hours' dredging. One bushel is estimated to contain more than 1,000 star-fish. The fish so caught are spread on the land as a fertilizer.

Making Black Leather.

It is not every sort of leather that will take the black color equally well, says *Gerberzeitung*, the oak tanned taking the color best, pine and birch bark leather taking it the worst. If the leather does not take the color well, it should receive some previous preparation. A solution of the carbonate of soda is generally used for this purpose; although the use of caustic soda or ammonia is less injurious to the leather. The leather is then washed off with clean water and the ground color laid on thinly with a brush and rubbed in until it is all taken up.

A good preparation for this purpose is obtained by boiling Campeachy wood for half an hour in twice its weight of water, adding a sixth part of fustic to give a more intense black, pouring off the decoction, and boiling the wood in clean water for two hours. Some potash may be added to the second decoction to aid in the extraction. The dye is poured off clear or filtered and preserved in a closed vessel. The black color is prepared by treating old iron with a decoction of barley, sour beer, or sweet tan liquor. It is left for a few days, the dirt removed from the surface, and the clear liquid drawn off. This black color must not be applied until the ground color is completely absorbed, or the leather will be sooty. After the black dye has been rubbed in with a brush, it will have a finer appearance if another light coat of Campeachy solution is applied, and then rinsed with water until it runs off clear.

The Tehuantepec Ship Railway.

The survey for the Eads ship railway is now completed, and has been handed in to the company's office in New York, by Mr. Van Brocklin, the resident engineer. Together with a large corps of assistants, Mr. Van Brocklin was employed from March 20 to August 17 in making a minute and accurate transit and level survey of the proposed route, and the results are most satisfactory to the projectors. The total length of the line from Minatitlan to Salina Cruz is 153 miles. For the first 60 miles it would pass over a well timbered and fertile alluvial plain. The next 20 miles would be a gradual ascent up a wide valley to the foot of the hills which form the backbone of the isthmus. Here there would be some difficulties to be encountered, but nothing at all exceptional. The hilly portion would be about 33 miles, after which the line would run over a level plain. The maximum gradient will be only 1 in 100, and this will only be found within a distance of 12 miles. The health of the surveying party was excellent during the whole time of their work. The estimates of construction are now being prepared, and will shortly be ready.

AN International Society of Electricians has lately been organized under the patronage of the French department of Posts and Telegraphs. The society now has 900 members, among the organizers having been Sir William Siemens, V. H. Preece, Dr. O. Frolich, Latimer Clark, F. Bolton, Sir William Thomson, C. H. Gray, and many others. The date for applications for admission from United States members was postponed to January 15, and should be addressed: President of International Society of Electricians, No. 99 Rue de Grenelle, Paris, France.

Liquid for Determining the Specific Gravity of Minerals.

Nearly all natural minerals are heavier than water, and therefore sink in it. But when they are placed in a heavy liquid which does not dissolve them, some sink and others float. If two minerals of unlike gravity occur in the same rock, they can be separated by pulverizing the rock and putting them in a liquid intermediate in weight between both. A new liquid for this purpose has been devised by C. Rohrback, having a density of 3·57. It is an iodide of barium and mercury, and is prepared as follows: 100 parts of iodide of barium and about 130 parts of red iodide of mercury are mixed with about 20 c. c. of distilled water, shaken, and heated on an oil bath to 150° or 200° C. until dissolved, and then concentrated until it will float a crystal of topaz. After standing several days the clear liquid is decanted and filtered. It has a yellow color, boils at 145° C., and refracts light strongly. It can be used for separating axinite, kyanite in part, epidote, heavy mica, some garnets, and nearly all hornblendes; also jade, olivine, orthite, nearly all members of pyroxene group, saussurite, titanite, topaz, heavy tourmaline, vesuvianite, and basaltic rocks. In diluting it to obtain any special density, it is mixed with a dilute solution of the same, so as to avoid precipitation. After the separation the powdered minerals are washed with a few drops of iodide of potassium.—*Wiedermann's Annalen.*

The Life-Saving Service.

The report of the General Superintendent of the Service for the last fiscal year shows that there were 149 stations on the Atlantic, 37 on the Lakes, 7 on the Pacific, and 1 at the Falls of the Ohio, a total of 194. During the year there were 300 disasters to vessels, on board which were 3,792 persons, of whom 3,777 were saved and only 15 lost. There were 651 shipwrecked persons succored at the stations, 1879 days' relief being afforded. The estimated value of the vessels was $5,100,925, and of the cargoes, $2,075,615. Of this amount $5,611,800 was saved and $1,564,740 lost. Sixty-eight vessels were totally lost. There were 116 disasters to smaller vessels, on which were 244 persons, all of whom were saved but 4. The property here involved was $66,180, $6,280 of which was lost. The assistance rendered during the year in saving vessels and cargoes has been much larger than in any previous year, 337 vessels having been worked off when stranded, repaired when damaged, piloted out of dangerous places, or similarly assisted by the station crews. There were, besides, 125 instances (39 more than in the preceding year) where vessels running into danger of stranding were warned off by the night signals of the patrols, most of them thus being saved from partial or total destruction.

New Steam Bronze.

On adding a solution of potassium bichromate to one of manganese chloride no precipitate is obtained, but if the neutral chromate is used there is an immediate bronze precipitate. Setting out with these facts, M. Blanche has made up a color with a mixture of potassium bichromate, manganese chloride, and sodium acetate. By the action of heat the sodium acetate is decomposed, the acid chromate neutralized, and the precipitate mentioned above is formed upon the cloth. The color employed was:

Bichromate	100 grammes.
Water	850 "
White starch	150 "

Boil, let cool, and add:

Crystalline manganese chloride	210 grammes.
Sodium acetate, 16½° B	210 "

The color, when printed and steamed, gave a very intense bronze, scarcely affected by washing and soaping. The cloth was not affected. The same mixture, leaving out the starch, may be used for steeping cloth, and thus produces a bronze, which may be discharged by tin crystals and an acid. M. Blanche also inquires whether the bronze is manganese peroxide or a sub-chromate.

Storage Battery Light.

A Pullman dining car of the 5:40 express to Leeds has been lit by six Swan incandescent lamps, supplied with electricity from one primary battery of twelve cells, the dimensions of the battery being: Length, 4 feet; breadth, 8 inches; and depth, 8 inches. The battery is of zinc and carbon, with new depolarizing arrangement, the details of which have not been made public. The lamps diffused a bright, warm, and perfectly steady light, which was at no moment affected by the oscillation of the carriage, and which made it not only possible, but perfectly easy, to read a newspaper or book printed in small type. The result of other preliminary trials of the system has been that several railway companies, including the Great Eastern, the South-Eastern, and the London and Southwestern, have shown a desire to adopt it. The light can be turned on or off at pleasure, and it can, therefore, be used in the day when a train is passing through a tunnel. The inventors of the battery express a belief that they will be able to supply private dwellings with electric light for less than the estimate lately put forward by the Edison Company and the Golcher Company. The battery which was used on Thursday week weighed under 150 lb., and one capable of supplying eighteen lights for eighteen continuous hours would weigh about 3 cwt. The inventors of the system are Mr. G. C. V. Holmes and Mr. F. E. Burke.

Surviving a Severed Throat.

In 1877 Louis C. Londenski was crossing the mountains in Roumania when his party was attacked by robbers. All had their throats cut, but Londenski had only his windpipe severed, his jugular vein being unharmed. As he showed signs of life he was hanged, yet the rope did not strangle him, as he still breathed through the aperture. After a time he was discovered and cut down, when he was removed to Vienna, when Professor Schraeder effected what is almost a cure. From Vienna he traveled about the world, exhibiting himself at different medical colleges.

He is at present in Buffalo, N. Y., and Dr. S. H. Warren, after a careful examination, describes his wound as follows: "An incision was made across the throat from the inner side of both jugular veins, which extends to the carotid artery, severing the tracheæ, or bronchial tubes. Through the orifice can be seen the vocal cords, larynx, and diverging tubes. Londenski, at his pleasure, can show the action of the glottis in respiration—something never before beheld by surgeons in a living subject."

The *Tribune*, in describing the case, states that he breathes through a tube three-eighths of an inch in diameter, which curves downward. He lives mainly on liquid food, being unable to digest gross food. He smokes considerably, having been advised to do so by Professor Schraeder, exhaling the smoke through the hole in his neck, which is just below the Adam's apple, and in which is a tube that he closes when he wants to speak. The glottis, through disuse, has almost closed up.

Purchase of the Great Mexican Volcano.

It is said that the recent excursion to Popocatepetl had for its object the looking over the ground for the mammoth works projected to facilitate the mining of the sulphur from the crater. It is proposed, says the *Mexican Financier*, to drive a tunnel into the crater of the volcano and to build from the mouth of the tunnel a railway to connect with the Interoceanic Railway at Amecameca. The parties who are in negotiation for the property with the owner of the volcano, General Gaspar Sanchez Ochoa, are said to be a rich American house. The representative of the house visited the volcano with the French engineer, Mr. Charles Roay. A contract is said to have been made for the exportation of 50,000 tons of sulphur a year at least. It is also proposed to establish a factory of sulphuric acid for use here in Mexico, selling it at $3 a quintal of 65° strength. These products of Popocatepetl will add largely to the business of the Interoceanic Railway. The railway up the side of the highest mountain in North America will probably be largely patronized by tourists, who would go there by the thousands annually were facilities offered to make the trip.

Lighting Hell Gate.

The foundations of the electric light tower at Hallett's Point, Hell Gate, have been finished some five weeks. They are five in number, built of concrete on the solid rock, and in height are about four feet above the level of tide water mark. They are arranged—four of them—in the shape of a parallelogram, with another support in the center. Those supporting the corners of the tower are eight feet square and about forty feet apart on one side, and sixty feet on the other. The center support is five feet square. The structure will jut out from the shore, one corner of it being at the extreme angle or corner made by the sharp trend of the land. The ironwork of the tower has been built in Ohio, and is now on its way here. The tower will be similar in construction to that on Coney Island, and the light will be in intensity equal to the power of 5,000 candles. The whole structure will be 250 feet high, cost $20,000, and be completed this autumn.

How the Mint is Guarded.

"It would not be healthy for a burglar to attempt any of his tricks about the mint," said Colonel A. Loudon Snowdon, the other day, to a reporter on the Philadelphia *Record*. "About a year ago I caused all the muskets to be changed for repeating rifles and seven-shot carbines that are darlings. Our outside watchmen, who patrol the streets about the place, are well supplied with firearms. In fact, they are walking arsenals. We can readily arm every person in the building who can handle a pistol or gun. There is no trouble apprehended that I know of, and I cannot divine why the Secretary of the Treasury has ordered Gatling guns and carbines for the mints. I have not requested any, because we are sufficiently armed. At this time there are being turned out over a million of standard dollars each month, and we frequently have $15,000,000 in silver in the vaults. But it would take a little army with cannon to get at it."

A California Canal for Irrigation.

In the SCIENTIFIC AMERICAN of Oct. 27 we copied from the Los Angeles *Herald* some interesting particulars about a great irrigating enterprise being inaugurated in Fresno Co., Cal. The dimensions of the canal and the engineering work required have called out considerable notice, but we would suggest that our California contemporary probably printed the area of land to be irrigated with one too many ciphers. This area was stated at 30,000,000 acres, or substantially the area of New York State, an obviously pretty large territory to irrigate with even a dozen canals, were it desirable to have the job done.

ENGINEERING INVENTIONS.

An improved reversing and expansion valve gear has recently been patented by Mr. Carl W. Finger, of Wilkesbarre, Pa. The object of the invention is to avoid the use of eccentrics and link motions, and economize fuel in working locomotive and stationary steam engines.

Letters patent have been issued to Mr. John D. Fisk, of Hartford, Conn., for a revolving guard to be attached to the cow catcher of a locomotive to throw stones, ties, or other obstructions from the track. A rotating shaft is mounted at the bottom of the cow catcher, and is provided with blades which project about two inches below the bottom rails of the cow catcher. and thus are able to reach and remove obstacles which the cow catcher might not be able to throw out of the way.

Letters patent have been granted to Messrs. James H. Flood and Henry F. Knoder, of Cardington, O., for an improved car coupling. The invention consists of a clasprod for raising the coupling pin from the top or sides of the car for uncoupling the cars, which rod is provided with a set screw for limiting the upward movement of the rod, to prevent the coupling pin being raised too high or entirely out of the drawhead. This invention may be applied to drawheads at present in use, whereby the ordinary link and pin coupling may be made automatic in its action.

MECHANICAL INVENTIONS.

A feed mechanism for cotton seed mills, patented by Mr. Chas. J. Hooper, of Edinburg, Miss., combines a hopper having a flat bottom with two diametrically opposite openings, a centrally revolving shaft, and a sleeve with paddles, the latter inclined to feed the seed into said openings.

A knitting machine has been patented by Mr. Stephen Woodword, of Franklin, N. H. The improvement relates to ribbing attachments, to provide for working any desired number of ribbing needles, so that changes may be made from ribbed to plain work without changing the operating cams or employing other devices for throwing a portion of the needles out of operative position.

Mr. Jean J. A. Larroque, of Paris, France, has obtained a patent for an improved tricycle. In this machine the pedal movement is improved so as to avoid dead center, the seats are so arranged as to be able to be moved either horizontally or vertically, according to the size of the velocipedist and the location in which he wishes the weight to be placed, and further mechanism is provided for rendering the wheels one piece with the axle during the movement in a straight line, and for automatically disconnecting one of the wheels in going around a curve.

An improved clay crusher has been patented by Mr. William W. Wallace, of Frankfort, Ind. This invention consists of a rotary clod breaker placed in the hopper over a pair of crushing rollers, to break the hard clods and cause the clay to feed into the rolls. A weighted relief gate is arranged to be forced open for the escape of stones or clods too hard to be broken by the breaker; and this gate is also arranged to shift as the ends of the clod breakers wear short to maintain the same relations with the clod breakers, whatever their length may be. The same inventor has further obtained a patent for an improved brick and tile machine. In this improved machine hydraulic and screw pressure is employed for pressing the clay through the dies for forming it into bricks, tiles, and other objects. With this machine stiffer clay can be worked than with the ordinary press. It also consists of an arrangement of two pressers and pressing apparatus in such relation with the mixer that the operation may be continuous with the reciprocating presses by alternate action.

AGRICULTURAL INVENTIONS.

An improved form of stock barn has been patented by Mr. Benjamin Walton, of Fairburg, Ill. The walls are double, floors reached by inclined planes, so as to afford free ventilation from passageways and stairways, while the offal may be removed quickly from any height without soiling the outer walls, the double walls having passages communicating with the several floors, and discharging outwardly at the ground.

What constitutes a combination of harrow, roller, and cultivator has been patented by Mr. William H. White, of Cincinnati, O. The rollers may easily be detached or the roller arms elevated, or the cultivator be thrown out of play, so as to use only the harrow, or the device may be easily arranged to use all three together.

MISCELLANEOUS INVENTIONS.

An improved chest protector has been patented by Mr. William H. Purcell, of Elizabeth City, N. C. This chest protector consists of some flexible fabric, woolen, and felt put together in layers, and united at the edges to form an air space within to temper the cold air as it strikes through.

A combined presser foot and gauge for sewing machines has been patented by Mr. Emilus A. Wellman, of Searsport, Me. Its object is to enable the operator to stitch as closely to the edge of the material as may be desired, and with greater facility than with the ordinary presser foot.

An improved oil stove has been patented by Mr. Martin W. Walker, of Sing Sing, N. Y., by which the burner and oil tank are so protected from the heat that the wick tube may be extended nearer the oil, and by expanding the flame above the cone a narrower wick tube may be used.

A bicycle riding platform has been patented by Mr. James B. Elliott, of London, England. It consists in a platform to revolve in a horizontal plane, so that by operating the bicycle thereon the rider will make no headway, thus producing some very novel and comic effects.

An improved folding ladder has been patented by Mr. John K. Landes, of Caledonia, O. Besides being contrived to fold into a very small space, it can be erected to the desired length very rapidly, and can be adjusted to various shapes and forms to make scaffolding.

Mr. P. H. Cherry, of Parsons, Kas., has patented an improved cup for mixing lemonade and other mixed drinks. The cup is provided on its upper rim with a rubber packing ring, and when the tumbler is pressed against the ring a close connection is formed, which prevents the liquid from leaking out during the mixing.

Mr. Daniel B. Hiser, of Wooster, O., has obtained a patent for an improved burial casket. The invention consists in a metallic casket constructed with side pieces and end pieces united by screws passed through the top and bottom rims or flanges, so that none of the screws or bolts will appear on the sides or ends of the casket.

An improved kiln, for burning bricks, tiles, and other wares, has been patented by Mr. Henry McCue, of St. Louis, Mo. The kiln furnace has in its arch hollow spaces and air inlets to direct the air upon the fire bed, with perforated air pipes along the inside of the walls, to insure more perfect combustion and prevent the formation of clinkers.

An improved method of sealing fruit and other cans has been patented by Mr. John Waterous, of Brooklyn, N. Y. By this invention the cement coated cord or strip is applied to the can before the cap or cover is put on, and in such manner that the sealing material will be covered and protected by the cap or cover.

An improved fire escape has been patented by Mr. James Reidy, of Pittsfield, Mass. It is a simple, strong, and easily operated device or machine, to act by its friction on a hanging rope or chain, and also designed to be useful for riggers or others in elevated positions, or while at work on the exterior faces of buildings.

An improved form of rowlock has been patented by Mr. John Snowman, of Weld, Me. The invention covers a collar or sleeve to receive the oar, and having an eye for connection to the thole pin, and a screw or its equivalent to pass into a socket or aperture of the oar, for locking it against rotation in the sleeve, or releasing it to rotate axially and freely in the sleeve, for feathering on the return stroke.

An improvement in pipe clamps has been patented by Mr. Henry M. Dixon, of New York city. It has a slotted base and slotted right angled standards secured to the base adjustably by bolts; the standards have jaws upon their upper ends and ratchet teeth upon their outer sides, and to them are secured curved arms carrying swiveled jaws, so that pipes of different sizes can be firmly held.

An improvement in sewing machine motors has been patented by Mr. John M. Cayce, of Nashville, Tenn. This invention relates to the application of springs for running sewing and other light machines; but such use is made in different forms from those heretofore, so that, by improved construction and arrangement of parts, this source of power will be made more effective.

An invention relating to an improved head for brooms and brushes has been patented by Mr. David B. Turney, of Nebo, Ark. It has special devices for engaging the tufts to prevent them from being accidentally withdrawn from the strips. It is intended that, by this construction, a new broom may be made in a few minutes by simply taking the head apart, removing the old tufts, and replacing with new.

An invention of improved form of elevated tank, designed to facilitate filling street sprinkling wagons, has been patented by Mr. Nathaniel T. Whiting, of San Francisco, Cal. The tank may be made of wood or iron, but must have strength sufficient to resist the pressure in the water main under the street, for it is provided with an automatically closing vent pipe which acts when the tank fills.

An improvement in whiffletree clips has been patented by Mr. Richard E. Harper, of Butler, Mo. A brace or plate is inserted longitudinally in a mortise near the end of the double tree, and a brace or plate cast in one piece with the former passes once around the double tree, so as to firmly hold the clip and give greater strength than is attained in the ordinary construction.

A cream puff filler has been patented by Mr. James H. Mount, of Jamesburg, N. J. The filler is constructed with a hopper to receive the cream, a cylinder and plunger for forcing the cream into the puff, and a tubular cutter for cutting the puff and conducting the cream in. A gauge is so connected therewith as to be readily set to cause the required quantity of cream to be forced in by each forward movement of the plunger.

A metallic insulating covering for telegraphic wires has been patented by Mr. Edward Clark, of Cornwall, N. Y. The wires are coated with copper, then with a compound of copper and Babbitt metal, and the latter covered with lead. The wires are then covered with lead or other moisture excluding material and incased in a metallic tube to adapt them to be laid under ground and in water.

An improved fire wheel for bicycle performances has been patented by Mr. James B. Elliott, of London, Eng. In a wheel adapted to support a bicycle, grooves for receiving fireworks are provided for in the edges or sides of the felly, so that the fireworks may be ignited when the wheel is being revolved by the wheel of the bicycle placed on it, thus producing novel and handsome effects.

An adjustable eaves trough bracket has been patented by Mr. Franklin P. Campbell, of Bloomfield, N. J. The bracket has a trough holding arm with a toothed segment on its inner end, and this is connected with a slotted shank by a pivoting rivet through the teeth of said center of the segment, and a locking rivet between the segment, so that the shank and arm can be adjusted at any desired angle.

A combination tool has been invented by Mr. Ingersoll T. Torrey, of Breton, Ontario, Canada. It is a cleverly devised shears, for the use more especially of railroad men and mechanics, for cutting wires and tin clips used in sealing packages, and combines in one tool shears, tack hammer, claw for pulling tacks, and a screw driver. Mr. Torrey has obtained patents for the above in the United States and Canada.

An improved knob lock has been patented by Mr. Le Grand Terry, of Horseheads, N. Y. In combination with a door knob shaft is a key sliding in a groove therein, which can be moved by a sleeve with a diagonal slot, into which a stud on the knob shaft passes, so that by turning the sleeve the sliding key can be passed into a notch in the knob ring, or rose of the lock.

An electric clock has been patented by Mr. Jean Paul Arnold Schlaefli, of Soleure, Switzerland. The invention relates to an improved secondary electric clock to be actuated by a weight raised periodically by a current at frequent intervals from a central station. The clock has no pendulum or balance wheel to regulate its rate of going, but is dependent solely upon the current transmitted, the minute hand being moved at minute intervals over minute spaces.

An improvement in conduits for electric wires has been patented by Mr. Bernhard A. Dryer, of New York city. The conduit is designed to be placed in the street with its vertical side against the curbstone, the cover forming the gutter, or it can be placed under the outer part of the sidewalk, its vertical side forming the curbstone, and the cover the outer part of the sidewalk, the whole being designed to fully protect the wires and give easy access thereto.

An improved stenographic machine has been patented by Mr. John Galloway, of New York city. It is adapted for rapid writing by those who can see, but is more especially intended for the use of the blind. The alphabet consists of different combinations of eight dots, these being impressed on paper by small impression rods or keys, forming the characters in relief on the back of the paper, so that the matter written may be read by the sense of touch as well as by sight.

An improved form of gate has been patented by Mr. William Mason, of Puyallup, Washington Territory. It is automatic, and combines with the gate and the rear post a swinging bar, and cam levers, so connected with wires that the gate can be easily operated, and it is intended to be so arranged in practice that the gate can be opened and closed by a person sitting in a carriage, and the horses and carriage be out of the way of the swing of the gate.

A gutter, curbstone, and sidewalk conduit for electric wires forms the subject of a patent which has been issued to Mr. Edward Clark, of Cornwall, N. Y. The object of the invention is to obtain space for electric wires, such as telegraph, telephone, fire alarm, and electric light wires, without interfering with lamp posts, hydrants, sewer well holes, and sidewalk vaults, and without going into the middle of the street.

An implement for handling coils of wire, or an improved coiled wire lifter, has been patented by Mr. Anthony McGuiggan, of Delavan, Minn. This invention is more particularly designed to facilitate the handling of coils of barbed wire, so that the hands need not be brought in direct contact therewith. Two bars are each shaped into a handle at one end and a hook at the other, and pivoted together, their form and manner of pivoting being such as to make an efficient lifter for wire in bundles or coils.

A permutation lock has been patented by Mr. Robert Schuetze, of San Antonio, Tex. It has three eight-toothed wheels having unequal length, and engaging with each other and the bolt, plate, and catch, and a knob and knob spindle connected with one of the toothed wheels, whereby the plate and catch can be operated to release the bolt, and the bolt drawn back by operating the knob, the whole forming a lock inexpensive in manufacture, strong, durable, and not likely to get out of order.

Mary E. Higgins, of Cadillac, Mich., is the patentee of an improved underwaist for children, composed of two half bodies, and capable of adjustment down its back and front to vary its size, and having combined with it hose or leggings supporters. The same inventor has obtained a patent for another form of underwaist. In combination with the underwaist or corset is a pendent flap piece, to connect with and support the hose, so that the tension of the hose supports is not allowed to cramp, bind, or interfere with the freedom of the lower part of the waist and the skirts.

A rotating stand for effectively displaying samples of fringes and other goods has been patented by Mr. Christian A. Schmidt, of New York city. The stand is rotated by a motor connected with a spindle and gearing into a gear wheel attached to the lower disk of the tubular shaft, so that both sides of the wings hinged to the disks will be displayed. As the stand is rotated the outer edges of the hinged wings come in contact with a spring attached to a stationary support, and crank arms attached to the upper pivots of the wings come in contact with a stationary cam suspended above the stand, so that the wings will be held and then turned quickly to allow the samples upon the opposite sides of the said wings to be distinctly seen.

An automatic resistance cut-out for telephones has recently been patented by Messrs. Charles D. Wright and Charles A. Fisher, of Petersburg, Ill. The object of the invention is to provide an improved attachment for telephone instruments, so that all the telephones on the line between the two instruments may be cut out automatically, and whereby the circuit will be materially shortened and the resistance decreased correspondingly. The same inventors have obtained a patent for a cut-out for telephones, and the invention consists in a telephone cut-out constructed with a clockwork mechanism which is released by means of an electro magnet as soon as the current passes through the instrument, whereby a lever resting on a notched wheel of the clockwork mechanism is brought in contact with a spring connected with one of the binding posts, so that the current will be short circuited, and will pass through the instrument without passing through the transmitter or receiver, whereby the telephone can be cut out.

NEW BOOKS AND PUBLICATIONS.

ELECTRICITY AND ELECTRICAL ENGINEERING. By Lieutenant Bradley A. Fiske, U.S.N. D. Van Nostrand, New York.

This book does not aim to be very pretentious, but treats the subject in a rather elementary way. The author starts out with the intention of making the volume "a bridge between works written on the theory of electricity and those written on its practical applications," and with this view has brought together and set forth in plain language many important facts concerning electricity for lighting and for power, as well as its adaptations in the telegraph and telephone.

A MANUAL OF CHEMISTRY. PHYSICAL AND INORGANIC. By Henry Watts, B.A., F.R.S. P. Blakiston, Son & Co., Philadelphia.

As an "introduction to larger and more comprehensive systematic works," and to help in "preparing the student for the perusal of original memoirs," the 600 closely printed and well indexed pages of this volume form a valuable contribution to the literature of what may be called elementary chemistry. The field of chemical knowledge is now so wide, and its development has of late been so rapid, especially in connection with the recent developments in electrical science, that such hand books as these are perhaps of more use to the reader or investigator of average attainments than would be the more elaborate treatises of eminent specialists. The writer is the editor of the *Journal of the Chemical Society*, and the author of a "Dictionary of Chemistry," but great pains have evidently been taken throughout the book to find the most simple language in which to set forth ideas and facts in what is now probably the most abstruse and involved of all the sciences.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) F. A. B. asks how to etch upon steel (such as is done upon knife blades). A. For etching upon knife blades: Cover the blade with a thin coat of asphalt and beeswax, about equal parts melted together. Warm the blade and damp the whole surface with a little cloth pad slightly saturated with the wax in the same manner you would ink type. Then scratch the design with a metallic point through the wax and dip in a weak acid, one of nitric to ten of water. Wash in warm soda water, warm, and clean off the wax with turpentine and alcohol. Or paint the design with asphalt varnish and dip as before for bright figures and dark ground.

(2) W. R. H. writes: In a discussion, R. said that a round chimney offered less resistance to the wind, and therefore was less liable to be blown down, than a square one. W. is of opinion that a heavy wind or gale has the same effect on either. Please decide. A. For chimneys of the same flue area, the square chimney contains the most material, and its form is more favorable for bonding the brick work. Its square lines of resistance are stiffer than the round chimney. Its exposure in one direction is less than the round form, while its greatest exposure is about 20 per cent greater. The difference in weight of material is about 18 per cent greater in the square form. Altogether, we should say that the square form would be the safest.

(3) D. C. E. E.—Very small taps and drills can be hardened by heating with a Bunsen burner, the temper being drawn with the burner. If you have no gas, a large oil or kerosene lamp will do. If the pieces are too large to heat in a lamp, a charcoal fire in a small furnace such as tinsmiths use, with a hand bellows to blow with, or a small pipe from a blower nozzle, will be all that is required to do good work. Put a little hard soap upon taps before heating; it protects them from oxidation.

(4) R. B. writes: I am running a Corliss engine 16 inch cylinder, 42 inches stroke, and it runs 81 revolutions per minute, with 40 and 45 pounds pressure. I can change the wheels on the upright and engine shaft, and run it 70 revolutions and carry 75 pounds pressure. What will be the difference in the fuel consumed? A. It will be most economical to run it at the fast speed if your cut-off is allowed to cut short enough to meet the change in velocity; but under your conditions we could not recommend the change. Carry 75 or 80 pounds in boiler and throttle down till your cut-off has control of the speed of the engine.

(5) J. H. asks how to figure the horse power of a high pressure engine from cards made by the indicator. A. The indicator card will give you the average effective pressure during one stroke of the piston; this multiplied into the area of the piston gives the average constant force acting on the piston, which multiplied by the velocity of travel of the piston in feet per minute, results in foot pounds work of the engine, which divided by 33,000 gives horse power.

(6) A. G. M. asks: If an opening was made directly through the earth and a weight was let fall into it, would the momentum carry it beyond the center, or only to it? A. Theoretically the ball would be carried beyond the center, and would oscillate forever under the action of gravity.

(7) J. J. G. asks how to gild the edges of cards which are not beveled. A. Coat the edges with size and dust the powder as in the ordinary process.

(8) B. F. C. writes: I am about to have some printing done on card board. 1. Will you tell me the most suitable varnish, that will be colorless of course, and dry very quickly? A. A map varnish will answer. 2. Is map varnish the right thing? If so, will you please give me recipe for making it? A. Pulverize one ounce sandarac, a quarter of an ounce mastic, a quarter of an ounce elemi, dissolving them in half an ounce of Venice turpentine, and adding to it a solution of 4 ounces shellac and 3 ounces oil of lavender in 12 ounces alcohol. 3. Is there any danger of the printer's ink running during varnishing? A. Not if the printer's ink is first allowed to dry. 4. What kind of brush is the best? A. Use a flowing (hair) brush.

(9) L. B. B. asks for a good imitation cherry stain for pine, something that will not require skilled labor. A. The following is recommended as a suitable cherry stain:

Rain water.....3 qts.
Annatto.....4 ozs.

Boil in a copper kettle until the annatto is dissolved, then put in a piece of potash, the size of a walnut; keep it on the fire about half an hour longer, and it is ready to bottle for use.

(10) W. H.—Toy balloons are made by the rubber companies and sold to retailers, who inflate them with a pump, using hydrogen gas or sometimes gas from the house burners. The balloons are then varnished with a thin glue to keep the gas in, as it will pass through the rubber by its *osmose* properties.

(11) W. C. E. asks for receipt for dressing and tempering mill picks and also for tempering locomotive springs. A. Much depends upon the style of mill picks that you require to temper. Sectional or what are called inserted blades made of thin steel are easily handled in the fire, but still require great care not to burn or overheat the corners either in hammering or hardening. A slow charcoal fire is the best. Do not hammer to a thin edge. It is an old adage to harden thick and grind thin for cutlery, which is equally good for mill picks. The principal point is good mild steel. Harden at as low heat as possible, and not draw the temper. If you have thick, solid picks to harden, you will require extra caution in leaving the edges thick and in heating the whole pick evenly, so as not to burn the corners; use water only at about 70°. The shape of locomotive springs must decide the manner in which they are tempered. They should not be overheated in any part. Hence it is necessary to have a large slow fire. Harden in good lard oil. The burning off for temper should be also done over a large slow fire to insure evenness.

(12) C. W. B. writes: I desire to inquire concerning the kinds of telescopes in which the correcting lenses are placed back in the tube. How do they compare with the glasses where the correction is made in the object glass? Will the lenses called cosmorama lenses do for object glasses for that style of glass or telescope? A. The dialytic telescope has not compared well with those in which the correction is made in the object glass. There is an interference in the field, and as a general principle persons building this class of telescopes do so for reasons of economy and are liable to select inferior glass, whereas it requires glass just as free from defects and striæ as any other form. There have been but very few of these telescopes (and those with sulphuret of carbon correctors) that have claimed real merit.

(13) E. G. writes: In the telephone described in SUPPLEMENT No. 142, are the plates, C, which clamp the magnets together, of iron or wood? A. The plates which clamp the magnets together in the telephone referred to should be of wood, brass, rubber, or some other non-magnetic material. 2. How far will this telephone work? A. This telephone works well if carefully made.

(14) J. J. F. writes: I made the induction coil described in the SCIENTIFIC AMERICAN SUPPLEMENT, and it has proved a success. Now I wish to make one as follows: Length of core, 14 inches; diameter, 1½ inch; over this I propose to wind two layers of No. 14 copper wire (American gauge), the whole well insulated and incased in a fiber tube three-thirty-seconds of an inch thick. The secondary wire will be No. 38, silk covered, copper wire, which I will wind in disks one inch thick to slide over the primary, like washers over a bolt, connecting their outer terminals with the inner of the next and so on, there being 14 disks or sections in all—the whole being 7 inches diameter. Could I increase the diameter with advantage? How are the proportions? How many jars 6x8 Bunsen do I need for a spark 17 or 18 inches long, using a large condenser? A. The diameter is large enough; nothing would be gained by making it larger. The proportions are very good. It is probable that 4 layers of No. 12 for your primary would be better than two layers of No. 14. You can hardly expect to get a spark longer than 6 or 8 inches. Better use four or six cells of plunging bichromate battery.

(15) E. P. W. asks: 1. Is the removal of the hair from a hide at any time or place called tanning? A. No. It is called the depilatory process. 2. Has leather other than sheep or calf skins ever been tanned in forty-eight hours? A. Thin leather may have been tanned in forty-eight hours by some of the new or hot processes; they are of doubtful utility, and not practiced by the makers of good leather. 3. What is the usual time occupied in tanning sole or harness leather? A. It requires from 20 to 30 days. The best English sole is said to take from 4 to 6 months.

(16) A. F. T. asks: How is horsehair straightened for uses of brushes? A. In the New York market horsehair that is naturally curly is not used for brushes. Hair that has been curled or bent by packing is straightened by drawing through a hackle and tying with strings in small bundles, steaming or boiling the bundles, then rolling in a cloth press, and drying in an oven, care being used to keep the bundles straight. Naturally curly hair may be straightened for the time, but will curl by use, and is declared unfit for brushes that may require to be wet, as the wetting will in a short time bring back the natural curl.

(17) A. R. R. writes: Suppose a copper rod measures just 100 feet in cold weather; how much longer would it be when suspended a few feet from the ground in the hot sun in summer time? What would be the expansion of the copper plate on a vessel say 300 feet long when unloaded, and the broadside exposed to the hot sun? What is the age, as near as you can tell, of the oldest bronze statues that have been exposed to the weather, or how long will a good bronze statue last? A. 100 feet of copper wire at 32° will expand to 100·04928 feet at 212°, or nearly $\frac{1}{20}$ of a foot. The temperature of metals exposed to the sun in summer will rise to about 100° and in still air possibly to 110° or 115°; say 106° for an average, will give a total expansion of $\frac{25}{1000}$ of a foot, or $\frac{3}{10}$ of an inch. There are bronze statues in Europe 2,000 years old in good preservation. Many that have been buried in the earth for from 1,500 to 2,000 years are in fair condition.

(18) H. A. F.—The method for crystallizing tin plate is given as answer to query 57 on p. 28 of SCIENTIFIC AMERICAN for January 13, 1883.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

G. Bros.—The samples are apparently nothing but quartz containing mica, and show no evidences of gold. If however you have reasons for suspecting the presence of gold it will be best to have the ore assayed. For this purpose a large amount of mineral will be necessary, and the expense $5.00.

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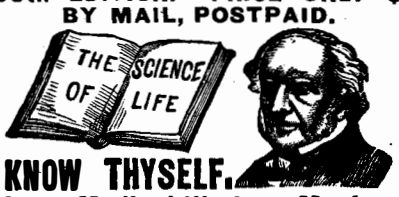

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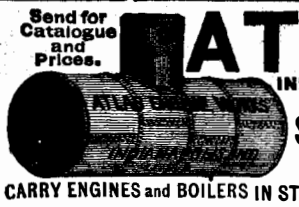

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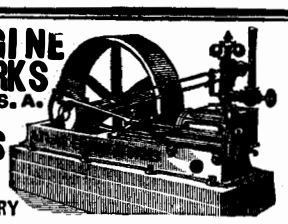

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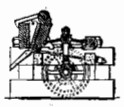

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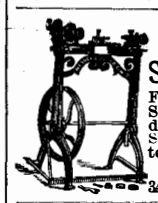

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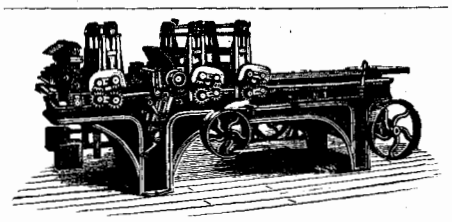

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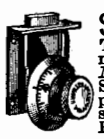

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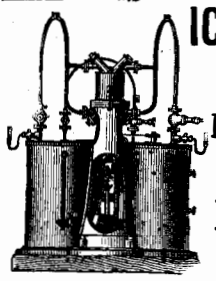

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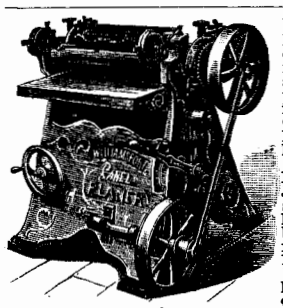

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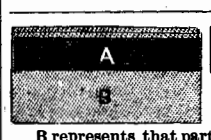

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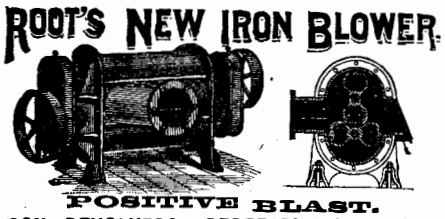

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