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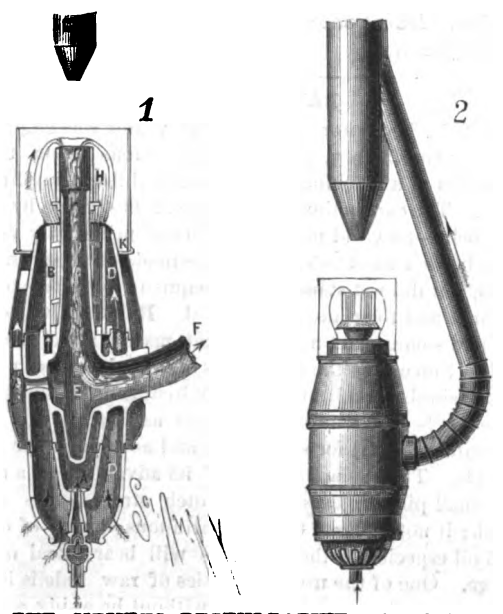
## THE SIEMENS REGENERATIVE GAS LAMP.

In the latter part of 1879, Frederick Siemens made the announcement that he had practically succeeded in greatly increasing the light to be obtained from ordinary coal gas, by what he called the regenerative process, through the superheating of the gas and the air which supported combustion. In a lecture delivered at that time, before the Prussian Society for the Promotion of Industry, he stated that the idea was then twenty years old with him, and was one of the results of experiments relative to heat-regenerative furnaces, which have done so much to change the old order of things in nearly all branches of metallurgical work. He then experimented but little on the gas lamp, as it "seemed impossible to properly supply the gas flame with heated air, owing to the supposition that double glasses or chimneys, one within the other, were necessary to bring the combustion gases and the fresh air together, and the inner glass could not withstand the heat." His later experience in regenerative furnaces taught him to abandon separate combustion chambers, and utilize the natural currents of gas and heated air, in a large oven, and then it naturally followed that the regenerative principle could only be applied to lighting purposes by taking advantage of the automatic motion of air, gas, and the products of combustion at different temperatures. The introduction of the electric light, with the call thereby created for burners of higher lighting power, and the close investigations made as to the relative economy of gas and electricity, led Mr. Siemens to return to the subject of his earlier experiments, and the present Siemens regenerative gas lamp is the result.

This lamp, in its present improved construction, is shown in Figs. 1 and 2, Fig. 1 showing the details of internal arrangement. The gas enters from a pipe at the bottom to the chamber, A, passing up thence through the small gas tubes, B, around the flue, E (through which the products of combustion escape), to a number of small burners, C, arranged around a porcelain chimney, H. Air enters at the bottom to the chamber, D, and is heated with the gas around the central discharge flue, so that the gas and the air to feed the flame meet at a high temperature at the point of ignition. Outside of the burner proper there is a jacket of sheet metal, I, between which and the burner a current of cool air ascends to prevent the overheating of the burner and also add to the supply of air to the flame.

The flue, F, connects the regenerative heating chamber with the chimney, as more fully shown in Fig. 2. The pipe, G, directly over the burner, to which the side arm is attached, is the outlet for vitiated products of combustion, the connection thence to be made to a chimney or flue, which gives this burner great advantages as a ventilator. The glass cylinder, K, around the top of the burner, is simply to protect the flame from the action of the wind. When lighting, the gas is first turned on slowly until the flame reaches about one-fourth the height of the porcelain, and is allowed to remain thus for about ten minutes, until the different parts of the burner become heated; then it is further turned on until




THE SIEMENS REGENERATIVE GAS LAMP.

the flame enters the porcelain cylinder about an inch, the gas and heated air naturally taking the direction indicated, and making the heat in this regenerative heating chamber, or discharge flue, E, as high as about 1,600° F. Any excess of gas beyond the quantity indicated interferes with the perfect combustion and diminishes the light.

The illustrations at the bottom of the page show the testing of the burners as set up at the factory, a burner as adapted for street lighting, and one of the styles suitable for lighting halls or assembly rooms. These lamps are made in sizes which enable them to compete on most favorable terms with some of the best electric lamps, running from 100 candle power to 1,200 candle power, the former burning 14 and the latter 100 cubic feet of gas per hour. Of the comparative economy of burning gas with these burners, the testimonials are very numerous, and from the best of sources, although it is only about four years since they were first put on the market in Europe. The illumination is said to be from two to three times greater, for the same quantity of gas used, than can be obtained by the ordinary burners, while the flame is white and remarkably steady, and the light is admirably diffused. This burner received the Richardson gold medal, as "an exhibit of pre-eminent merit," at the Sanitary Congress Exhibition in England in 1882, the London *Times* describing it as "saving 50 per cent of gas, and greatly lessening the unhealthy condition of the air in which gas is burnt." It has also received the warm indorsement of many leading firms throughout Europe, who have adopted its use in extensive manufactories.

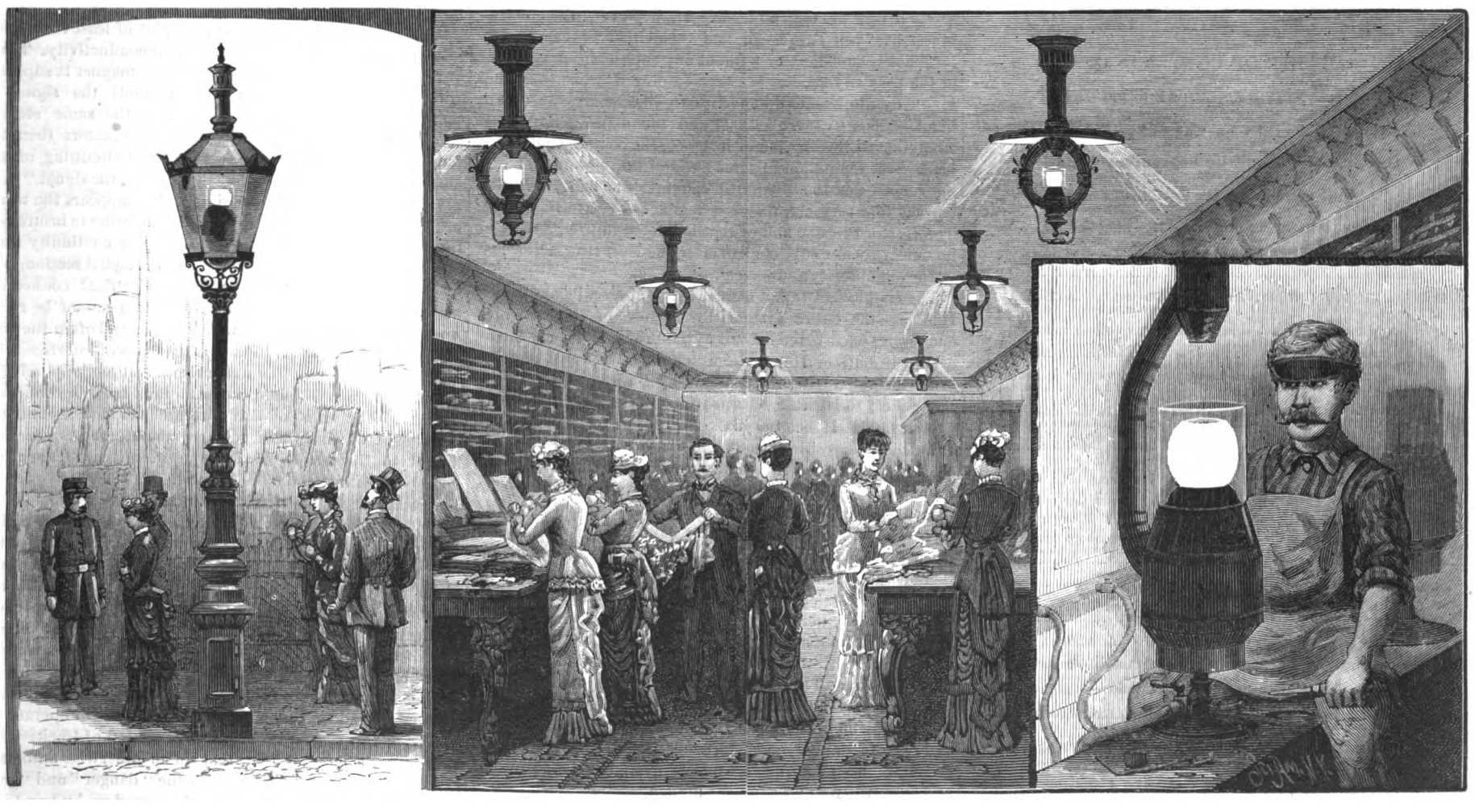
The Siemens Co. light the restaurant of the Electrical Exhibition, a room 40 × 96 feet, ceiling 19½ feet high, with six lamps 500 candle power each, at a cost of about 9 cents per hour. The light is soft and pleasant to the sight, and casts no shadows.

The sole right to manufacture and sell this burner in the United States has been acquired by the Siemens Regenerative Gas Lamp Co., of Philadelphia, who have recently fitted up an extensive factory for the manufacture at the northeast corner of Twenty-first Street and Washington Avenue, in that city.

### Soldering Aluminum.

M. Bourbourze (*Comptes Rendus*, xcviii., 1490) has found a means of soldering aluminum successfully. Hitherto the great drawback to the extended use of this metal in the arts and in scientific instruments, for many of which it is peculiarly fitted by its great lightness and resonance, has been the difficulty of making good joints. M. Bourbourze uses alloys of tin and zinc, or of tin, bismuth, and aluminum; but one of tin and aluminum yields the best results. The proportions of alloy vary with the kind of work it is intended for. For instruments which have to be turned or shaped after soldering, an alloy composed of 45 parts of tin and 10 of aluminum is most suitable. This will resist even hammering. Metal which it is desired to solder to aluminum should be first tinned with pure tin.

THE other morning in Philadelphia, at a session of the American Association, the reading of the first paper was about to proceed, so the story goes, on the "Nervous System of the Flea," when a member jumped up and moved an adjournment. Unanimously carried. Thermometer, 96°.



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**THE SCIENTIFIC AMERICAN SUPPLEMENT**

**No. 456,**

**For the Week ending September 27, 1884.**

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**SOLDERING ON CAST IRON.**

There are cases where brass requires to be united to cast iron, and drilling and riveting would either make a clumsy job or would weaken the parts. Soldering, if effective, is incomparably the better way. By many mechanics it is supposed to be either a trade secret or a skillful trick to make solder adhere to cast iron, but it is not so. The process differs but slightly from soldering on an already tinned surface, as sheet tin.

If the cast iron is white iron, or a thin casting that has become chilled in the casting—iron not amenable to the file—it should be cleaned from surface impurities by scraping, or scouring and washing in potash water. Then dip it for an instant in clear water, and wash it quickly with undiluted muriatic acid of the ordinary commercial strength. Go over it at once with powdered rosin, and solder, with the soldering iron, before the surface has had time to dry.

Another plan, and a better one especially for soft gray iron castings, is to file the surface clean, wash as before, wipe it over with a flux made of sheet zinc dissolved in muriatic acid until it is surcharged, or is a saturated solution, and has been diluted with its own quantity of water. Then sprinkle powdered sal ammoniac on it, and heat it over a charcoal or clear hard coal fire until the sal ammoniac smokes. Dip at once into melted tin, remove, and rap off the surplus tin.

**RAW HIDE WHEELS.**

In 1860, just before the war, the writer was employed to start a manufactory, one of the exactions being the construction of a machine for drawing and flattening fine brass wire. The connections of parts were first made by pulleys and belts—they did not hold; gears of necessarily very fine cogs broke their teeth; some were made of steel and hardened, but did not stand. The requisite appeared to be resistance and toughness of material. Raw hide was suggested, and some gears made of that material did their work well. Since then the use of this material has been noticed under similar conditions. Lately hydraulic compressed raw hide has been favorably mentioned as material for friction rolls and pulleys, for skate rolls, and as facings for friction wheels. There is no question of its advantage as a material for small pinion gears where much strain comes on each tooth; if not exposed to the continuous action of oil—animal oil especially—these wheels will bear a deal of rough usage. One of the useful qualities of raw hide is its yielding to a shock or sudden strain without breaking and without giving a permanent backlash. Steel and the best of Norway iron will break under strains to which compressed raw hide will only slightly and temporarily yield. The teeth of raw hide blanks can be cut in the gear cutting engine as well as those of iron or steel, and the material can be more readily turned in the lathe. If a lubricant is required in the working, clear water is the best.

**CANCER.**

Any disease which is acknowledged by all to be full of danger, is sure to be associated with quackery. Unprincipled men take advantage of the popular ignorance of medical remedies to make money. In respect to no disease is this more true than in the case of cancer. And the success of imposition is made easier from the fact that the name is constantly applied to tumors of various kinds, which have nothing of a serious character, which will disappear of themselves if they are only *let alone*. If, however, the name of *cancer* has been suggested, and then either a "cancer doctor" has been called, or without any such addition some one of the boasted remedies has been employed, when the tumor gradually diminishes and eventually disappears, the case is heralded as a "cancer cure," and the delusion is greatly strengthened thereby. For instance, the common red clover has a great reputation in some parts of the country for curing cancer, and to attempt to convince the believers in its efficacy that they are under a mistake is perfectly useless. The case of this one and of that is quoted in proof, whereas no one of them doubtless had ever the least reason for fear or the slightest sign of cancer.

The simple fact is that cancer is not at all a local disease. It affects the entire system; the change of tissues which constitutes what is recognized as the "cancer" is only the local manifestation. Hence the well known truth that removal of the ulcerated part, the tumor, is constantly only a temporary relief; the disease returns to its power, and commonly is soon fatal. Hence the universal dread of "the knife," and hence the readiness to flee to those who give the comforting promise that they will "draw out the cancer by the roots;" and beyond question such men will be encouraged in their imposture by continued applications for the use of their *skill*. If they treated only cases where true cancer exists there would be but comparatively small evil done, for there is too much reason to believe that the disease is of its very nature fatal, and that its progress to a painful death is sure and steady despite the utmost reach of human skill; but harmless tumors are constantly submitted to their care. Everything with them is invariably a "cancer," and it must be drawn out. The applications which are made destroy the tissues, for how can they draw the cancer out without it? That which was harmless becomes a source of suffering and even of danger, and if the patient recovers after the "doctor" has taken all the money available, it is paraded as a *cure*, whereas no cure was needed.

The domestic remedies, such as the clover above noted, are commonly harmless, and while they do no good they serve to pacify the patient. If *cancer is* there, it goes on its evil way unchecked; if a simple, non-malignant tumor is involved, it either disappears or remains stationary in progress, and presently clover or perhaps cancer root (*Conopholis Americana*) is in greater repute than ever.

**The International Electrical Exposition, Philadelphia.**

(THIRD PAPER.)

The number of visitors daily arriving in incoming trains shows a steady increase, and the great hall, which, during the very hot weather of two weeks ago, was but sparsely filled, is now, at certain hours of the day, almost crowded. At night there has been, ever since the opening, a large attendance; at times reaching the respectable figure of 7,000 visitors

Crossing the wooden bridge which separates the main hall from the annex, and descending to the ground floor, the visitor has his attention attracted by a circular railway with miniature locomotive and cars. This is the exhibit of a switch and signal company, and is constructed in exact imitation of a section of railroad. The general plan of this system is not new, but novel features have recently been introduced which do much to make a perfect safeguard against ordinary accidents. Experience has shown that no one person, however trustworthy, should be intrusted with the signaling of swift moving trains; and this automatic signal system, never tired, requiring no sleep, and not subject to sudden attacks of disease, is designed to operate railway signals with unfailing certainty It is operated by a current of electricity transmitted along the rails, showing the customary red targets when trains are in dangerous proximity, and white targets when all is clear.

The trouble with this class of signals heretofore has been that when, by one of those accidents to which electric currents are subject, the flow of electricity is stopped, the warnings cease. Not so, however, with this one. A stoppage of the current causes the dropping of the danger signal, and not until the circuit is again complete will the safety signal be shown.

An eminent authority, who has looked carefully into the matter of electric signaling, insists that the normal condition of the signals should be "danger," and that the agency through which they are worked should at all times be active when "safety" is shown. The apparatus should be free from atmospheric influences, simple, strong, and not easily disarranged.

These conditions seem to be present in the apparatus described. Move the miniature locomotive along the same track on which another car rests or is moving, and, when it reaches the same section, the engineer is confronted with a series of red danger signals. He can follow another train if he will, but he cannot get into its immediate vicinity without being warned, not once, but frequently.

The track is, in fact, only used for a part of the circuit. There is a secondary or telltale signal; the switches are all automatically locked and fitted with a circuit breaker. To illustrate the working of this system, let us take a section of the track, insulated at the ends of the section from the adjacent rails. At one end of the section there is a battery consisting of a single cell, one pole being attached to each rail, while at the other end of the same section there is placed an electro-magnet with one wire attached to each rail. Here we have established a complete metallic circuit from the battery, through the rails and magnet, back again to the initial point.

The electric current, seeking the point of least resistance, flies along the rails, for they have great conductivity. Thus, even during storms of rain and snow, the magnet is supplied with electricity. Now the magnet holds the signal at "safety;" but when there comes into the same section another train, the wheels, being better conductors than the small wires of the magnet, effect the short circuiting of the current, and, demagnetization taking place, the signal "safety" is permitted to drop, and in its place appears the warning "danger." The projectors say that in order to insure perfect reliability of working, reliable metallic continuity must be had throughout the whole length of the signal section. The fish-joints, they say, make ordinarily electrical connection between adjacent rails, but this connection cannot be relied upon; sometimes the splice will be loose, and often the rust and dust between the rails and splice bar will interfere with a continuous circuit. To make the circuit entirely reliable therefore at the rail joints, adjacent rails must be connected by wire. The ends of this wire are wrapped around the heads of stout rivets and soldered thereto; holes are then drilled in the flanges of the adjacent rails, and the rivets firmly driven into the holes, thus making an entirely reliable electrical connection from rail to rail. They thus explain the insulation of the track. Plates of fiber about one-eighth inch thick are placed between the bottom of the rail and the chair, and between the forelocks and the rail. There is also placed a piece of the same material, of the shape of the rail section, between the ends of the connecting rails, to prevent an electrical contact being made by the creeping or expansion of the rails. The latter are insulated by using a wooden splice bar on the outside of the rails, a divided fish-bar on the inside, and a piece of fiber between the ends of the rails. It should be added that a single cell battery will operate the signals of this system through a mile section of track.

It seems somewhat odd that in an otherwise automatic system, the weights which operate the "danger" and "safety" signals should be required to be wound up by hand. To the average student of human nature, it would seem as easy

for a man to forget to wind up a pulley apparatus as it is for a switchman to forget to turn his switch or show his danger signal.

Now that the Edison exhibit is in good running order, it attracts, and naturally, much interest. The chief object is, of course, Edison himself, though one of his employes, who is usually seated in the pagoda-like structure at the southern end of the exhibit, was frequently surrounded last week by a curious audience under the misapprehension that they were in the presence of the wizard.

In dynamos are shown the various sizes manufactured by the Edison Company, ranging from that of a capacity of twenty-five lights to the largest one ever constructed, and said to possess the power of generating 1,200 incandescence lights, each of 16 candle power. The Edison dynamo of the ordinary type has often been described to the readers of the SCIENTIFIC AMERICAN. But there are two dynamos placed on exhibition here by the Edison Company which are in some not unimportant features essentially novel. One is a type of disk machine, and the other the great 1,200 light machine already referred to. The principle upon which these two machines are constructed is, of course, the same, but the application is dissimilar. In the disk dynamo there are two electro-magnets of the horseshoe pattern placed upon a horizontal plane surface, having their opposite poles in series. Radial segments forming a disk of copper revolve between the poles. These segments are insulated the one from the other. Upon the periphery of the disk there are a number of thin pieces of copper—each being likewise insulated—connecting certain pairs of segments.

The armature of this dynamo is the disk itself, and as in the case with the wire of the armatures of dynamos of the regular type, the current is excited by the passage of the segments through the lines of force of the magnet. The axis is the initial point of departure of the current in this machine, thence it traverses the segment *en route* to the circumferential strip. After completing half the circumference and reaching another segment, it is led off by the brushes from the commutator. The current has therefore three consecutive times been led by the poles of the magnets; an operation which has served to increase it. The great 1,200 incandescence light dynamo is again different from this. The magnet does not differ from that found in the Edison dynamo of the well-known type, save in its immensity. It is the armature of this machine which is particularly unique. There are circular iron plates forming the core placed similarly to like plates in the ordinary dynamos. On these, however, set up longitudinally, are copper bars ¾ of an inch wide and having a thickness of ½ inch. Each is served with *a coating of parchment* paper and mica for the purpose of rendering them well insulated, not only from the core, but from each other as well. There are spaces between these bars through which a current of dry air can be forced, so as to prevent, at all times, the armature from becoming heated. Then there are circular strips of copper at the end of the machine served with vulcanite in order to insulate them from each other. The bars are joined in pairs to these circular strips. The commutator is not reached by the current until the latter has been twice through the magnetic field. So perfect is this mechanism that, it is said, not even a portion of the current, not a spark, can leave the brushes of the commutator until it has done its work.

There are other apparatus in this Edison exhibit which, by reason of recent improvements, merit more than passing notice; new devices for systematizing small incandescence systems, new modes of controlling current, and the like. These will be noticed in a subsequent article.

As types of incandescence lamps may be multiplied as long as any new material can be found for an incandescent loop, the crop of new lamps may safely be relied upon not to fail for some time to come. In the Weston exhibit is a new incandescence lamp which is said to give promising results when tested as to resistance and life. The filament is formed of an altogether novel material called tamadine. It is prepared from cellulose by a new process, the details not having yet been made public. It is said to be unusually strong when compared with other filaments used in this species of lighting, and to be capable of sustaining high temperatures. It is cut in sharp curves in the ordinary loop-form.

With gas and electric lighting in juxtaposition as they are here, and their respective adherents ready to demonstrate their relative advantages, an excellent opportunity is offered for comparison. The description given on the fifth day of the National Conference of Electricians by Prof. Preece, of a recent installation of an isolated electric light plant in his house to the exclusion of gas, proved a rather severe blow to the representatives of the gas lighting interests at the Exposition, not because of the fact, which really proves very little, but because it comes from so distinguished a man as the Chief of the Postal Telegraph system of Great Britain. Prof. Preece said that he had experimented with, or rather established, the secondary battery in his own house as a means of supplying electricity for lighting. He explained that he lived far away from any source of electricity, and consequently his house had been lighted by gas. He preferred, he said, to burn his gas in the garden to avoid the poisonous products of combustion, and merely use it as a means of power for running a dynamo-electric machine. His gas-engine was, he said, of two horse-power, and ran a Gramme dynamo of 42 volts and supplying 52 amperes. This dynamo, running three hours each day, under the care of a servant, charged 17 Plante cells, each containing 12 plates about two feet square. This arrangement, he continued, had run for about four months without the sign of failure, and lights his house perfectly with incandescence lights, besides being used lavishly for other purposes.

Now, to those who have had the time and inclination to compare the relative cost of gas lighting and that to be had from electricity through the interposition of storage batteries, this lighting-plant of Prof. Preece's would not particularly commend itself. But to the casual observer it is otherwise, and when so good an authority as Prof. Preece talks about "the poisonous products of combustion" in illuminating gas, it sends a cold shiver through him.

As a professor of physics remarked here the other day, there is nothing like giving figures when comparisons are made, and it would have been just as well if Prof. Preece had told us how much it had previously cost him to do with illuminating gas what he was now accomplishing with electricity, and just what his secondary battery plant was costing him. Had he done this, there is excellent reason for the belief that those now contemplating the establishment of a similar plant would liever have a little poison in their atmosphere and save their purses so unwonted a strain.

Speaking of giving figures, the following table has been prepared by an authority, giving the comparative amounts of the products of combustion of electricity, illuminating gas, and oil:

| Light of 100 candles. | Products per hour. | | |
|---|---|---|---|
| | Water Vapor, Kilos. | Carbonic acid in cubic meters. | Heat in calories. |
| Electric lamp, arc..... | ..... | ..... | 57—15 |
| " " incandescent.... | ..... | ..... | 29—586 |
| Gas, Argand burner..... | 0·086 | 0·046 | 4860 |
| Lamp, petroleum, flat flame.... | 0·080 | 0·095 | 7800 |

Next in importance, perhaps, to knowing what force electricity is the expression of—a problem for abstract contemplation—comes the ability to accurately measure it. It may do to-day for a company with thousands of lights aglow and a great plant to offer the incandescent light for the same price as that demanded by the gas companies for the same intensity or candle-power. But should the gas companies lower their rates thirty per cent., or even fifty per cent., and there is good reason to believe that they could reduce them still lower than this, how are the electric-light people to know exactly how much light each patron is using?

A voltameter will show the amount of electricity passing during a certain period, and hence it might seem to have the requisite ability; but it is well-known that, as the amount of electricity which has gone through any part of a circuit is not a true measure of the work done unless accompanied by indication of the resistance through which it is forced, or the potential through which it falls, any apparatus, to give true results, should indicate directly the number of units expended, or indirectly by expressing some function of what has been done.

There are several meters that will perform this work more or less accurately, for it has long been known that a certain amount of current would transfer electrolytically a certain amount of metal from one electrode to another, and many electricians have tried to get a meter founded on this action of the electric current, their labors being attended with more or less success. It seems, however, that up to quite recently no one has attempted to join the hydrometer with this well-known action of the electric motor. Such an instrument, with the hydrometer as a base, is now to be seen at the Exposition in Philadelphia.

It may be described as a hydrometer furnished beneath the bulb with an electrode, and still another connected with the cell, graduated to mark on the flotation-line as it goes up or down just what amount of electricity has gone through. For example, suppose that the metal has been charged on the bulb electrode for three months. As a result of this charging, the hydrometer will be found to have been lowered in a just proportion. If now the current be reversed, for the same period of time, the electrical equivalent of the total metal that has been thrown off from the bulb will be found to be shown on the rising scale.

If this little apparatus, which it should be said is of simple construction, is found to give an exact measurement under all conditions, it is bound to become an indispensable adjunct to all electric lighting plants.

Though the Exposition has now been open since the 2d instant, not a single accident has been recorded, notwithstanding the fact that powerful currents are at all times running from one end of the building to the other. This indicates how excellent has been the supervision of the committee, and does much to sustain the assertion made by the electric light companies last winter, when so much indignation was expressed against the maintenance of their street lines, that, when properly insulated and left undisturbed, currents of high and low potential can be carried through a crowded thoroughfare without injury to either life or property.

All the circuits are insulated, and are metallic throughout, no ground connections being used. The conductors of all the main circuits had sufficient weight per running foot to enable them to carry their currents without heating. In cases where circuits are taken from large to small conductors, and the large conductor carries a current likely to raise the temperature of the smaller wire, if accidentally diverted through it, an improved automatic safety device is introduced into the circuit of the smaller conductor, by which the circuit is automatically interrupted whenever the current, passing through the smaller conductor, is in excess of the point of safety. Similar automatic safety devices are used in all circuits run in the vicinity of electric light and power circuits. Circuit wires exposed to moisture are provided, in addition to their insulated covering, with a coating of waterproof material.

When the electric motive force exceeds 300 volts, the different parts of circuits outside the electro-generator, or the apparatus which they energize, are not permitted to approach one another nearer than eight inches. Where it is practicable to do so, positive or outgoing conductors are clearly marked so as to distinguish them from negative or return conductors. Where circuit wires pass through walls, floors, or ceilings, special insulating incombustible tubing is used to incase the wire. All the dynamo-electric machines are insulated from the ground, and are surrounded by railings, so as to prevent the too close approach of the public.

### An Australian Drought.

In February last, in New South Wales, a correspondent of a provincial newspaper traveled for some 200 miles by railway, and throughout the whole journey he saw on either side nothing but a desert—"a wilderness destitute of any green thing, without any water worthy of the name, of cattle in the paddocks, dead or dying; the sun's scorching rays fell on fields as hard as iron. The leaves of the trees were as motionless as death itself, there being not a breath of air stirring. The state of affairs was quite as bad in other parts of the country. There were thousands of square miles of land, baked and cracked, with the dry, brown grass flying off in dust, without a vestige of green or a drop of water anywhere." The expedients resorted to in this terrible crisis were sometimes of a most desperate character. Some farmers endeavored to send their cattle down to the coasts or to the towns, but they died on the road, and their owners had to bear not only the loss of the animals, but the cost of their conveyance. This double loss largely prevented others from imitating their example. They sat down in mute despair to watch their ruin. One man lost 20,000, another 50,000, and the third 150,000 sheep, without the slightest power to save one of them. Millions of sheep have died, and hundreds, and probably thousands, of colonists who were prosperous last year are poor and, perhaps, ruined to-day. Even in Sydney the drought was so severe that the inhabitants had to be placed on an intermittent allowance of water. Rain has at last fallen, and, therefore, the severity of the crisis may be regarded as past.

### Death of Robert Hoe, Printing Press Manufacturer.

The firm name of R. Hoe & Co. is known wherever American printing presses are to be found, and that is in nearly every quarter of the world. The senior member of the house, Robert Hoe, died at Tarrytown, N. Y., Sept. 13, in his 70th year. The elder Robert Hoe, the father of the deceased, came to this country from England in 1803, and was the first man in the United States who made saws of cast steel, beginning the manufacture of printing presses in 1805. The late Robert Hoe, when a young man, with his brother Richard M., succeeded to the business established by their father, which has become the largest of its kind in the world.

Their cylinder press, in 1827, marked the first great advance on hand printing presses, and it was followed in 1837 by the double cylinder, and in 1846 by the rotary, of which the largest sized, or ten cylinder, would print twenty thousand sheets on one side in an hour. Their latest, or perfecting, press will print twenty thousand large sheets on both sides in an hour, and deliver them folded. The deceased was a public spirited citizen, an active member of several charitable institutions, and one of the chief movers in the establishment of the Academy of Design.

### The St. Louis Industrial Exhibition.

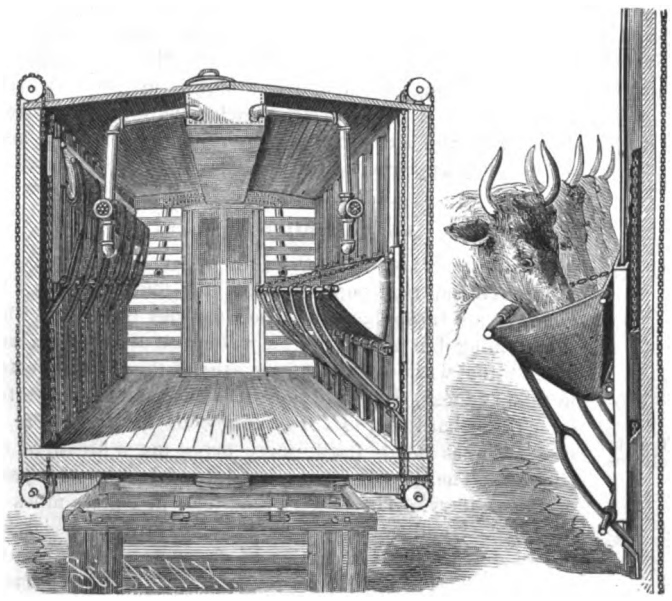
This exhibition, which opened Sept 2, presented a worthy comparison with other similar displays being held in several of our large cities. Over $600,000 had been been expended on the erection of a fine exhibition building, and the aggregate exhibits are valued at more than $3,000,000, including machinery, textile fabrics, and a good representation of the products of the West and Southwest. The railroads made low fares to intending visitors, and the city and State will undoubtedly reap the benefit of the enterprise and liberality which originated and carried through so creditable an exposition.

### Copper for Roofing.

The newspapers published in the Lake Superior copper mines region recommend the use of copper as a roof covering in place of tin. In reply to an inquiry by one of our contemporaries as to the relative economy and benefits of copper over tin, an architect furnishes the following: We always specify the use of copper for covering roofs, when we can induce owners to allow us to do so, on account of its durability; although its cost is about $14 per 100 square feet over price of tin roofing. But when we reflect that a tin roof requires constant repairs, and painting at least every two years, at a cost of two to three cents per foot, varying as to the number of coats, the cost of repairs for six years, together with the cost of tin roof, equals the cost of copper.

### A WATERING DEVICE FOR STOCK CAR.

The accompanying illustration indicates so plainly the principal features of an improved means of furnishing railway cars with watering troughs as to hardly call for any detailed description. The troughs are made of rubber cloth or other waterproof flexible material, and have slides, rods, and bars arranged to fold the trough while being raised and open it while being lowered. The trough-operating slides have straps or chains connecting them with wheels and shafts, so the slides can be readily operated to raise and lower the troughs. The water tanks are placed in the upper part of the cars, from which pipes, as shown, lead down to



WATERING DEVICE FOR STOCK CAR.

such positions as to discharge water into the ends of the troughs when they are lowered and opened, the tanks themselves being supplied with water in the same manner as the locomotives are watered, through spout projections in the roof of the car.

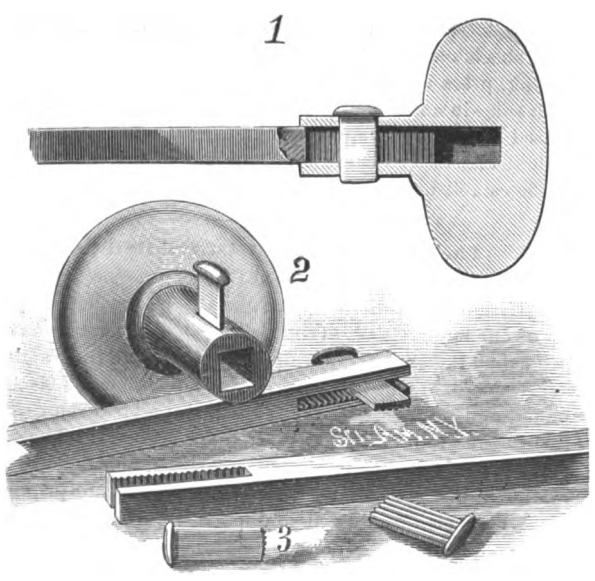
This invention has been patented by Messrs. John P. Christopher and Murray McCallum, of Michigamme, Mich.

### An Intermittent Oil Well.

Phillips Bros.' well near Butler, Pa., is one of the most phenomenal wells ever seen in the whole oil regions, and all interest is now centered there, to the exclusion of the lately discovered Glade district, which is rapidly waning. Phillips' well was drilled on Aug. 30, and has been producing since over 1,300 barrels daily, reaching on the 7th 100 barrels an hour. It flows with the regularity of clockwork, the oil gushing out at intervals of nine minutes and a half, the flows lasting about four minutes. Large numbers of people visit the well.

### AN IMPROVED DOOR KNOB.

The engraving represents a door knob recently patented by Mr. Edwin A. Johnson, of Allegheny City, Pa., which may be securely attached to the spindle and easily and quickly adjusted according to the thickness of the door. One end of the spindle is formed with a longitudinal slot, the inner side of one of the prongs of which is provided




JOHNSON'S IMPROVED DOOR KNOB.

with vertical serrations. The knob has the usual neck for receiving the end of the spindle, and also a vertical slot in the neck through which a flat key is passed between the prongs; the key has serrations upon one surface which exactly correspond with those on the prong, so that they will bind, and thus hold the parts firmly together and prevent rattling. Both ends of the key receive the strain of the knob, and the bottom projection facilitates removal when necessary. The end of the spindle can be passed into the neck a greater or less distance, as may be required, according to the thickness of the door; and in any position the knob can be locked in place by passing the key through the neck and between the prongs.

### Tempering Steel by Compression.

M. Clemandot's method consists in heating the metal so that it becomes sufficiently ductile, and then submitting it during cooling to a strong pressure. He noticed that this treatment affected the structure of the metal in such a way that it acquired properties analogous to those brought out by tempering. The metal thus obtained differs considerably from steel simply cooled, by its finer grain, its greater hardness, and its greater resistance to rupture, particularly with grades of pretty high carbon steel. In these respects it approaches in quality steel tempered in water, without being identical with it. It has two different effects, almost simultaneously—an energetic and continuous compression, and a rapid cooling of the steel. The cooling is caused by the contact with the platform of the hydraulic press, and takes place much more rapidly than when the same piece is allowed to cool without being compressed. The remarkable results obtained by M. Clemandot are explained by the combined action of cooling and compression. The first, in its results, resembles the compression effected by hammering or rolling; the second, the effect of tempering by immersion. It has been urged that the piece of steel must be inclosed by a mould into which it fits exactly. It is, however, only necessary that the compression act upon two opposite faces. A square bar, whether straight or curved to horseshoe shape, need only be laid down flat and compressed between the two platforms of an hydraulic press. In order to obtain the best results, the cherry-hot piece of steel should be as rapidly as possible subjected to the pressure settled upon beforehand, ranging from 10 to 80 kilogrammes per square millimeter.

While the tempering process by immersion brings about an increase in the volume of the steel and a corresponding decrease in its density, the action of high mechanical pressure during the entire process of cooling tends to bring the metal back to its original volume or its normal density, thus preventing the creation of a state of intermolecular tension noted in tempered steel. Actual experiment has confirmed these theoretical deductions, so far as the resistance of the compressed steel to stress is concerned.

### A Delicate Instrument used by the Government for Testing Thickness.

The Post Office Department at Washington recently cancelled a contract with an envelope manufacturing firm for not furnishing the precise article in matter of weight contracted for, and, according to one of our contemporaries, a curious little machine in the office of the Chief of the Stamp Bureau was the cause of the cancellation of the contract. It is a queer looking contrivance, a cross between a set of butcher's scales and ordinary grocer's scales, or rather a combination of the two. There is a large dial, like the face of a clock, with a little hand that flies around the face pointing to the figures at the side, which are arranged like the figures on the clock face, with little dots between. "You see three dots," said the gentleman in charge, inquiringly. "Well, the space between those indicates one sixteen-thousandth of an inch. Getting it down pretty fine, isn't it? You see this movable piece of iron here, which comes down with a smooth surface upon this other solid surface? Well, the raising or lowering of that moves the pointer which runs around the dial. To test the thickness of a sheet of paper, we simply place it between this movable piece and the solid surface below, and when the movable piece of iron comes down upon the paper the hand registers the true thickness of the paper. Delicate instrument? Well, I should think so. Just give me a hair from your head, will you?"

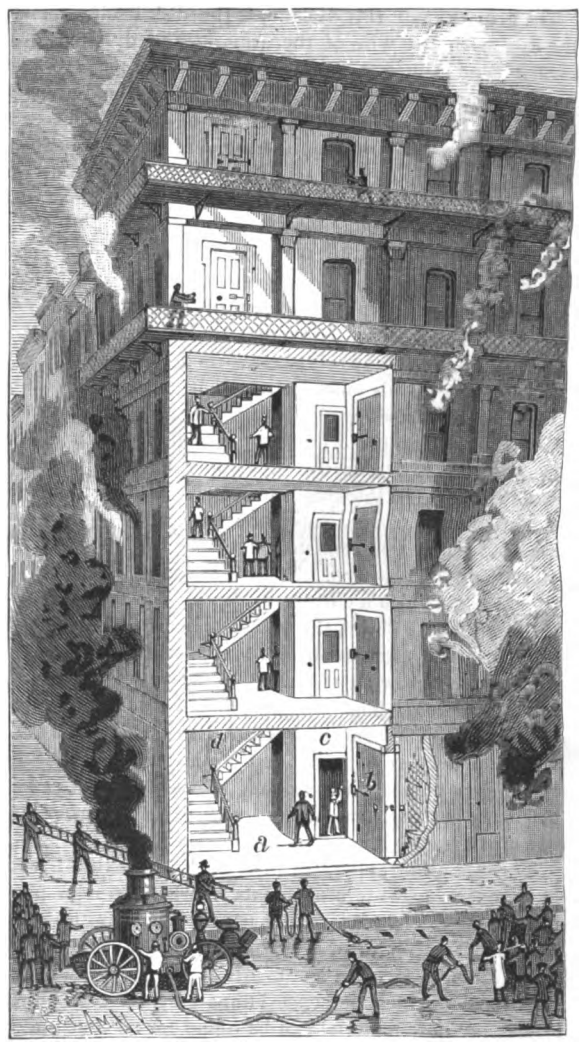
Then he took a hair and slipped it deftly between the movable pieces. The hand on the dial followed the motions of the screw until it stopped at the figures 20. "Just twenty sixteen-thousandths of an inch in diameter," he said. "Now let me try a hair from your mustache? They are generally much larger, especially if you have been in the habit of shaving." He took up a pair of scissors, and clipped off a hair from the mustache and placed it in position. The hand stopped at 50. "Fifty sixteen-thousandths of an inch thick," he said. "That shows the effect of shaving. I measured a hair from the hand of a gentleman a few minutes ago which was forty sixteen-thousandths thick, but those in his mustache were precisely the same thickness, the reason being that he had never shaved. Yes, that is the machine that proved that the firm making our envelopes was not fulfilling its contract," he said, as he fell back admiringly

### Weather Forecasts.

It seems to be overlooked by meteorologists, says a writer in the *Journal of Science*, that when a season has taken a decided character, whether as wet or dry, the ordinary indications of change seem to lose their meaning. In 1879 all signs of fair weather, drawn from the appearance of the clouds, the actions of birds and insects, etc., were quite misleading. And in the present season I have more than once seen the commonly accepted signs of rain go for nothing. The sky may become gradually overcast, with dark ragged masses of underscud; there may be a "hollow and a blustering wind," swallows may fly low, slugs come out in numbers, bubbles of gas rise from ditches, etc., but the weather remains dry, or at the most there is a slight shower.

### AN IMPROVED FIRE ESCAPE.

The engraving shows a fire escape recently patented by Mr. W. F. Cullen, of Logansport, Ind. In any approved part of the building—frequently in one corner—and connecting with the main hall, is constructed a fireproof compartment on each floor, thus forming a series of compartments one above another extending from the ground floor to the top of the building. The walls, floors, and ceilings of these chambers are built of fireproof material, and are provided with fireproof and self-closing doors communicating with the interior of the building and also with similar doors opening upon verandas which may be built only at the upper stories, or at all of the stories, to enable people to reach the fire escape by the exterior passages when cut off from the more direct interior course by fire within the building. Double doors, made of boiler iron, are used, and are provided with springs for closing them self-actingly, one door swinging inward and the other outward. Within the compartments are constructed fireproof stairs leading from one story to another, and when an elevator is used, as shown in the engraving, in which the escape chamber is shown at *a*, the fireproof doors at *b*, the elevator at *c*, and the iron stairways at *d*, the shaft is built of fireproof material, and being thus protected, it will not act as a flue to accelerate and spread the fire, as elevator shafts generally do. This device affords, practically, the advantages of a completely fireproof building—so far as protection from fire is concerned—without the cost of making the whole structure




CULLEN'S IMPROVED FIRE ESCAPE.

incombustible, and it may be readily built into buildings already erected.

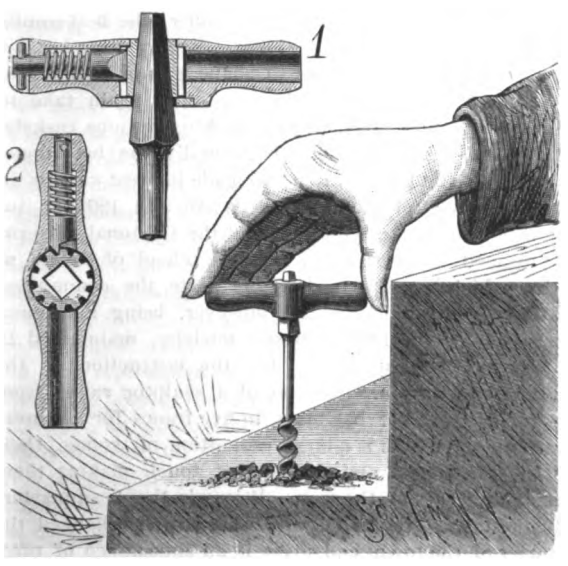
The compartments are of sufficient size to contain at once as many people as are likely to occupy a floor at any one time, so that all can at once escape into chamber, and the door may be quickly closed behind them to exclude heat, smoke, and fire. Once within the compartment they may descend at leisure, even though the fire be burning fiercely close by. Also, by reason of the safety and permanence of the chambers, firemen are enabled to pass up to the different stories to rescue those overcome with the heat and to battle with the fire.

### Buttered Flour.

A Connecticut company, says the Hartford *Times*, makes flour all ready for baking biscuit or strawberry shortcake; it only requires to be mixed with milk or cold water, and the batter is ready for the oven. The process of its manufacture is interesting. A quantity of wheat flour is sifted and dumped into a large tub. Butter cut into large cubes is added to the flour. Then the white-coated operator weighs out certain mysterious quantities of baking soda and fine table salt, which go to swell the contents of the tub. Then the mixture is placed in a large polished cask, which revolves slowly in one direction, while a sort of dasher inside moves in the opposite direction. The cask revolves about 30 minutes, at the end of which time it is opened. It is found that the ingredients have been thoroughly mixed; every particle of moisture contained in the butter has been evaporated, and that the mixture is as fragrant as new mown hay. It is then placed in bags and boxed for shipment.

### RATCHET TOOL HANDLE.

Fig. 1 is a sectional side elevation, and Fig. 2 a sectional plan view of a ratchet tool handle recently patented by Mr. Christian Hermann, of Bristol, R. I. The handle is a straight bar of suitable length formed with a recess in which is seated a ratchet sleeve having an angular aperture for passing upon the tool shank. The handle is b ored lengthwise through both ends, and in one hole is a sliding pawl that engages the ratchet sleeve. A spiral spring acts to move the pawl, the movement being limited by a cross pin through the outer end of the dog, that enters a groove in the handle to prevent the pawl from turning accidentally. The ratchet is held in the recess by a ring plate fitted to the under side of the handle in a manner to allow removal. The hole in




HERMANN'S RATCHET TOOL HANDLE.

the opposite end of the handle permits the insertion of the dog, and can be used to receive a bar and to give greater leverage.

This handle can be readily applied to bits, screw drivers, and other tools, and by drawing back the pawl and giving it a half turn the ratchet mechanism is changed from right to left, so that the handle can be used to withdraw a boring tool or back out a screw.

### Brier Root Pipes.

*In a report on the* trade and commerce of Leghorn, the following note on the so-called brier root pipes, which have become so large an industry of late years, will be read with interest: "An interesting industry has been started here within the last three years by a Frenchman from Carcasonne, for the export of material for the manufacture of wooden pipes. Similar works are also to be found at Sienna and Grosseto. Selected roots of the heath (*Erica arborea*)—preference being given to the male variety—are collected on the hills of the Maremma, where the plant grows luxuriantly and attains a great size. When brought to the factory the roots are cleared of earth, and any decayed parts are cut away. They are then shaped into blocks of various dimensions with a circular saw set in motion by a small steam engine. Great dexterity is necessary at this stage in cutting the wood to the best advantage, and it is only after a long apprenticeship that a workman is thoroughly efficient. The blocks are then placed in a vat, and subjected to a gentle simmering for a space of twelve hours. During this process they acquire the rich yellowish-brown hue for which the best pipes are noted, and are then in a condition to receive the final turning and boring, but this is not done here. The rough blocks are packed in sacks containing 40 to 100 dozen each, and sent abroad, principally to France (St. Cloud), where they are finished into the famous G. B. D., or 'Pipes de Bruyere,' known to smokers in England under the name of 'brier wood pipes.' The production of this article is considerable, four hands turning out about 60 sacks per month. Consignments are also made to England and Germany, but at present the demand is said to be rather slack."—*The Gardeners' Chronicle.*

### Ingenious Idea.

It is told of a man in Connecticut who wanted to put a water pipe through a drain several feet below the surface of the ground, without digging up the drain. To accomplish it he tied a string to a cat's leg, thrust her into one end of the drain, and giving a terrific "scat," the feline quickly appeared at the other end; the pipe was drawn through the drain by means of the line, thus saving considerable expense.

### New Italian War Ship.

The latest addition to the Italian ironclad navy, the Ruggiero di Lauria, was launched at Castellamare on the 9th ult. This vessel forms one of the Andrea Doria class, and is a modified type of the Italia. She is constructed entirely of steel, and her principal dimensions are: Length between perpendiculars, 328 ft. 1 in.; extreme breadth of beam, 65 ft. 7 in.; mean draught of water, 25 ft. 6 in.; displacement, 10,080 tons. Her twin screw engines, of 1000 indicated horse-power, have been supplied by Messrs. John Elder and Co., of Glasgow, and are estimated to propel her at a speed of sixteen knots per hour. The chief armament of the Ruggiero di Lauria will consist of four 17 in. Armstrong breech-loading guns of the latest design, mounted *en barbette*, and she will likewise be provided with the most modern type of torpedo apparatus and machine guns. The most vulnerable parts of the hull will be protected by 17¾ in. armor, the system of which, viz., steel or compound, does not appear to have been decided upon as yet. The only explanation which can be found for this is that various conflicting interests are at work at the naval headquarters for the purpose of mere political opposition, and we therefore find Italy expending enormous sums on competitive armor-plate trials, reoccurring with every change of ministry, while the question of the comparative value of the different systems of armor has long been settled by every other naval power.

### The Breaking up of Monitors.

According to one of our contemporaries, the breaking up of an old wooden hull is not an easy matter, but it is nothing compared with the task of dismantling a disused ironclad, as some contractors at Philadelphia, who have been trying to break up an old monitor, have found to their cost. A fire has been burning briskly for several weeks on board the old United States monitor Dictator, at Tasker Street wharf, Philadelphia, the contractors having been endeavoring, with but little success, to get rid of the woodwork which lies firmly embedded between the armor and the hull. Nine months have been spent in the work of tearing the old hulk apart, with prospect of many more passing before the vessel will be reduced to old iron and ready for the furnace. Several thousand tons of material have been taken out of the Dictator, and yet there are many more concealed in her massive frame. As soon as the remaining portion is cut down to the water's edge, the hull will be towed to a shoal spot on the Jersey side of the Delaware River and—blown up!

### HORSESHOES.

We illustrate in the accompanying engraving some curious specimens of horseshoes that were recently shown at the Exhibition of Hippic Material in Paris.

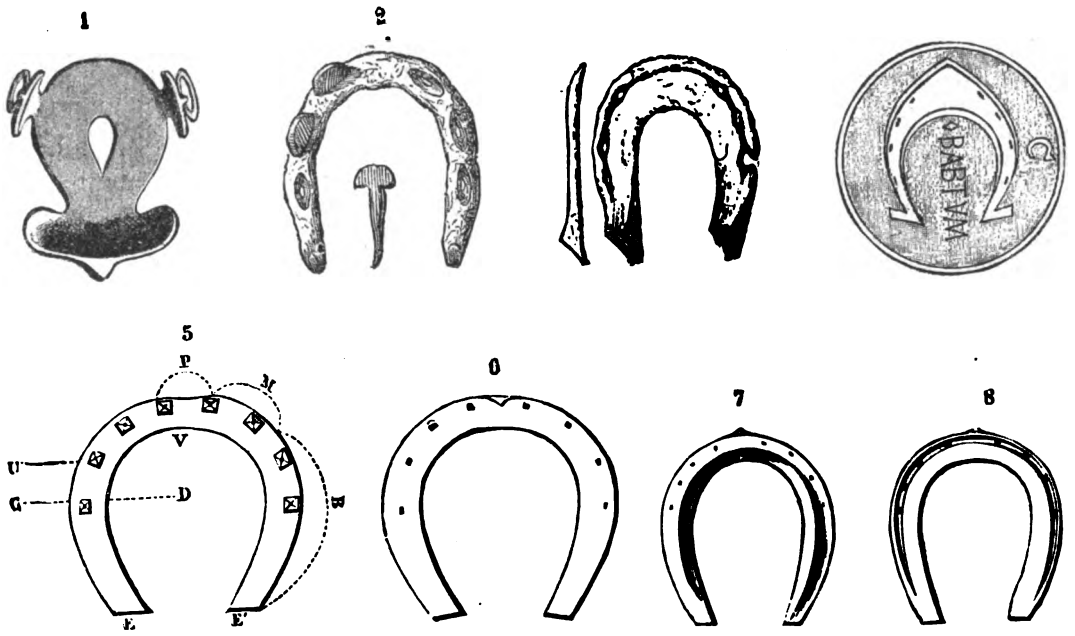
Fig. 1 is the *solea*, an oval plate, entire or perforated in the center, and provided with a heel piece and lateral ears. This is found in France, England, Germany, and all places where the Romans once established their power.

No. 2 is the Celtic shoe with nails in the form of violin keys. This was found in the environs of Alise.

The horseshoes of the seventh century (Fig. 3) are distinguished by the thickened extremity of their branches. Those of the middle ages (Fig. 4) were proportioned to the large stature of the war horse and the weight of the knight's armor. They sometimes weighed over two pounds, and were wide, pointed at the toe, and provided at the heel with a long projection.

In the French shoe (Figs. 5 and 6) we distinguish the toe, P, the *mammelles*, M, the branches, B, and heel, E.

The English shoe (Figs. 7 and 8) differs from the French as regards the arrangement of the iron and the method of applying it to the hoof.—*Science et Nature.*

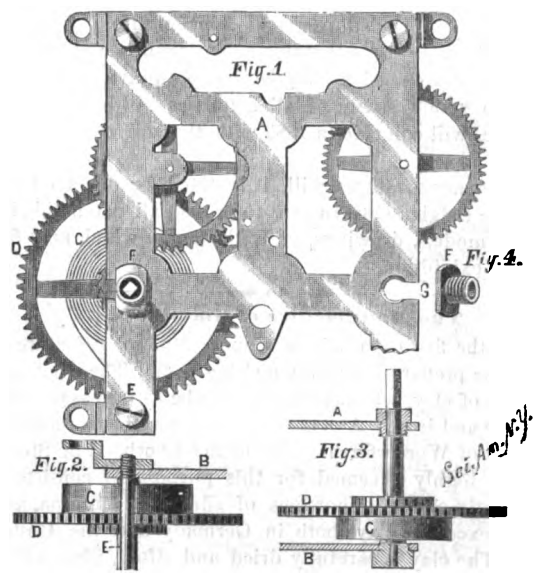



HORSESHOES OF DIFFERENT NATIONS.

According to the *Journal d'Hygiene*, citric acid is a most powerful disinfectant, preserving meat from putrefaction, and proving rapidly fatal to septic microbia. The soluble citrates have no similar action.

### AN IMPROVED CLOCK FRAME.

The invention herewith illustrated provides for the ready removal of the main spring or springs and main wheels of a clock without disturbing the rest of the movement, or taking it apart in case of breakage or for necessary repair, and so they may be quickly and easily replaced. The front plate of the frame, A, Fig. 1, is made with a peculiar slotted construction for a screw boss or front bearing for the arbor of the main wheel, as shown at G, the form of these detachable screw bosses being as represented by F, Fig. 4. One main spring, C, and wheel, D, are shown opposite, fixed in place in a similar bearing. E represents the pillar or bolt of the main frame, to which the main spring is attached, and




WYKHUYSEN'S IMPROVED CLOCK FRAME.

this pillar has at its rear end a screw thread adapted to screw into the back plate of the movement, B, as shown in Fig. 2, although the rear bosses may be permanent attachments, as in Fig. 3.

This invention has been patented by Mr. Hendrik Wykhuysen, of Holland, Mich., to whom communications should be addressed.

### A Whale Caught by a Telegraph Cable.

Mr. Robinson Kendal, chairman of the West Coast of America Telegraph Company, has communicated the following extracts from letters received from that company's officials on the west coast of South America, to the papers. The captain of the company's repairing steamer writes: "Having picked up 21 knots of cable, and while continuing picking up, an immense whale came up to the bows entangled in the cable. It seemed to be about 70 feet in length. In its struggles to get free the cable cut right into its side, the whole of its entrails coming out, and great streams of blood. In its last dying struggle it parted the cable on the bow sheaves, and floated to windward of the steamer.

"The cable was twisted up in the form of a wire rope for about two fathoms, and in six different parts it had the appearance of having been bitten through sufficiently to stop all communication. There is no doubt the whale has been the cause of the interruption." Their manager also writes: "The cause of the breakage of the cable, as has been pointed out to you in Captain Morton's report, was a huge whale, which became entangled in the turns of the cable, and was held prisoner for seven days; the interruption was unfortunate, but it is, at least, satisfactory to know that the cable did not give way naturally, and that where picked up, the sheathing yarn and core were found to be in an almost perfect state of preservation, in fact, looked as good as on the day the cable was first laid."

### Great Fire in Cleveland.

On the 7th of September the city of Cleveland, Ohio, was the scene of a gigantic fire, which swept away for the time being many of her manufacturing industries, caused the loss of life, and also destroyed property to the value of two millions of dollars. The burned area covers more than fifty acres, extending from Scranton Ave. and the Bee-line track on the east and west, and from the river to Gerard St. on the north and south.

Included in the property destroyed were several lumber yards, thirty-five million feet of lumber, coal yards, many railway cars. The fire was spread from point to point by the burning boards, which were floated into the air by the strong upward current. The heat was terrible. Several fire engines were consumed, owing to the rapidity with which the fire spread.

### Antwerp International Exhibition, 1885.

The International Exhibition at Antwerp will be a national and governmental undertaking, under the immediate patronage of His Majesty the King of the Belgians. The president of the exhibition will be His Royal Highness the Count of Flanders, and the vice-president the Minister of Agriculture, Industry, and Commerce. The committee will consist 450 members, and the Belgian Parliament will be asked to vote a sum of money for the commission. The State will nominate the jury and regulate its functions. The exhibition will be opened on May 2, 1885, and will embrace five principal divisions or sections, namely: 1. Education, including the fine arts and art applied to industry. 2. Manufactures. 3. Commerce and navigation, fisheries and pisciculture. 4. Electricity. 5. Agriculture and horticulture. Each of which will again be subdivided into groups and classes. The triennial exhibition of painting, sculpture, and architecture, to which artists of all countries will be invited to contribute, will coincide in 1885 with the universal exhibition.

All necessary measures will, it is stated, be taken on the part of the Belgian Government to protect all patentable inventions, models, drawings, or trade marks which may figure at the exhibition.

### The Manufacture of Glass Pots.

One of the first essentials to a successful manufacture of glass is the preparation of the melting pots. These pots are composed of clay, which is required to be as free as possible from lime and iron. A clay obtained from the carboniferous shales of Worcestershire, in the neighborhood of Stourbridge, is highly esteemed for this purpose; it consists of pretty nearly equal proportions of silica and alumina, and there are excellent clays both in Germany and the United States. The clay is carefully dried and sifted, after which it is mixed with hot water, and worked into a paste; it is then transferred to the kneading floor, and when sufficiently kneaded—which is done by men treading it with naked feet—it is laid in large masses in a damp store cellar to ripen, a process the theory of which is not well understood. When required for forming the pots, a sufficient quantity is taken and again kneaded with one-fourth of its quantity of the material of old pots, which are ground to fine powder and carefully sifted; this material gives firmness and consistency to the paste, and renders it less liable to be affected by the heat.

The pots are of two kinds, the opened and the covered. The first is used for melting common glass, such as window and bottle glass; the other for flint glass. In each case the pots are made by hand, and require great skill and care. The bottom is first moulded on a board. When the bottom is finished, the workmen begins to build up the side of the pot by first forming a ring of the same height all round, taking care to round off the upper edge to a semicircular curve of great regularity; upon this he begins bending over other lumps of the paste until another equal layer is formed, and these are continued until the pot is complete; but the workmen do not work continuously at each pot until it is finished; they leave off from time to time, spreading wet cloths over the edges when they discontinue working. This is necessary, to admit of a certain amount of drying, otherwise, says the *Glassware Reporter*, the large weight of clay used would prevent the form being kept, and the pot would fall to pieces or lose shape seriously; the building of the pot is consequently extended over several days.

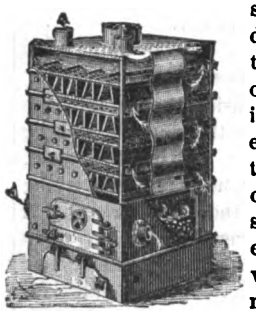
Those made in a favorite mode are from three to four inches thick, but the flint glass pots are only from two to three inches. After the potter has finished his work the pots are removed into the first drying floor, where they are only protected from draughts, so that the drying may be conducted with the greatest possible uniformity. When they have progressed sufficiently they are removed to the second drying floor, which is heated with a stove, and the drying is here completed. They are then placed in the store, where usually a good stock is kept on hand, as time improves them, and they are seldom kept less than six or nine months.

When required for use, they are placed for four or five days in the annealing furnace, which is on the reverberatory principle, and they are there kept at a red heat. This furnace is so situated that the pots, when ready, can be most quickly transferred to the main furnace—an operation of exceeding difficulty, and requiring great skill and dexterity, as they have to be removed while red hot, and it must be done so quickly that no sudden cooling shall injure the pot, a difficulty which can only be understood by remembering that the ordinary pots are nearly four feet in depth, are the same in width at the mouth, by about thirty inches at the bottom, and they weigh several hundredweight. The enormous amount of labor bestowed upon these pots makes them very expensive, their value being from $30 to $50 each.

Their removal from the annealing oven to the main furnace is effected by an immense pair of forceps several feet in length, which are placed horizontally upon an upright iron pillar about three feet in height, which rises from a small iron truck on four wheels, so that the whole apparatus can be easily moved from place to place. By means of this instrument the pot is lifted and dexterously withdrawn from the oven, and as quickly transferred to its position in the main furnace, in which usually ten or twelve are placed on a platform of firebrick or stone, each pot being opposite to a small arched opening through which it can be filled and emptied. The entrance to the main furnace, through which the pots have been introduced, is then closed with a movable door of firebrick, and covered over with fireclay, to prevent the escape of heat; the pots in the furnace are filled with the prepared materials for glass, now called grit, mixed with about a sixth or eighth part of cullet, or broken glass; the openings are closed temporarily for two or three hours, by which time the first charge of material has melted down, leaving room for a further supply, which is then thrown into the pot, and this is repeated two or three times until the pot is completely full. The openings are then closed, and the heat increased to the utmost for ten or twelve hours; and the result of it is to perfectly melt and vitrify the materials.

### BOILER FOR HEATING BUILDINGS.

The engraving represents a boiler composed of sections mounted one upon the other, for use either in heating and circulating water, or for generating and circulating steam, to be used in heating buildings and for other purposes. The fire box section and the several horizontal sections are cast or made of metal. The joints of the sections have putty or cement applied to them to prevent leakage, and the sections are held firmly together by bolts passing through lugs upon opposite sides of the boiler. Cast with each section is a series of parallel horizontal water ducts; these are so arranged that the ducts of one section will be over the flue spaces of the section immediately above or below it, thus establishing tortuous channels for the passage of the products of combustion. The ducts in each section are in communication with each other at their ends, and the water spaces are alternately connected above and below, on opposite sides of the boiler, by tubular nozzles constructed so as to form sockets. These connections provide for the circulation of the water alternately in reverse directions through the sections. One or more of the sides of the boiler may be fitted with doors opposite the flue spaces to provide access for removing matter deposited on top of the ducts.



Further information concerning this invention may be obtained from Messrs. Redman & Byram, of Fishkill Landing, N. Y.

### Swiss Wood Carving.

The London *Times*, in a letter from one of its correspondents referring to the removal of a number of Swiss carvers to the United States, says that they earn as much as eight dollars a day—more than they can earn at home in a week. This turned into francs sounds a good deal, and is, indeed, an undeniably high wage, eight dollars a day being nearly 10 pounds a week, only a little less, says the writer, than the salary of the President of the Confederation. For all that, the *Berner Post* and other papers of the district are strongly of opinion that the wood carvers would do much better to stay at home. They say: "Do not be so selfish as to follow the example of the horologists of the Jura, and establish in America a new trade which will compete with one of our most important local industries. In the United States you will be far away from your native mountains, from the scenes which suggest and the objects which inspire. The only works of art you will see are statues of Washington and Lafayette, and though you may earn more money you will not be half as happy as you are at Brienz and Meyringen and Interlaken. Stay at home, and instead of going to America let the Americans come to you and buy your chalets, your bears, and your chamois, in the land where they are made."

How far these persuasions will be effective remains to be seen, but it is greatly to be feared that the inducement of 40 francs a day may prove more potent. On the other hand, the attachment of the Swiss to their homes has passed into a proverb; and although some of the watchmakers of the Jura have gone to America, the deftest of them, those who live in the valley of Lake Joux, resolutely refuse to leave their native mountains and abandon their traditional habits for all the inducements that foreign capital can offer.

Swiss wood carving is a much younger industry than Swiss watch making. It was introduced into the Bernese Oberland some fifty years ago by Christian Fischer, a self-taught peasant artist of Brienz. But he was more peasant than artist, detested working indoors, and his ambition did not extend beyond carving rings for table napkins, cutting wooden egg cups, and adorning them with flowers. He was also a musician and village bone setter, and altogether, a man of versatile genius. But his great merit was being the creator of a new industry, for though Fischer did no great doings himself, he put into practice a valuable idea, and founded a school. Peter Baumann, of Grindelwald, and a man named Flenz, belonging to the same country, improving on Fischer's idea, began the making of those charming Swiss chalets, now so popular, and which it is now almost *de rigeur* for tourists in Switzerland to purchase. What was more natural than for these peasant artists to model, first of all their own picturesque houses with their overhanging roofs, their quaint galleries, their painted ornaments, and carved figures, brown with age, standing on a plinth of white stone, overshadowed with trees, within sound of a rushing torrent, and sheltered from avalanches and the north wind by the rocky rampart of some Alpine height?

Peter Baumann, who seems to have been more thrifty and steadfast than his predecessor, settled at Meyringen and taught his art to his three sons, one of whom, Andreas, became the *facile princeps* of wood carving. His work is deemed unapproachable, and his bouquets of roses still serve as models for aspiring sculptors. The success and celebrity acquired by the Baumanns caused the industry to spread, and wood carving soon became the winter occupation of every household in the vale of Hasli. But there was no regular market for their productions, their only customers were casual visitors, their only agents hotel porters and small shop keepers, who took the lion's share of the profits. The trade wanted organizing, in fact, and, after several tentative efforts in this direction, the Brothers Wirth established their extensive workshops, where several hundred sculptors of the Oberland now find regular employment. In this industry, as in almost every other, the best results are obtained by a division of labor. Every carver has his or her specialty. Some prefer to shape groups of animals, others like better plants and flowers, others again take to building miniature chalets, and making curious caskets, and what they like the best is generally the best done. Elaborate artistic furniture is also made in great variety in the establishment of the Brothers Wirth. In 1862 the industry had become so important that the Cantonal Government deemed it expedient to found a school of design at Brienz, which is maintained by the State, the communes, and the fees of pupils, the last, however, being little more than nominal. In 1869 a master modeler, maintained in like manner, was appointed for the instruction of the carvers of Interlaken. The pay of a sculptor varies from two francs a day for beginners to five francs for the more expert, among whom is a large proportion of women, their natural tastefulness and deftness of touch making them formidable rivals to the men. Brienz is the headquarters and chief mart of the trade, which has entirely changed the character of the town, and gives it an appearance of prosperity that in former years was conspicuous by its absence. The number of male and female sculptors employed at Meyringen and Brienz amounts to 2,500, and their industry brings into the district some two million francs a year.

Successful enterprise is always a healthy and stimulating influence, and the success of wood carving at Brienz suggested the idea of making parqueterie and chalets at Interlaken. The former has already grown into a large business, the annual production of one establishment alone amounting to nearly 700,000 square feet of parqueterie, valued at half a million francs. Chalets are made for use, not for show, in parts, and, the parts being numbered and arranged to fit without trouble, a man may order a house by post, have it delivered by rail, and enter into possession, all within a few weeks. Attempts have also been successfully made to turn to account the indigenous stone of the country—variegated marbles, which are found in great variety, as also a soft stone, peculiar to the Oberland, which, while easily worked and susceptible of a high polish, acquires by exposure to the air an adamantine hardness, and has the further quality of being almost indestructible by fire.

### Determination of the Earth's Magnetism at Paris.

Very careful determinations of H, the value of the horizontal component of the terrestrial magnetic field, have recently been made at Paris by M. Mascart, the well known electrician. The measurements were made in the observatory of the Parc St. Maur, and the method of Gauss was adopted as one of those giving the most correct results. This consists in oscillating a magnetized bar under the influence of the earth; then placing it a certain distance from another bar submitted to the action of the earth, and noting the deviation suffered by the latter. Let

$M$ = magnetic moment of the bar.
$K$ = its moment of inertia.
$T$ = the duration of infinitely small oscillations.
$R$ = the distance between the centers of the two bars.
$\alpha$ = the deviation of the auxiliary bar.
$a$ = a constant determined by experiment.

If the deviating bar is perpendicular to the magnetic meridian, and directed toward the middle of the bar deviated, we have

$$H = \frac{\pi}{T}\sqrt{\frac{K}{R}\frac{2}{\tan.\alpha}\sqrt{\frac{1}{R}\left(1+\frac{a}{R^3}\right)}}.$$

If the deviating bar remains perpendicular to the direction of the bar deviated, tan. $\alpha$ should be replaced by sin $\alpha$. It results from the experiments that the mean value of the horizontal component at the observatory of the Parc St. Maur on July 1, 1884, is $H = 0{\cdot}19\ 414 \pm 0\ 00012$ C. G. S. unit. The error is probably below 0·0001.

### An International Scientific Congress.

During the recent meeting of the American and British Associations a proposition was brought forward for the organization of an International Scientific Association, to meet at intervals in different countries of the civilized world. It came in the shape of a petition signed by eight past presidents of the A. A. A. S., and many members of both associations. The matter was referred to a committee from the British Association consisting of Sir William Thomson, Sir Lyon Playfair, and Vernon Harcourt; and from the American Association a similar committee was appointed, namely, Professors Newcomb, Hunt, Barker, Pickering, Powell, Remsen, and Minot. The joint committee will confer and report hereafter. The idea meets with very general approval

## Correspondence.

### The Planet Neith.

*To the Editor of the Scientific American:*

The interesting article in your last number on the supposed planet of Neith brought to my mind a hypothesis entertained upon the discovery of the satellites of Mars, that they were not its own original production, according to the nebular theory, but were some of the planetoids which had come within the range of its attraction.

Jupiter has sifted out belts of space in the region of the planetoids which are now comparatively empty; may not Mars have done a little, a very little, on the other side of the group? J. R.

Ottawa, Sept. 9, 1884.

### The Planet Neith.

*To the Editor of the Scientific American:*

Your issue of Sept. 6, 1884, contains an interesting article on the "Problematic Planet Neith," in which it is said that that is the name given the little planet in honor of the mysterious goddess Sais, whose veil no mortal has raised.

This is as confusing as it could well be made, for, first, the article is to prove that the veil has been raised, and the name is therefore singularly inappropriate. Second, Sais was not a goddess, but a town in Egypt, in which Neith was worshiped. Neith was a goddess of great local veneration, who represented universal motherhood.

Her name would therefore be more appropriate for the son, which, no doubt (in my mind, I mean), was really worshiped under this designation.

It is the general opinion that it was long ago agreed upon by astronomers that new planets should have Latin mythological designations, so the name of Herschel was refused to the world he discovered, and it was hardly suggested that Leverrier should attach his patronymic to the planet he gave to science.

If it be true that the new planet was formerly a satellite of Venus, and is now beyond her attraction, the name Adonis, typical of the loved and lost, would be far more appropriate than the one suggested. J. C. B.

### Balancing of Wheels and Cylinders.

*To the Editor of the Scientific American:*

An article entitled "Balancing Wheels and Cylinders," in your issue of Aug. 30, excites many thoughts which may be carried further. No. 368 of SCIENTIFIC AMERICAN SUPPLEMENT published the most exhaustive article on the subject of balancing which has yet appeared. The balancing of highly speeded machinery is imperative. Your suggestion that an object, a pulley, for instance, should be poised so as to be free to oscillate in all directions about its center, is the key to the correct method for balancing all rotating objects the center of which is accessible by a pivot or other equivalent means of support. It can then be, first, reduced to a standing balance by applying weights in deficient parts, and afterward, by rotating, be made to indicate where, in lines transversely to the plane of rotation, the weights should be placed to secure a running balance.

That the process involves no uncertainty we may feel sure, from the fact that Pratt & Whitney have recently established in their works in Hartford, Conn., a complete set of apparatus for securing a running balance to all rotating or revolving parts of machinery. They are able to suspend a cylinder, the center of which is inaccessible by a pivot, between two centers, with the axis perpendicular, and obtain indications showing points of excess or deficiency of weight. It is obvious that the center of gravity of a rotating body and its mechanical center must coincide. A running balance will in every case, therefore, be a standing balance; and a balance at one rate of speed is a balance at all rates of speed. The inside of the rim of a wheel may be improved by turning; but cannot often be brought to a balance by that means, as the lack of homogeneity will defeat.

All rotating bodies will strive to rotate in planes parallel to their greatest sectional weight. A pulley or cylinder, whose axial dimension is greater than its equatorial dimension, cannot be long retained upon its mechanical axis when poised near its center of gravity; but upon slight disturbance will fall out of the plane in which it is desired it shall run. It can in no case, unaided, recover rotation in such plane. It is, therefore, necessary, when balancing a cylinder, whose length exceeds its diameter, to poise it so that it be restrained from assuming a plane of rotation parallel to its greatest sectional weight. Yet the restraint should not be so great as to prevent each end of the cylinder from rotating upon its center of gravity. The mode of suspension mentioned above as adopted by Pratt & Whitney is believed to be the best.

An unbalanced pulley running at a high velocity in the middle of a slender shaft, will deflect the shaft no more than enough to permit the mass, consisting of shaft and pulley, to rotate upon its center of gravity. But within that limitation, however small, its energy is irresistible. The point of greatest prominence of the pulley will coincide with the point of greatest deficiency of weight. It is very frequently but erroneously supposed that the opposite effect is realized, and that the heavy portion of the pulley will "throw off" by centrifugal force, like the ball of an engine governor, to an extent limited only by the restraint [illegible] of the shaft. W. M. D.

### A New Invention Called For.

There is an opportunity now presented to inventors with some knowledge of the facts such as rarely is open to any man.

Wanted, a cotton gin: one which does not abuse the cotton like the saw gin, one that is more positive in its feeding arrangements and with greater facility of doing work properly than the roller gin. The gin wanted is for the grade of cotton known as peeler, or medium between the upland and Sea Island.

There is an increasing demand to-day for a better grade of cotton than is raised in Georgia, South Carolina, with more certainty to the staple than with the Florida cotton, with the fineness that the best Louisiana, Mississippi, and Alabama cotton is noted for, but with an increased length of staple running from 1¼ to 1¾ inches.

The saw gin tears this cotton to pieces. The roller gin is so slow that it does not pay the planters to raise this extra staple cotton, for the simple reason that it takes them, to use their own expression, "from November to July" to gin it.

The saw gin must sooner or later be abandoned for all cotton, and yet to-day it is the best gin in use for upland and common cotton. Inventors who would make a success of this must study the cotton question, and in several things must absolutely abandon previous practice. The saw first of all doubles the staple or fiber into several sharp turns. This is done suddenly with a great deal of force, and if the cotton is not perfectly dry, the outside of the fiber is torn and its strength is forever gone. The roller gins of to-day are covered with leather, rubber, paper, cotton cloth, and a half dozen other mixtures. They drop the cotton off from the seed, and there are quite a number of systems of machinery which are not particularly speedy in quantity. In some of these a straight edged knife, like the doffer on the cotton card, strikes across another knife of the same kind without injuring the fiber of cotton, but in this way, while the fiber is bent over the top of the knife, held against it by the pressure of the rubber or cloth covered roll, it breaks the seed away from the fibers, the cotton is carried through and thrown into the pile. This is practically the way cotton is ginned to-day.

There must be some Yankee who can see his way out to perfect a gin which is free from the faults of the saw gin in handling the cotton, and has vastly more virtues than any roller gin ever yet put on the market. What is wanted is something which will take the fibers of cotton from the seed, leave the fibers as nearly parallel as possible and without injuring them. The man who perfects this machinery will have a far more legitimate and quite as valuable a matter in his hands as the telephone or any of the other inventions of the past few years.

If a man can be found who can raise this kind of a gin without going into some kind of a stock speculation, or without putting it upon the market until after it is thoroughly tested, that man will not need to do much work the rest of his natural life unless he attempts to ape some of the bonanza kings or other fungous growth of society. There are a great many questions included in this of the cotton gin. The doors are wide open. There are no patents on the records that amount to a straw man, and whoever can see some way to do this properly, thoroughly, and efficiently, will find a rich harvest.

The ginning of cotton to-day, so far as the saw gin goes, is barbarous, so far as the roller gin goes is not worth considering in the amount of work the roller gin will do, yet the demand is for better cotton. The planters are ready to furnish it. We should suppose the spinners might take a little interest in some of these things, but they are too busy buying cheap cotton. The woods are full of inventors and patents which are principally worth the value of the paper on which they are written, per pound, at least so far as the spinner goes, for really accomplishing the object aimed. Who is the man that tackles the job?—*Manufacturer's Gazette.*

### The New Australian Silver Mines.

Australia has long been noted as a gold producing country, and now what bids fair to be an extensive silver producing region has been found. The mines are in the Barner ranges of New South Wales, near where the colony joins South Australia. Silver bearing ores were first found there in 1872, by a shepherd, but the nature of the ore was not understood, and nothing was done. Two years ago a lot of ore was sent to England, this time with better results, though through inexperience the miners selected the lowest grade ores, viz., argentiferous galena. They netted the handsome return of £7 per ton on the shipment, after the highest commissions and charges had been exacted. Miners who were working silver properties in these parts were all making money before they sold out.

Now there has been an influx of miners, and a town known as Silverton has been built up. The country is represented as inhospitable, rocky, and mountainous. Over the whole of the great mountain chain are found localities of the precious metals, and, following their leading structural idea, they arrange themselves in parallel zones of a similar nature to those of the Cordilleras and California. Where the section of the formation can be examined, there can be seen folds of more or less complexity, twisted and warped by longitudinal forces and often compressed into a series of zigzags of a wonderful nature. The mines of this district consist of two groups. The one at Silverton embraces eleven claims, in which the ore consists of sulphides of lead or argentiferous galena. The profits secured on these ores amount to £12 per ton. About eight of these mines are opened up, six of them to a considerable extent. There is one shaft down 180 feet, carrying the lode very strong in the bottom. The lode at this point gives indications of turning from sulphides of lead into sulphides of silver. Fifteen shafts have been sunk on different parts of these eleven mines, their depth varying from 30 feet to 75 feet, one being 130 feet. The lode is disclosed in each of these shafts, and found to be of a thickness varying from 1 foot to 3 feet. Some rich returns are now being obtained from these mines, the ore yielding, as above stated, a clear profit of £12 per ton. The second and larger group of mines is situated at a distance of 28 miles from Silverton. They are called the Lakes Camp group. The ores here are purely sulphides of silver, and very rich. Two tons of ore recently sent to England for assay were sold for £600. Shafts have been sunk in many parts of the ground held by the syndicate, and ore has been discovered everywhere, but, of course, all of it is not of the richest quality.

The lodes have all the appearance of permanency. In one shaft, the deepest of this group, the lode has been traced to the total depth—75 feet—and at the bottom it is six inches thick, with indications of continuance and improvement. A great drawback to the rapid development of these mines is the scarcity of labor at Silverton.

### Covered and Uncovered Boilers.

In order to ascertain the degree of advantage obtainable by felting and lagging steam boilers, Mr. B. H. Thwaite, F.C.S., has carefully carried out the following experiments on a Bull type of vertical boiler: A definite quantity of water was poured into a vessel of a size sufficient to cover one square foot of plate surface, the vessel being externally lined with wood. The rise in degrees of heat during the hour's exposure was noted. The same weight of water, with identical initial temperature, was then placed for the same time on the surface of the lagging, which consisted of three thicknesses of three-eighths inch felt, covered with one-half inch tongued and grooved battens. On the naked plate it was found that 516·75 heat units per square foot were absorbed by the water; and on the lagged portion only 145·75 units per square foot were given off. This is equivalent to a reduction of wasteful radiation, due to the lagging, of 34 per cent; or with a vertical boiler, say 4 feet in diameter and 9 feet in height, working for ten hours, there would be saving, due to the lagging, of at least 70 pounds of coal.

### Railway Law.

Railway companies are often called upon, says the *St. Louis Railway Register*, to defend suits in which passengers, who have, either by their own carelessness or misfortune, suffered losses of property, attempt to recover compensation therefor. It is interesting to read reports of these cases, and to know how far common carriers of passengers can be held for such losses. Without attempting any subtle analysis of the cases, or argument as to their correctness, we will briefly refer to some of them, and try to deduce the principles involved.

At New Orleans, recently, Mrs. Henderson sued the Louisville and Nashville Railroad Company to recover ten thousand dollars for the loss of a little handbag which contained money and jewelry worth that sum. It seems that she was going from Mobile to New Orleans, and, as the wind came in too strong through the open window, she arose to close it, having her bag in her hand. In some unexplained way she lost her treasures through the window, and the conductor refused to stop the train until it arrived at the next station. Then she sent a man back for the bag, but it was too late, it had been picked up and kept by some one. The Federal court decided that although, possibly, there was a moral obligation resting upon the conductor to stop the train when apprised of the loss, he was not legally bound to do so, and the company was not liable for the property lost.

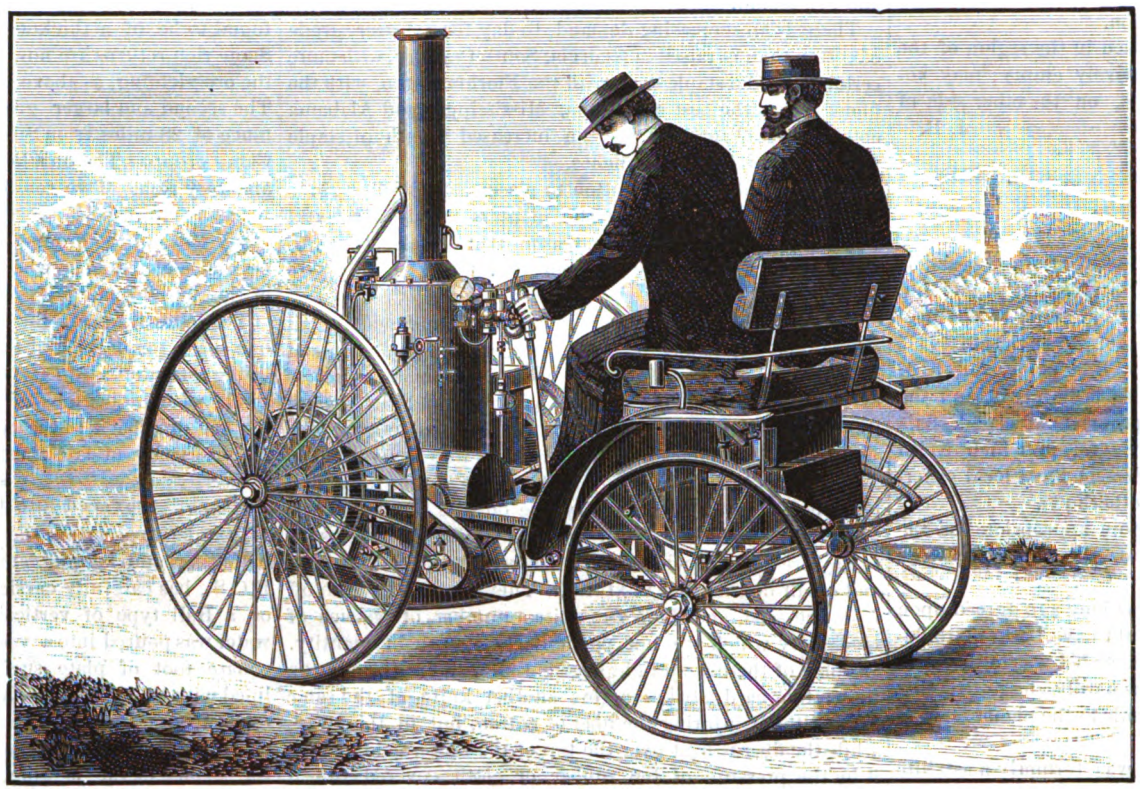
Some years ago one McElvoy took a train on the Marietta and Cincinnati Railroad with 4,000 dollars in his pocket belonging to a bank for which he was agent. The train went through a shaky bridge, caught fire, and poor McElvoy and the money were both burned up. His widow sued for damages for his death, and the bank sued for the money. How the first suit resulted we do not know, but the bank was beaten in its attempt to make itself good. The court said that McElroy ought to have sent the money by express if he wished for absolute security; and that when he carried the funds in his pocket he assumed the risks himself.

In New Hampshire, once, Mrs. Smith, a poor woman who sewed for her living, took a train with a big bundle of coats, cut ready for making, and placed it on the seat with her. During a few minutes' absence her property was stolen, and she sued for its value. The judge decided that the company was not liable, for there was no agreement to carry the bundle either as goods or freight.

A certain Mr. Weeks was still more unfortunate. He was going to New York on the New York and New Haven road, and when the train arrived, horses were attached to the car to pull it down to the station. Weeks went to the door to watch the work, when three men attacked and robbed him of 16,000 dollars in cash. He sued the company, also, and the highest court in Connecticut decided that the corporation could not be made to assume the loss.

## A NEW STEAM CARRIAGE.

A few weeks ago an experiment was made on Grande Armee Avenue, at Paris, with a steam carriage that greatly excited the curiosity of passers-by. This apparatus, which we figure herewith, and which is the invention of Messrs. Dion, Bouton & Trepardoux, consists of two trains of wheels, which are connected to the frame to which the generator and motor are fixed by means of springs that are double behind and single in front. The entire affair, then, is supported by springs, and the wheels are provided with rubber tires. The hind, steering wheels are loose upon two independent axles, each of which is provided with a crank connected by a rod that receives from the directing lever to the right of the driver a transverse motion from left to right or *vice versa*. The carriage is slowed up or stopped by means of two Prony brakes coupled to a single maneuvering lever placed to the left of the driver and acting upon the two large wheels.



A NEW STEAM CARRIAGE.

The carriage is actuated by two independent oscillating motors. The diameter of the cylinders is 2¾ inches, and the stroke of the piston 4 inches. The number of revolutions for a velocity of 2½ miles per hour is about 450, or 900 piston strokes per minute. The escapement from the motors occurs in a jacket that surrounds the fire box. The steam cools the sides of the latter, becomes superheated, and then enters the smokestack, above the damper, and makes its exit colorless. The water is heated by steam in the reservoir, and enters the boiler nearly at the boiling point.

The generator employed is of a new system, and the arrangement of it is shown in Fig. 2. It consists (1) of a double-shell, E E, C C, that carries all the necessary accessories of a boiler; and (2) of an internal cylinder, D, which is connected with the shell by a number of tubes, T, radiating from it in an inclined position. The water is therefore inclosed between the two cylinders, E and C, in the tubes, T, and in the vertical cylinder, D. The flames circulate around the cylinders and impinge against the tubes. This arrangement permits of an economical utilization of the fuel and of a rapid circulation in the direction of the arrows. The vaporization reaches about 10 pounds of steam per pound of coke. A self-regulating and constant level feed water is connected with the boiler. The level regulates itself without its ever having to be looked after. This feed water is a double-acting pump, which is actuated directly by a special motor, which takes its steam from the boiler at the normal height of the water level. The carriage can be run with the ash pan open or closed. In the latter case the combustion is quickened by means of two steam blowers that introduce air mixed with steam under the grate. The exact dimensions of the carriage are as follows:

Length of frame, 6 feet; distance between the wheels from axle to axle, 5¼ feet; height of seat above ground, 35 inches; height of frame above ground, 20 inches; diameter of large wheels, 4 feet; and of small ones, 2½ feet. The carriage, properly so called, weighs 285 pounds; the boiler, fire box, blowers, etc., 395 pounds; the motors, 55 pounds; the feed water, 22 pounds; and the maneuvering apparatus, etc., 88 pounds. With a supply of 18 gallons of water, sufficient for an hour and a half, and 65 pounds of coke, the total weight is 1,034 pounds.

The carriage makes very little noise; it operates without visible escape of steam or smoke; will turn around in a circumference of 8 feet radius; and is capable of reaching, on a good road, a speed of 2½ miles per hour. In our engraving (Fig. 1) the driver is represented at the moment at which he is grasping the starting lever.—*La Nature.*

A POULTRY raiser says that short eggs produce hen chickens and long eggs produce cocks.

## IMPROVED HOTCHKISS RAPID SIX POUNDER GUN.

The important order for single barrel machine gun recently given by the British Government to Mr. Hotchkiss, of Bridgeport, Conn., is the result of the competitive trials carried out last year by the Ordnance Committee at Shoeburyness.

In 1881 it was decided by the British war office to invite inventors to supply a new gun for the light armament of the navy, and the following memorandum of conditions to guide manufacturers was issued by the War Office, dated December 29, 1881.

*Quick Firing Rifled Breech-loading Gun for Auxiliary Armaments.*

1. The gun to be a breech-loader which will range with accuracy to 4,000 yards.

2. The muzzle velocity of the projectile to be not less than 1,800 f. s.

3. The projectile to be shell and steel shot of 6 pounds weight.

4 The projectiles and powder charges to be made up in one cartridge for simultaneous loading.

5. The service of the gun to be capable of being performed by three men.

6. The gun to be able to fire under the above conditions not less than twelve aimed rounds per minute.

7. The mounting to be suitable for either ship or boat service. An alternative mounting to be provided, to enable the gun to be readily mounted for field service.

8. To be capable of readily delivering an all-round fire.

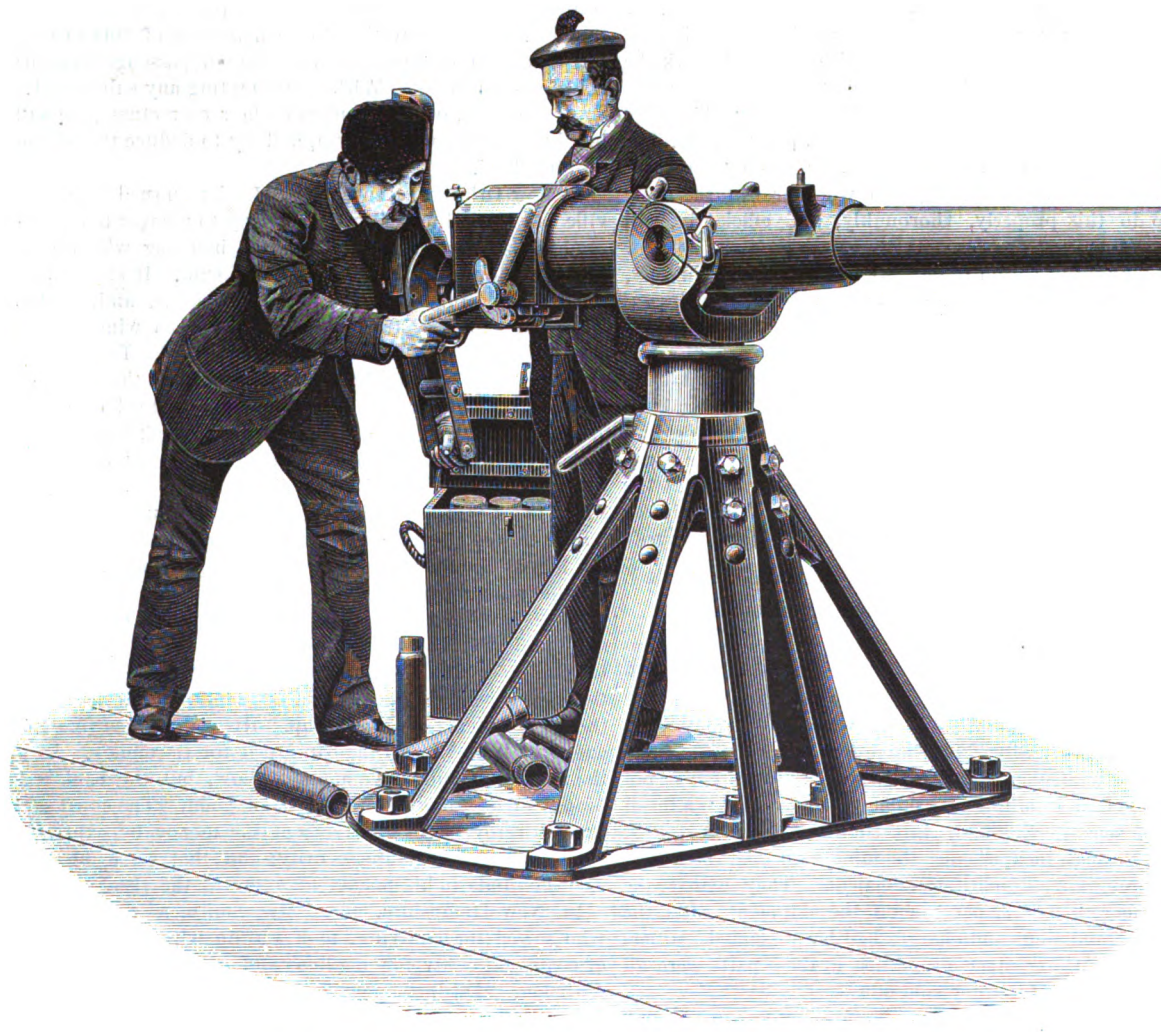
9 The recoil to be reduced to the lowest limits, and the gun to return after recoil to the firing position.

10. The gun to be provided with an easy removable shield, proof against the fire of the Martini-Henry rifle at 100 yards range.

11. The total weight of the gun *and ship mounting not to* exceed 10 cwt.

In the spring of 1883 three different guns constructed to fulfill, as nearly as possible, the above conditions, were delivered for trial by the following firms: Sir William Armstrong, Michell & Co., Hotchkiss & Co., and Thorstein Nordenfelt.

The Armstrong gun was withdrawn from trial after the preliminary experiments, as it did not give, says *Engineering*, the expected results, the Ordnance Committee recommending the Hotchkiss gun, after a series of very successful experiments at Shoeburyness. There being, however, some diversity of opinion in the navy on the system of training the guns, the Admiralty decided to order, besides the Hotchkiss gun, a certain number of Mr. Nordenfelt, who was to adopt the Hotchkiss non-recoil system of mounting, and to embody similar ballistical features in his gun, so that the ammunition could be fired from either system with exactly similar ballistical results.



IMPROVED HOTCHKISS RAPID SIX POUNDER GUN.

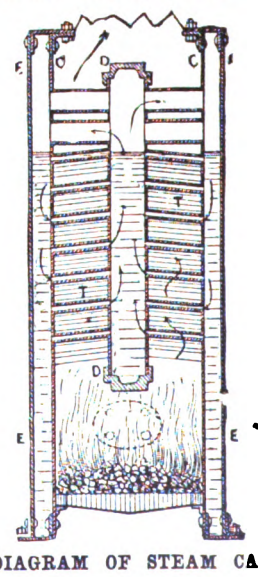



Fig. 2.—DIAGRAM OF STEAM CARRIAGE.

The exact shape of the pedestal for the guns is not yet decided; it will vary somewhat, according to the construction of the ships and the places for the guns. The first 77 Hotchkiss guns ordered are, according to the term of the contract, to be delivered by Hotchkiss & Co. by the beginning of April next.

The Hotchkiss guns are called "non-recoil" because they are generally mounted on fixed elastic pivots and have no

perceptible recoil, although the guns in reality have a definite amount of movement at the departure of the projectile, sufficient to relieve the mountings of undue shock.

In all cases, except for the larger calibers for boat service and for the field, these guns are laid by means of a stock, or shoulder piece, bearing against the left shoulder (as in the Hotchkiss revolving cannon) and a pistol grip with trigger, which the gunner grasps with his right hand. He fires the moment his sights bear upon the object aimed at, by pulling the trigger, so that it will be seen that this gun has the general characteristics of the Hotchkiss mounting, viz.:

1. The gun is mounted on a pivot and trained direct by the shoulder without the aid of any elevating or directing mechanism; thus enabling it to be pointed easily and rapidly from moving and rolling vessels against swiftly moving objects.

2. The sighting and firing are effected by a single man, as clearly indicated in the perspective view upon the opposite page.

The gun is made of Whitworth's fluid-pressed steel, oil tempered. The body consists of a tube and a jacket carrying the breech and the trunnions, so that the longitudinal and transverse strains are divided. The jacket is shrunk over the tube, and to prevent any slipping they are locked together by a screwed collar, carrying the fore sight. The gun is exactly balanced in the trunnions,

The breech action belongs to the class of guns with a breech-block sliding vertically through a mortise, and actuated by a lever, the movement of which opens the breech, extracts the fired cartridge case, and cocks the hammer for the next shot. The action is composed of the following parts, viz., the wedge, with its stop-screw for limiting the run; crank and crank handle, for moving the wedge up and down; firing hammer and its rocking shaft; main spring, trigger sear, trigger spring and trigger, and the extractor.

A STATISTICIAN, Dr. Farr, we believe it was, recently stated that if one could watch the march of 1,000,000 people through life, the following would be observable: Nearly 150,000 would die the first year, 53,000 the second year, 28,000 the third year, and less than 4,000 in the thirteenth. At the end of forty-five years 500,000 have died. At the end of sixty years 370,000 would be still living; at the end of eighty years, 97,000; at eighty-five, 31,000; and at ninety-five years there would be 223; at the end of 108 years there will be one survivor.

## MESSRS. RENARD AND KREBS' ELECTRIC BALLOON.

The problem of steering balloons, which was for a long time regarded as visionary, has made great progress in recent years, and may now be considered as solved. Captains Renard and Krebs have the honor of being the first to successfully accomplish this, and therefore merit the gratitude of their contemporaries. But, of whatever interest be their work, we must not forget those who have preceded them, and shown them the path that they should follow. Before speaking of the memorable ascension of Aug. 9, 1884, we think it indispensable to trace the history of the steering of elongated balloons provided with screw propellers.

It was in 1852, thirty-two years ago, that the way was opened by our great engineer Henri Giffard. It was then that a true aerial ship, of elongated form, and provided with a screw and rudder, was for the first time seen to rise into space. This ship was 44 meters in length, and its equatorial diameter was 12 meters. The balloon was surrounded on every side, except beneath and at the ends, with a netting whose extremities united on a stiff wooden bar. At the extremity of this latter there was a triangular sail, movable around a rotary axis, which served as a rudder and keel. At six meters beneath the bar a steam engine mounted upon a wooden frame was suspended along with its accessories. The propeller, which consisted of two large blades, was 3·4 meters in diameter, and made 110 revolutions per minute. Empty, the engine and boiler weighed 150 kilogrammes. Provided with water and coal for starting, they weighed 210 kilogrammes; the accessories to the engine and the supply of coal and wood weighed 420 kilogrammes more.

Henri Giffard had then no financial resources. He agreed to make his first ascent on a certain day at the Paris Hippodrome. On the 24th of September, 1852, the balloon was inflated with illuminating gas, and Giffard ascended all alone to the sharp whistling of his engine. The wind was very strong that day, and the inventor could not think of stemming the aerial current, but the different maneuvers were effected with the completest success. The action of the rudder made itself felt very plainly, thus proving that the aerial ship had a very appreciable velocity. At an altitude of 1,500 meters, Giffard met slower currents, and found it possible at moments to keep head to the wind. The future inventor of the injector had performed an experiment which caused him to be called by a celebrated writer of the time "the Fulton of aerial navigation."

Giffard's efforts, which were renewed by him in 1855, were followed by the fine experiment executed by Mr. Dupuy de Lome, on the 2d of February, 1872. This gentleman's balloon was 36 meters in length, and about 15 in equatorial diameter. It had a capacity of 3,500 cubic meters, and was inflated with pure hydrogen. The propelling screw was 6 meters in diameter, and was actuated by seven men in the car. The motor was assuredly insufficient, but De Lome, under the influence of his screw, nevertheless obtained an appreciable deviation from the line of the wind, and ascertained that his aerial ship had a velocity 8 kilometers per hour.

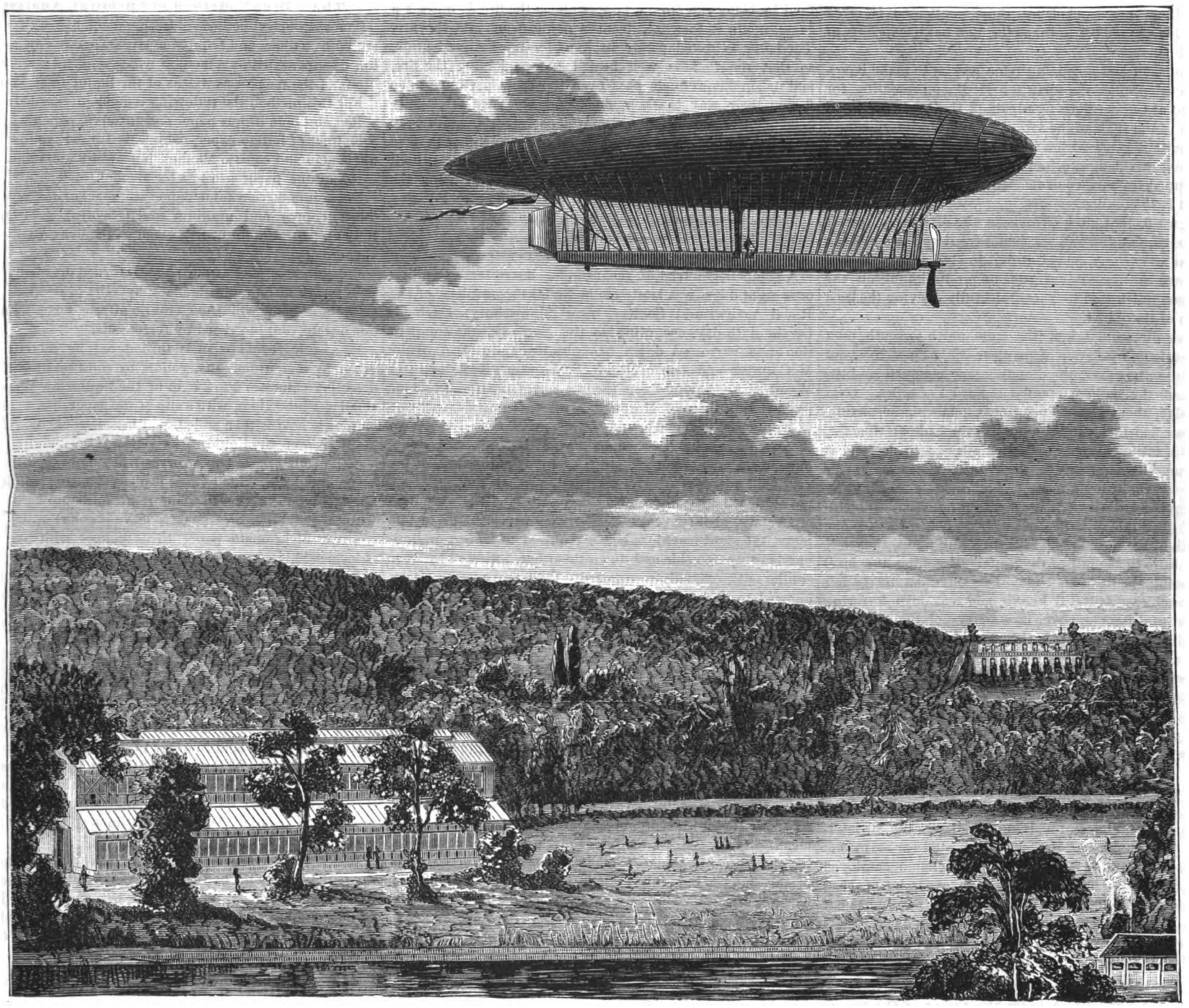
What had been wanting up to this time was a motor that was truly adapted to balloons—a light motor that did not necessitate the use of fire, and that should lose no weight during its operation. As long ago as 1881 Mr. Gaston Tissandier made known the result of his studies and experiments upon the "Applications of Electricity to Aerial Navigation." In a note presented to the Academy Aug. 1, 1881, he expresses himself thus:

"The recent improvements made in dynamo-electric machines have given me the idea of employing them for the directing of balloons, concurrently with secondary batteries, which, although of relatively light weight, store up a large amount of energy.

"Such a motor, connected with a propelling screw, offers advantages over all others, from an aerostatic standpoint. It operates without any fire, and thus prevents all danger from that element under a mass of hydrogen. It has a constant weight, and does not give out products of combustion which continuously unballast the balloon and tend to make it rise in the air. It is easily set running by the simple contact of a commutator.

"I have had a small elongated balloon made, which terminates in two points and is 8·5 meters in length by 1·3 meters in diameter at the center. This balloon has a capacity of about 2,200 liters. Inflated with pure hydrogen, it has an excess of ascensional power of two kilogrammes.

"The balloon is provided with a small Siemens dynamo-machine weighing 220 grammes, whose shaft is connected, through the intermedium of a gearing, with a very light, two-bladed helix, 0·4 meter in diameter. This little motor is fixed to the lower part of the balloon, with a secondary battery weighing 1·3 kilogrammes. The screw, under such circumstances, revolves at the rate of 6½ revolutions per second, acts as a propeller, and gives the balloon in still air a velocity of 1 meter per second for more than forty min-



MESSRS. RENARD & KREBS' ELECTRIC BALLOON.

utes. With two secondary batteries mounted for tension, and weighing 500 grains each, I can gear with the motor a screw, 0·6 meter in diameter, that will give the balloon a velocity of about 2 meters per second for about ten minutes. With three elements the velocity reaches 3 meters. I have renewed the experiments a large number of times."

It will be remembered that this model was exhibited while the Exhibition of Electricity in 1881 lasted. After these first experiments Mr. Tissandier had constructed at the Siemens works a light dynamo machine, and soon devised a new style of bichromate of potash pile, which gave him a powerful and light generator of electricity that was more favorable than accumulators of the same weight. He then resolved to construct a screw-propelled electric balloon designed to work in the free air. M. Alb. Tissandier, his brother, joined efforts with him, and it was at the expense and with the collaboration of the two in common that the first trial of aerial navigation by electricity was made last October. The Tissandier balloon was 28 meters in length and 9·2 in diameter at the center. As we have already given an illustrated description of it,* we need not here repeat it, but may pass on to the remarkable experiments of Messrs. Renard and Krebs.

The balloon constructed by these gentlemen is 50·42 meters in length and 8·4 in diameter, and has a capacity of 1,864 cubic meters.

The motor is constructed in such a way as to make it possible to develop upon the shaft 8·5 H. P., representing for the current at the entrance terminals 12 H. P. It transmits its motion to the shaft of the screw through the intermedium of a pinion that gears with a large wheel.

The pile is divided into four sections that are capable of being grouped for surface or tension in three different ways. Its weight is 19·35 kilogrammes.

On August 9, 1884, at 4 o'clock in the afternoon, the air being nearly quiet, the balloon, being freed and possessing a very slight ascensional power, arose slowly in the air. The machine was set in motion, and under its impulsion the balloon soon quickened its pace, faithfully obeying the least indication of its rudder.

The first direction taken was from north to south, over the plateau from Choisy to Versailles. So as not to stand over the trees, however, the direction was changed and the fore end of the balloon pointed toward Versailles. Over Villacoublay, about 4 kilometers from Chalais, the aeronauts, entirely satisfied with the behavior of the balloon thus far, decided to retrace their steps, and attempt to descend at Chalais, notwithstanding the slight space that existed free from trees. The balloon made its half turn to the right by a very slight angle (about 11°) given to the rudder. The diameter of the circle described was about 300 meters. The dome of the Invalides, taken as a directing point, then left Chalais a little to the left of the route. Reaching the level of this point, the balloon changed its direction to the left with as much ease as it did before, and was soon hovering at a height of 300 meters over its starting point.

Its tendency to descend at this moment was shown the more by a maneuver of the valve. During this time it became necessary to run backward and forward several times, in order to bring the balloon over the spot chosen for anchorage. At a distance of 80 meters above the ground the rope was thrown out, and, being seized by men, the balloon was drawn down to the very field from whence it had started.

In our engraving the balloon is shown in profile, at the moment when it is beginning to be set in motion. The screw is in front, and, in revolving, it drives the air laterally over the two sides of the large, elongated car, 33 meters in length. We are informed that the dynamo employed was constructed by Mr. Gramme. The generator of electricity consists of a battery of piles whose nature has not been made known by Captain Renard. The travelers stand in the center of the car, and one of them runs the machine, while the other governs the rudder.—*L'Illustration.*

### Predicting the Weather from the Color of the Stars.

From the fact, determined by W. Spring, that the color of pure water in great bulk is blue, M. Ch. Montigny explains the predominance of this color in the scintillation of the stars just before and during wet weather. The luminous rays, he argues, traversing the air charged with large quantities of pure water are necessarily tinged with the blue color of this medium. The excess of blue thus becomes an almost certain means of predicting rain. This theoretic conclusion corresponds with the results of his observations continued for several years past on the appearance of the stellar rays in connection with the state of the weather. During the few months of fine weather in the present year blue has been much less conspicuous than in the corresponding months of previous years since 1876, when wet weather prevailed. It also appears that green, which had always coincided with clear skies during the fine years before 1876, has recently again become predominant. Hence he thinks it probable that we have got over the cycle of bad seasons, and that dry weather and more normal summers may be anticipated, at least for some time to come. The above is from *Nature*, and the same number contains an abstract of a paper by Professor C. Michie Smith, on green colored suns, in which he concludes that this phenomenon is due to the presence of unusual quantities of watery vapor in the atmosphere.

*SCIENTIFIC AMERICAN SUPPLEMENT, No. 416.

### German Shop Practice.

A German correspondent of the *Railroad Gazette* says: "Wood working machinery in German shops is comparatively small in amount, owing to the great and yearly increasing use of iron in all parts. This is due to increasing cheapness of iron as compared with wood, and of wrought iron as compared with cast in proportion to its security. The use of wrought iron instead of cast is very extended. I saw narrow gauge stock building at Chemnitz and Leipzig with iron frames throughout, which had absolutely no cast iron in any part except the journal boxes. The increased use of iron is regretted by some master mechanics, on account of the greater rigidity and of the consequently greater violence of shocks in train service. A surfacer, band saw, cut-off saw, or driving planer and boring machine are the tools ordinarily found in German wood shops. Suctions for carrying shavings to the boiler room are not used in the shops I have seen. The shavings are used, however, very extensively for firing, in combination with about nine times their weight of coal slack.

This coal slack costs 84½ cents per ton delivered at the railroad. It is fired automatically with a hopper and a screw, which pushes the fuel in under the fire. It is also fired by being run from a hopper above the fire door over a grate, inclined forward, from which it drops into the fire. The latter is raked partly back under the inclined grate, so that the fuel is well heated before joining the fire, and its smoke products pass over the front portion of the fire on their way to their flues, and are very effectually consumed. This firing method is common, I believe, to several styles of firebox, but I do not remember to have heard before of its application to this kind of fuel, to which it is well adapted. By the use of this fuel and firing the boilers of the Chemnitz shops of the Saxon State Railway evaporate 100 pounds of water at an expense of 1·11 cents.

### Trial of Sheaf Binder Harvesters.

A competitive trial of sheaf-binder harvesters extending over eight days was lately made under the auspices of the Royal Agricultural Society, near Shrewsbury, England. On the sixth day, according to the *Engineer*, the competition was narrowed down to eight machines, two of the McCormick and one each of the Howard, Kearsley, and Wood make having been thrown out from the previous day, leaving three of Hornsby's, two of Howard's, and one of Samuelson's, Wood's, and McCormick's respectively. In the morning nothing was done beyond testing with dynamometer, in consequence, as far as we could gather, of the next field not being staked out and mown round. It was not ready till somewhere about one o'clock. Out of a field of 18 acres, about seven or eight were parceled off in one piece, the eight machines being required to take a preliminary run up one side and down the other, followed by three similar cuts, officially recognized. Only one attendant was allowed to follow, and he was prohibited from touching the binder, unless called upon. This system gave the ordinary onlooker a much better opportunity of forming an opinion as to the relative merits of the competing implements. The test here assigned was much more severe than any previous one, partly on account of a boggy hollow in one portion of the field, and partly because of the flat condition of the crop. Hornsby's 4,569 was the first to start, and it managed to get through without much difficulty, and with only a slight pause. Next came Wood's selected machine. It made several stoppages; a good deal of straw and grain were wasted, in consequence of the reel having been set too backward and too low; and the delivery was by no means perfect. Howard's No. 45 left a clean cut stubble, but the nature of the crop made separation difficult, many of the sheaves hanging together. A leather band in the barley caused one stop. In Samuelson's portion we noticed an undue proportion of "baby" as well as "giant" sheaves, and some loose ones. Many heads of grain were left on the ground, in laid parts the corn and straw were considerably knocked about and wasted, and the pressure on the driving wheel seemed to be too heavy. Still the machine got through the most difficult portions without much trouble. Howard's No. 47 had three stops in the three journeys; some sheaves were missed, and the separation was not easy. A McCormick harvester finished the day's work; it left a few sheaves unbound, and a small, badly laid piece was uncut; but all things considered, it did fairly all through.

On the next and last day they were the most varied, most exciting, and most difficult of all. The only competitors now left were Hornsby (3 machines), Howard (2), and Samuelson (1). Hornsby made a very good commencement on the remainder of barley left from the previous day. The delivery and separation of sheaves were difficult processes to manage for all the competitors, and it may be doubted whether there was a very substantial difference in the work done. To make good performances was out of the question. Samuelson's was brought to a stop of two or three minutes in one place, and presumably for that reason they were not allowed to complete their plot. In the afternoon the judges pitched upon another piece of barley nearly an acre in extent, more flattened than ever, with the additional disadvantage of being purposely winding and hilly. For this final test Howard's 47 and Hornsby's 4,568 machines were ordered out. But now the competitors were used to rough work, and they submitted to the undertaking without a murmur. Each was given a preliminary canter, and then made to go two runs of about three minutes each round the plot. Howard, who led the way, was stopped with a large hedgehog on the second round, the knife cutting deeply into the unfortunate creature, otherwise the machine went smoothly both up hill and down dale. Hornsby's machine made as nearly as possible similar work, Howard, perhaps, having the advantage with their very useful butting board. Throughout this day, more than previously, the work of the two machines seemed to be pretty nearly on an equality, so that when the last cut was taken as the clock struck three, the opinion was formed that the judges would have a particularly difficult task in arriving at a decision beyond recall. Nevertheless, an hour later the awards were announced as follows:

Class 1.

First prize of £100 for a sheaf binding reaper, the binding material to be other than wire: Awarded to Messrs. Hornsby and Sons, for No. 4,568.

Second prize of £50 for a sheaf binding reaper, the binding material to be other than wire: Awarded to Messrs. J. and F. Howard, for No. 47.

Class 2.

Separate sheaf binder, the binding material to be other than wire: Prize withheld.

### The "Drop" Method of Chemical Analysis.

The customary methods of testing medicinal agents, which are both tedious and require a larger quantity of material, can be superseded by a method which requires merely single drops of the reagent as well as of the liquid to be examined.

For this method the following regents are needed:

Red and blue litmus paper and turmeric paper.

Extract of indigo paper, which is turned yellow by hot nitric acid and caustic alkalies, but not by ammonia.

Rosaniline paper as a test for alcohol.

Potassium ferrocyanide paper as a reagent for ferric salts (blue), copper and uranium (deep brown), gold (greenish brown), platinum (brownish green to reddish), thallium and vanadic acid (yellow).

Potassium sulphocyanide paper is turned decidedly yellow by bismuth nitrate, bluish black by salts of copper, red by solution of gold, white by mercuric nitrate, black by mercurous nitrate, and blood red by ferric salts.

Potassium iodide paper is turned red by mercuric salts, green by mercurous salts, yellow by solution of lead. For detecting chlorates 2 to 3 c. c. of the liquid are placed in a small test tube along with a slip of the paper; 1 c. c. of dilute sulphuric acid is then added, and heat is applied. If chlorate is present, the liquid turns yellow.

Mercurous nitrate paper serves when moistened to detect ammoniacal gas, which turns it black; caustic alkalies and alkaline monocarbonates stain it greenish brown to black, while the alkaline bicarbonates leave it colorless.

Silver bichromate paper turns yellow with free hydrochloric acid.

Besides these, the author mentions a number of other papers less frequently needed. The use of all consists in letting a drop of the liquid in question fall upon a slip of the paper.

The author tests for arsenic (arsenious and arsenic acids) by means of slips of sheet brass, 2·5 to 3 centimeters in length and 15 to 17 centimeters in length. The hydrochloric solution is mixed with a little oxalic acid, or the ammoniacal solution is supersaturated with hydrochloric acid and mixed with oxalic acid in order to reduce arsenic to arsenious acid. A drop of the solution is put upon a brass plate and sharply dried; the place of the drop is then washed with water, when a dark spot of a permanganate color reveals the presence of arsenic. Dark thin outlines still appear in case of dilution with 150,000 parts.

In cases where the papers and the brass plate are not used the auther places the two drops (of the reagent and the liquid in question) near each other upon a slip of glass, and mixes them. The transparency of the glass renders the slightest turbidity visible.—*Dr. H. Hager, Pharmaceut. Central-Halle and Chemiker Zeitung; Chem. News.*

### Railway from Sweden to Lapland.

The North of Europe Railway Company (Limited) has been formed in London, for the purpose of constructing a line of railway from Lulea in the Gulf of Bothnia to Ofoten Fjord in the North Atlantic Ocean, and thereby open up the rich stores of mineral wealth in that part of Lapland, and especially in the mines of Kirunavaara, Liosavaara, and Gellivaara. The legal guarantee has been deposited with the Swedish and Norwegian Governments, and Mr. P. Von Ehrenheim and Captain C. G. Hjertaboth, gentlemen of high standing in Sweden, and Lieutenant Lund in Norway, have been appointed resident directors. It is expected that one-third of the line, the Lulea-Gellivaara section, will be completed before the end of this year, the country being fairly level and easily traversed. Great results are anticipated by the local authorities from the opening up of the districts by this railway and also in peopling the northern provinces of Sweden, which now consist principally of waste lands, and are almost uninhabited. The province of Norrbotten, in Lapland, contains 105,000 square kilometers out of the 440,000 which form the whole of Sweden (nearly one-fourth of the kingdom), while its population only amounts to 92,000, or not quite one person per square kilometer; nevertheless Norrbotten is Sweden's richest province, its iron ores being unsurpassed anywhere in quality or magnitude. The great drawback to this province has always been the want of communication with the other parts of Sweden; along the banks of the river Torneå the land is fairly well populated.

## DECISIONS RELATING TO PATENTS.

**United States Circuit Court.—District of Indiana.**

NATIONAL CAR BRAKE SHOE COMPANY *vs.* TERRE HAUTE CAR AND MANUFACTURING COMPANY *et al.*

*Car Brake Shoe Patent of James Bing, granted Oct.* 6, 1883.

Woods, J. (charging jury):

In an action at law for infringement of a patent all parties who participate in the infringement are liable, although some are simply acting as officers of a corporation. All parties who participate in a tort or trespass are liable, and a man cannot retreat behind a corporation and escape liability for infringements in which he actively participates.

It is for the court, as a matter of law, to construe a patent, and for the jury, as a question of fact, to determine whether it has been infringed, and the amount of damages that should be allowed.

In an infringement suit the burden is on the plaintiff to show the amount of damages he has suffered; and if he furnishes reasonably satisfactory evidence on that subject, he is entitled to substantial damages; otherwise to nominal damages.

On the question of damages, it is competent for the patentee to prove the prices at which licenses were granted under the patent while it was in force; but in order to be competent evidence of value, the prices agreed upon must have been prices fixed with regard to the future use, when, there being no liability between the parties, they are presumed on both sides to have acted voluntarily, and therefore to have made up their minds deliberately as to what was a fair price. Such arrangements, licenses thus granted, fees thus fixed, are competent evidence to consider in determining what the actual value of an invention is and what the recovery ought to be for its use.

It is not competent for a patentee to prove the prices paid for infringements already perpetrated. Such settlements are not at all admissible on the subject of value.

The value of an invention for which an infringer is liable is the value at the time of the infringement. A man who has got a patent owns it as property, and if anybody sees fit to infringe it he is bound to pay for its fair value; and the fact that there is something else as good or better does not entirely destroy its value, but may affect it.

The doctrine of a confusion of goods has no application to a suit for infringement of a patent, especially where there is only a confusion of bookkeeping, and not a confusion of the articles themselves, the articles being incapable of mixture.

If a party shows an unwillingness to let the truth out, *and keeps back facts* and the means of getting at facts in his power, then the jury is warranted in drawing the strongest possible inferences against him which may be drawn from the evidence actually given in favor of the other party; but if he comes forward with his books, furnishes all the evidence in his power, and is fairly candid in the matter, no inferences should be drawn against him, except such as are fairly drawn from the evidence adduced.

Every one is bound to take notice of the existence of a patent and of the rights of parties under it. Like the record of a deed to real estate, the record of a patent at Washington is notice thereof to all the world.

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**United States Circuit Court.—District of Massachusetts.**

COLLINS COMPANY *vs.* COES *et al.*

*Patent of Lucius Jordan and Leander E. Smith, Oct.* 10, 1865, *for an Improvement in Wrenches.*

Before Gray and Nelson, Judges.

Gray, J.:

The application to a device of a feature which had already been in use for the same purpose in another form of tool lacks the invention requisite to support a patent within the decisions of the Supreme Court.

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### Abstract of Paper on Training for Mechanical Engineers.

BY GEO. I. ALDEN, WORCESTER, MASS.

Progress in education is secured by forces outside and above the schools. When a few have made discoveries in science, or advancement in art, or in engineering, they have set a standard which must thereafter be the aim of educators. Mechanical engineering as taught in the schools is subject to the general law of progress. It is taking a high rank as a liberal profession, and offers a broad field for the activity of the best powers of young men who enter it. The schools must look for progress in the education and training of engineers to two forces, viz., the *scientific attainments* and *practical achievements* of those foremost in engineering science and practice. A school for training engineers is properly a professional school, and should hold its standards of professional work sufficiently high to secure the success of its graduates, that it may be able to demand of candidates a liberal course of preparatory study for matriculation. It should aim to fit young men for immediate usefulness in the profession, and to lay the sure foundations for growth which shall enable them finally to take up the unfinished work of the engineers of this generation and carry it forward into the next century of progress.

To aim at practical achievements is not enough, for the man is more than his profession. Scientific attainments are not alone sufficient. The ability to apply knowledge to practical ends is valuable in the development of the individual as well as essential to professional success. The necessary scientific attainments are more than mere knowledge of facts and principles. The evidence of such attainments is the ability within a sufficiently wide range of inquiry to give accurate answers to definite questions. To secure this ability the studies in the curriculum of the schools should be taught by the most thorough and direct methods, with the aid of numerous well selected problems, and practice in laboratories. These problems should approach as nearly as possible the character of actual engineering problems, to the end that the student may acquire that complete assimilation and personal appropriation of the subjects taught throughout the course which is characteristic of the scientific attainments toward which the school should aim.

The practical achievements of the engineer are closely related not only to his scientific attainments, but also to the progress of machine shop methods and practice. All his designs must be sent to the shop in a form consistent with such practice. To secure a knowledge of machine shop methods, limitations, and possibilities, most scientific schools of to-day have a practical or shop department in their engineering course. It is important that the successful engineers of the country should say what the standards of such a department should be and what it should accomplish. The shop is made a department in the school, to add *methods* as well as *facilities* of instruction. It should not, therefore, be such an institution as would be developed out of or by the school, but should be superior in all its appointments, for practical work. It should have not only the tools, methods, and facilities, but also the business, of a leading productive machine shop, with unusual means for instruction and experience in the solution of practical engineering problems. Such a shop is able to adopt in its full measure the modern method of instruction aimed at in other departments, bringing the student as close as possible to the realities to which his studies are intended to direct his thought. The instruction will be in accordance with the economical principle of teaching analysis and synthesis in close relation. Work on real, practical, valuable products has important elements of training, which are in a great degree lacking in work on simple pieces. It cultivates practical judgment, and gives real experience and available skill. The high standards of practical achievement necessary to secure the best efficiency of the shop training are kept up by the demands of the open markets. The giving of instruction to the students will lower the *productive capacity* of the shop, but need not impair the *quality* of its products, and must not, if they are to be sold at the highest current prices. Such a business shop will stimulate to breadth and thoroughness of instruction in the theoretical studies of the school, and will itself ultimately reach a higher standard of practice, on account of its relation to the school.

It will give students who spend about ten hours per week for four years as much skill (and more general ability) in the shop as an ordinary three years' apprenticeship. This skill and ability open to every graduate a wide door to the profession, and secures to him independent self-support. The shop unites the study of theory and practice, and promotes economy of the school time by variety of occupation. From fifty to one hundred thousand dollars for shop and equipment would provide facilities for the instruction of one hundred students, and from three to ten thousand dollars per year would be required for current expenses. Experience shows that money expended in founding and fostering such a department yields large returns, both to the individual students and the engineering profession.

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### The Analysis of Ammoniacal Liquors.

A novel method for the quantitative determination of carbonic acid in the presence of alkaline sulphides, sulphites, and hyposulphites is described in a recent issue of the *Chemical News*, into which it is translated from the *Zeitschrift fur Analytische Chemie;* and as it appears to be peculiarly adapted for use in the analysis of ammoniacal liquors, we here reproduce it. The process is as follows: The substance to be analyzed is placed in a flask holding 300 c.c., and fitted with a caoutchouc stopper, having two perforations. Through the one passes a funnel tube, fitted with a cock, and reaching down nearly to the bottom of the flask. Through the other aperture it is connected air tight with the following pieces of apparatus: (1) A Liebig's bulb tube, containing a dilute solution of permanganate, slightly acidified. (2) A U-tube, filled with calcium chloride. (3) A Liebig's bulb tube filled with potash lye (sp. gr. 1·27), and weighed. (4) A U-tube, filled with calcium chloride. After the whole has been joined together, and the connections have been found air tight, a solution of permanganate containing 5 grammes per liter is allowed to flow down the funnel tube, shaking occasionally until the solution takes a permanent dark red color. The acid necessary for the decomposition of the carbonate (dilute sulphuric, nitric, or acetic, but never hydrochloric) is next introduced. The cock of the funnel tube is closed, and the decomposition of the carbonate and expulsion of the carbonic acid are effected by the application of heat, very gently at first, but afterward raised to a simmer. The heat is then withdrawn, the cock opened, and the funnel tube placed in connection with a washing bottle, filled with potash lye, when air is aspirated through the apparatus for 30 to 45 minutes. The increase of weight in the Liebig's bulb tube containing potassa gives directly the weight of the carbonic acid. The total sulphur present in the sulphur compounds can be determined in the same portion of the sample. After the determination of the carbonic acid, the contents of the decomposition flask and of the Liebig's bulb tube containing permanganate are rinsed into a beaker. The excess of permanganate is destroyed by the addition of hydrochloric acid and the application of heat, which at the same time redissolves any precipitate. The liquid is boiled to expel chlorine, and the sulphuric acid is determined in the ordinary manner. Of course, only nitric or acetic acid must have been used to decompose the carbonate.

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### What Constitutes One House.

A house, according to Mr. Justice Kaye, of England, is an edifice whose occupants may get in or out of without recourse to a door or staircase likewise used by occupants of neighboring apartments. It appears that the tenant of a piece of land held it under a covenant not to build on it a house worth less than £400. He began to build two houses, but the municipal authorities restrained him from carrying out his plans, on the ground that if completed as proposed there would not be enough air space behind them. He then lessened the height of the buildings, and to bring himself within the covenant, established communications between them on the ground floor, and called them one house. Each had a street door and a shop front, and together they cost more than £400. In Justice Kaye's opinion a common ashpit and closet, and a door between them, do not convert two houses into one. If they did, adds *Building*, there are places in this city where three or four tenement buildings would, in a legal sense, be but one house.

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### Lieut. Greely's Arctic Discoveries.

Although yet so feeble as to need to apologize to his hearers for his weakness, Lieut. Greely read a brief paper before the British Association, as follows:

"The geographical work of the Lady Franklin Bay expedition was nearly three degrees of latitude and over forty degrees of longitude. Starting from latitude 81·44 and longitude 84·45, Lieut. Lockwood reached, May 18, 1882, on the north coast of Greenland, latitude 83·24 and longitude 40·46. From the same starting point he reached to the southwest in May, 1883, Greely Fiord an inlet of the Western Polar Ocean, latitude 80·48 and longitude 78·26. This journey to the northward resulted in the addition to our charts of a new coast line of nearly one hundred miles beyond the furthest point seen by Lieut. Beaumont, R. N. It also carried Greenland over four hundred miles northward, giving that continent a much greater extension in that direction than it had generally been credited with. The vegetation resembled closely that of Grinnell Land. Among the specimens brought back, the Arctic poppy and several saxifrages were identified. About the eighty-third parallel, traces of the polar bear, lemming, and Arctic fox were seen, and a hare and ptarmigan were killed. Lieut. Lockwood and myself journeyed across Grinnell Land, and examined into its physical condition, discovering what may have been hitherto unsuspected, that between the heads of Archer and Greely fiords, a distance of some seventy miles, stretches the perpendicular front of an immense ice-cap, which follows closely from east to west the eighty-first parallel. The average height was not less than 150 feet. The undulations of the surface of the ice conformed closely to the configuration of the country, so that the variations in the thickness of the ice-cap were inconsiderable. In about sixty miles but two places were found where the slope and space were so modified as to render an ascent of the ice possible. This ice-cap, extending southward, covers Grinnell Land almost entirely from the eighty-first parallel to Hayes's Sound and from Kennedy Channel westward to Greely Fiord in the Polar Ocean. In connection with the line of perpetual snow, I may say that on Mount Arthur it was not far from 3,500 feet above the sea. From barometrical measurements it appeared that the crest of Grinnell Land was of about 2,500 feet elevation in front of the southern ice cap and 3,000 feet near Mount Arthur."

The paper was enthusiastically applauded. Mr. Henry Lefroy said, amid unbounded enthusiasm, that the British Association felt honored in being able to honor Lieut. Greely as the brave explorer who had surpassed the brilliant achievements of a glorious line of predecessors, and had been successful in the honorable desire to plant his national flag nearest to the North Pole, thus exceeding the noblest efforts ever made. Referring to the persistence of purpose shown by Lieut. Greely's party in bringing back the pendulum apparatus, he remarked that there was nothing nobler in the annals of scientific heroism than the determination of these hungry men to drag the cumbersome box along their weary way.

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### Interesting Experiment with Magnets.

A curious and instructive experiment has just been made by M. Duter, who took a number of very thin plates or disks of tempered steel, about a millimeter thick, and from five millimeters to forty centimeters wide, and built them into piles, the adjacent plates being sometimes in contact, and sometimes separated by a sheet of paper or cardboard. These piles were then inserted in a very powerful magnetic field, and withdrawn. It was then found that they had become powerful permanent magnets; but when the individual plates were separated they seemed to have lost their magnetism. On building up the pile again the original magnetism was restored to it. It appears then that the thin plates have not really lost their polarity on being withdrawn from the exciting field. Some of Professor D. E. Hughes' recent experiments have a great similarity to M. Duter's.

## ENGINEERING INVENTIONS.

A valve gear has been patented by Mr. Joseph Ralstin, of San Jacinto, Ind. This invention relates to reversing gear for plain slide valve engines, and covers a novel construction and arrangement of parts.

## AGRICULTURAL INVENTIONS.

A grain drill has been patented by Mr. Samuel H. Koble, of Hickman Mills, Mo. This invention covers certain novel features in the construction and arrangement of parts to promote convenience in operating and controlling grain drills, and to secure uniformity in the distribution of seed.

A check row planter has been patented by Mr. Charles R. Dollarhide, of Paris, Ill. By this invention the seed dropping mechanism is operated by an endless chain, which is made to travel on suitable wheels by means of projections on the chain, which are placed in contact with the ground, the device having also various novel features of construction.

A self-dropping corn planter has been patented by Mr. John A. Johnson, of London Mills, Ill. The self-dropping slide is connected with the axle of the drive wheels by a wheel on the axle, and provided with cams operating upon a vibrating frame, pivoted at one end of the carriage frame, and connected at the other end by a wire or attached to the seed-dropping slide, so the slide is operated by the revolution of the axle, with other novel features.

## MISCELLANEOUS INVENTIONS.

An improvement in fences has been patented by Mr. Charles C. Hinkle, of Hazleton, Ind. This invention relates to portable board fences, the construction being such as to make a frictional joint between the panels, with various other novel features.

A fitting for gas brackets has been patented by Mr. Henry P. Drew, of New York city. This invention covers a novel construction and arrangement of parts to prevent gas from escaping, strengthen the brackets, and prevent the swings from being turned too far.

A steam boiler has been patented by Mr. George W. Shealey, of Marshalltown, Iowa. The object of this invention is to provide an economical food cooker and boiler for steaming food for stock, and the device is one which has great working capacity, is easily operated, and is adapted to various kinds of fuel.

A fire escape has been patented by Mr. Edward Painter, of Easthampton, Mass. It is constructed of two endless chains or cables passed over notched wheels mounted on shafts journaled at the top and bottom of the building, the chains being united by cross rods, and buckets being hung on the chains.

A door signal has been patented by Mr. Alonzo L. Dorn, of Chicago, Ill. It consists of a contrivance to disclose a word signal and to sound a bell in connection with the unlatching wire extending from the front door to the interior or upper portion of the house, to admit people without descending the stairs.

A balanced stack roof has been patented by Mr. Frederick W. King, of Farmington, Iowa. It has slotted posts and rafters covered with boards and shingles, with ropes attached to the roof, passing over pulleys pivoted in the upper part of the slotted posts, with balancing weights attached to their ends, so the roof can be readily raised and lowered.

A hand elevator for packages has been patented by Mr. Frank Schumann, of Memphis, Tenn. This invention provides a rod with an adjustable and a pivoted clamping arm, making a device for use in depositing packages and small articles upon elevated shelving, or for taking them down, thus dispensing with the use of a step ladder for such purposes.

A log binder has been patented by Mr. John Flynn, of Roscommon, Mich. The invention consists in a lever with a grab and a locking latch pivoted to a frame connected with one end of the chain or some fixed object, one link being placed in the grab, the chain drawn taut, and the lever locked on the frame by means of the latch.

A spring holder for napkins has been patented by Mr John C. Tutt, of Kansas City, Mo. This invention combines with the end of a spiral spring a sharp pointed hook with a rigid cross bar, one at each end of the spring, so the contraction of the spring draws the hooks together, and holds the napkin, handkerchief, or other garment to the desired adjustment.

A trace carrier has been patented by Messrs John C. Glaser and Charles A. Cummings, of Monticello, Iowa. This invention consists in a metallic loop with sockets adapted to fit and slide upon a metallic bar or slide secured to the skirt of the saddle, a thumb screw being screwed into the slide to limit the movement of the loop.

A padlock has been patented by Mr. William W. Richards, of Washington, Ga. The invention consists mainly in the peculiar form of locking bolt and its combination with a spring, a tumbler, and key, the revolving tumbler barrel swiveling on the case, and the key having bits adapted to engage with and pull down the bolt.

A fender for wagon bodies has been patented by Mr. Christian L. Haubeil, of Waverly, Ohio. This invention relates to guards or chafing irons for wagons in which rollers are arranged to project on or from the body of the vehicle to prevent the wheels from chafing the body, and covers a novel construction of the rollers and means for supporting them.

A process of marking cakes of soap has been patented by Mr. James M. Craig, of Brooklyn, N. Y. The cakes are cast in moulds, around dies placed upon a rod, and when the soap is hard the rod and dies are withdrawn; the cakes are then placed in a mould covering the ends of the die apertures, and liquid soap of a different color is poured into the uncovered end of the rod aperture.

A friction balanced spring roller has been patented by Mr. James H. Russ, of Providence, R. I. This invention covers an improvement on a former patented invention of the same inventor, making a roller which is cheap, durable, and reliable, and in some cases, for very heavy window shades, a rubber washer is employed upon the spring head.

A gearing for windmills has been patented by Mr. Charles W. Roberts, of Oskaloosa, Kan. There is a combination of double gears and shafts for transmitting rotary motion from the wheel shaft of the mill to the line or driving shaft, with provision for certain of the driving gears to run idle in a back direction when the mill shifts or turns in the wind.

A railroad switch has been patented by Mr. Abraham Agres, of New York city. This invention relates to that class of railroad switches which are operated by the weight of the horses drawing the cars, the switch tongue being shifted by the movement of a rocking frame, thus securing ease of movement and reliability in action.

A wagon spring and gearing has been patented by Mr. Joseph Allan, of Carrolton, Miss. This invention covers a novel construction and arrangement of main and auxiliary springs in wagons, making a gearing that is substantial and comparatively inexpensive, combined with which is a fifth wheel that relieves strains on the king bolt.

A button attaching implement has been patented by Mr. Milton H. McNair, of Meadville, Pa. This invention relates to improvements in a magazine implement where the fastenings pass through the eyes of the buttons, and consists in a novel construction and arrangement of parts, and the implement may be operated or the mechanism organized for use with treadle or other power.

A pail, tub, or barrel of novel construction forms the subject of a patent issued to Mr. James W. Weston, of New York city. The invention consists in the combination, with head sections and key, for closed or headed receptacles, of a removable support or follower, to close the openings of the adjacent head sections, and there is also a novel device of sampling hole and plug.

A lead press has been patented by Mr. William A. Shaw, of Pittsburg, Pa. This invention covers a novel construction resulting in a duplex machine in which one charge of metal cools to proper consistency in position in its holder or cylinder, while another is being forced through the die of a different cylinder, so that no time is lost by the attendants in waiting for successive charges.

A carriage pole or shaft has been patented by Mr. James M. Dille, of Cooperstown, Pa. The invention covers a novel construction of devices for a part of the thills or pole to so attach the horse that he will have free and unobstructed movement of his limbs, and to relieve both the horse and the occupant of the carriage from shocks when the carriage wheels meet obstructions.

A boiler for heating buildings has been patented by Mr. William H. Byram, of New York city. It is composed of independent sections arranged one above the other, the connections being fitted together by tongue and groove joints, and the sections secured together by bolts, to make an efficient and economical sectional boiler, maintaining a positive circulation, and comparatively or wholly free from leakage.

A bicycle has been patented by Mr. William Clemson, of Middletown, N. Y. In combination with the wheels and fork, levers at or near their centers on the cranks, bars connecting the front ends of the levers with the fork, there being springs on the levers and foot rests on their rear end, to give greater leverage and enable the bicycle to be more easily worked.

A fire extinguisher has been patented by Mr. James McGwin, of Fulton, Mo. A revolvable, perforated, bottle holding cylinder is suspended within a vessel, and there is a shaft for revolving the cylinder, the shaft being also arranged to liberate acid and mix it with the contents of the vessel, making a simple portable fire extinguisher, which can be quickly brought into action.

A combined lint room and press has been patented by Mr. William B. Padgett, of Batesville, Ark. This invention pertains to attachments for cotton gins, and provides an improved contrivance for tramping the cotton in the press case, avoiding the former laborious and unhealthy method of tramping by the feet, while doing the work more efficiently and with less expense.

A harness has been patented by Mr. Cicero C. Ferrill, of Shubuta, Miss. This invention relates to a former patented improvement of the same inventor, and consists in part in adapting the ordinary breast collar to be used in connection with devices for attaching thills to a pair of hames directly, to dispense with all other parts of a harness except a collar and breeching, the latter attached to the thills.

A fire escape has been patented by Mr. Joseph M. Hodson, of Amherstburg, Ontario, Canada. It is formed of a casing on which a drum is pivoted, on which a wire is coiled, the wire being passed through apertured lugs or brake levers pivoted in the casing, the wire also passing between transverse pins or rods in the casing, the friction preventing the apparatus from descending too rapidly.

A workbox has been patented by Mr. Hugh S. Dickson, of La Harpe, Ill. This invention covers an improvement on a former patented invention of the same inventor, consisting of a workbox decreasing in depth from the bottom to the top, and having a cover increasing in depth from the bottom to the top, shelves being held in the cover from which inclined pins for holding spools project.

A device for unloading vessels has been patented by Mr. James H. Teubert, of Coal Valley, W. Va. A stationary inclined railway track is supposed to be built on the bank of a river, and the barges or vessels are to have hopper shaped receptacles for cargo from which discharge openings are arranged directly over the tracks, with sliding gates.

A milk cooler has been patented by Mr. Francis S. Hartzell, of Bean Pa. The object of this invention is to cool milk rapidly and uniformly, to raise cream in the shortest time, and for this purpose is provided an outer and inner metallic tank of special construction, so that the water spaces furnish a very large cooling surface, and the contents of the can are quickly and uniformly cooled.

A photographic camera has been patented by Mr. Walter Clark, of New York city. The invention provides a camera partition in front of the adjustable reflector and compartment or chamber in which the sensitive plate is exposed, thus dividing the box into two sections, whereby provision is made for inclosing the lens case and working mechanism within the box, and doing away with objectionable outside exposure of parts, with other novel features.

The manufacture of solidified compound metals forms the subject of a patent issued to Mr. Ferdinand E. Canda, of New York city. This invention contemplates the grinding or pulverizing of two or more metals or alloys, and then coating the particles with tin or Babbitt metal or other alloy melting at a low temperature, after which the mixture so made may be treated in a die or mould, after having been suitably heated.

## Business and Personal.

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If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN Patent agency, 361 Broadway, New York.

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Curtis Pressure Regulator and Steam Trap. See p. 78.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 77.

Drop Forgings. Billings & Spencer Co., Hartford, Conn.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 20,000 Crank Shafts and 15,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

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Friction Clutch Pulleys. D. Frisbie & Co., Phila.

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Renshaw's Ratchet Drills. No. 1, $10; No. 3, $15. Cash with order. Pratt & Whitney Co., Hartford, Conn.

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## Notes & Queries

### HINTS TO CORRESPONDENTS.

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

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

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

**Special Information** requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter**, should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

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

**Minerals** sent for examination should be distinctly marked or labeled.

(1) G. H. asks: On what part of the boiler does scale mostly collect—on shell or flues? A. It depends upon construction and way of operating. An examination of the particular boiler only will determine.

(2) Mrs. T. P. J. asks if there is any way of removing rust from cut steel ornaments. A. There is no way but to repolish them with a buff and rouge.

(3) W. B. asks a recipe for making the liquid used in the brilliant gold paint manufactured in Baltimore, or a liquid that would do. A. We do not know what is used in the preparation of the paint you mention, but benzine and paraffine are sometimes employed for this purpose.

(4) F. A. J. asks what the fulcrum of a safety valve is. A. The fulcrum is the center on which the lever moves. 2. What is meant by an automatic engine? A. An automatic engine is one governing its speed by the work it does, or having cut-off governors.

(5) A. S. B. asks what to put in hard water to keep lime from forming in his water pipes that feed his bathroom. A. A little caustic soda put into the tank will tend to break up the lime scale in the hot water pipes. About an ounce to the cubic foot.

(6) J. H. says: We have four sections of dry docks here in the Manatee River which are raised by hand pumps; why is it that the pumps work so much harder when we raise a large schooner than when we raise a light one? It looks as if we were pumping water from a reservoir, and the weight should have no effect on the pumps. A. Your pumps work harder on account of the increased height of the column of water you have to raise.

(7) S. H. B. asks for a good formula for making sticky fly paper. A. In a tin vessel melt together one pound of resin and add two fluid drachms of linseed oil. While the mixture is warm dip a spatula into it, and spread what adheres to the blade on foolscap paper. Different samples of resin require varying proportions of oil to make it spread properly.

(8) J. H. S. asks: Is there a mine in Pennsylvania requiring pipe strong enough to stand a pressure of 1,500 pounds to the square inch, for the purpose of pumping out water? A. No The pressure is sometimes nearly reached in the pipe of "oil lines," so that pipe and fittings have to be tested to 2,000 pounds.

(9) D. T. W.—To run water mixed with air through glass tubing, the water, colored or otherwise according to one's fancy, is allowed to drop quickly into a little funnel at the top of the glass tube. This carries air in with the drop, and may be managed so as to represent a string of colored or silver beads.

(10) C. H. K. asks if any of the readers of the SCIENTIFIC AMERICAN have any knowledge or information of that ill-fated American inventor, J. W. Starr, who about forty years ago exhibited, in conjunction with a Mr. King, an electric light of great merit, of said Starr's contrivance?

(11) E. S.—There is no general rule as to the width or richness in gold in gold bearing veins. It is said that the great Eureka vein in California was 6 feet wide at the outcrop and increased in width and value to a depth of over 1,300 feet. Sometimes the fissures are found to divide, and finally vanish in several directions.

(12) C. B. S.—The paint peels off the smoke stack because it is too thick. Use plumbago, lampblack, and boiled linseed oil. Thin with turpentine. Scrape off the old paint. If the brass of the boiler head is always hot, you can clean it with washed emery moistened with kerosene oil.

(13) W. P. asks: What is the best wood to make a banjo with, and what kind of wood is used by the makers? A. We believe that the kind of wood used in a banjo has very little influence on its tone. Curled or pin maple is largely used. Any strong wood capable of being steamed and bent may be used for the hoop, and the kind of wood employed for the neck is merely a matter of taste.

(14) C. G. R.—We know of no reliable method of plating with nickel without a battery, or its equivalent in the shape of a dynamo. You can tin articles by cleaning them thoroughly, and dipping them in melted tin covered with wax or tallow.

(15) T. R. asks how to make a solder that will come off easily without being heated after being put on. A. We know of no solder that will answer this purpose.

(16) W. D.—We know of no solder that can be used on tin without resin, acid, or some other form of flux. Oil is sometimes used instead of resin.

(17) G. B.—The lenses of a magic lantern will answer for a camera; it is not uncommon to use camera tubes for magic lanterns. Magic lantern tubes, as a general thing, are non-achromatic, and a tube of this class would make an inferior camera.

(18) H. C. B.—The phonograph cannot be applied in the manner suggested by you. It is necessary to speak very loudly in the mouth piece to produce any effect. The phonograph is the only instrument now known that will record articulate sounds.

(19) P. McC. says: I have a triangular boxwood scale that is dull in appearance and loses distinctness by use. How can I varnish it so that it will remain bright and yet not soil my drawings? A. A thin coat of French spirit varnish would improve your scale.

(20) J. K. C. asks the focal distances of the different glasses in the eyepiece as shown in Fig. 10, SUPPLEMENT, No 399. A. Beginning at the eye end, the focal lengths are respectively 1 inch, 2 inches, 1⅝ inches and 1¼ inches.

(21) E. F. McR. asks the proper method to clean oily waste. A. Place the waste in a solution of water and sal soda, and then blow steam through the mixture.

(22) W. B.—"Boiling coal tar" thickens it and makes it set quicker by evaporating part of its volatile element.

(23) J. M. asks how long it takes a train to come to a standstill when the Westinghouse brakes are put on, and what causes them not to act sometimes? A. A train running forty miles an hour can be stopped inside of 500 feet on a level. The train will not stop so quickly if the brakes become locked on the wheels.

(24) R. W. asks if the condensing of steam in an ordinary locomotive boiler, after the fire is put out at night, will cause a sufficient vacuum to draw water from a tank, the water in which is but little below the level of the water in the boiler, or will it cause a vacuum at all? A. Yes; it will draw the boiler nearly full if the valve on the feed is not closed, provided that the safety valve, gauge cocks, etc., are tight, and also depending somewhat on the temperature of the atmosphere. More apt to do so in winter than in summer.

(25) L. J. S. writes: We have an artesian well about 1,100 feet deep and 6 inches bore, tubed down 380 feet with 3 inch pipe; the water does not come up any higher than 25 feet from the surface, and we are pumping it out. Now, about ten years ago this well was built, and was bored down 525 feet; it then flowed out of tubing at surface; one year after this it was drilled deeper, down to the present depth—1,100 feet—and the water stopped flowing and we had to pump ever since. Now I would like to fill this well up with some material or plug it so that it will only be 525 feet deep, as it originally was, and think it will then flow again. What is the best method to pursue? A. The drilled well for the distance between 525 feet and the bottom contains 112 cubic feet. As clean sharp sand is the safest material to fill in with, we recommend it. Start by slowly filling in 25 cubic feet, and observe whether the water rises; if not, another 25 cubic feet, so on until you have put in 112 cubic feet. Then sound the well, and if the sand has not gone the same way that the lost water went, you should find bottom at about 525 feet, with a restoration of the old flow.

(26) N. W. asks: 1. What saving in friction is effected by anti-friction rollers, say 1 inch diameter, surrounding an axle of 2 inch diameter? I refer to rollers whose surfaces touch the axle and its box, not to rollers which turn on axles of their own. The saving of the latter is easily calculated, but the former seem difficult because they grind against each other. A. Friction rollers should not grind against each other, but should have end bearing running in a ring, which keeps each roller in its proper place. This form has the least friction. We have not the data for the amount. 2. Haswell's work on Engineering, page 354, states that the moving friction of a locomotive is 15 pounds per ton and that of trains only 6 pounds per ton. Is this true, and if so, why so? A. The difference of friction in locomotives and cars arises from the different weight upon journals.

(27) J. C. asks: 1. Is there any formula for determining the lifting power of a magnet? A. You do not say whether you mean electro or permanent magnets. As the power of a magnet depends on so many circumstances, it would be difficult to provide a formula for determining this accurately. 2. What sized wire should be used for the primary coils of a Hughes induction balance? What for the secondary? A. Number 24 wire answers very well for both coils.

(28) R. S. N. asks: (1) Is there any sodium chlorate ($NaClO_3$) corresponding to the potassium chlorate ($KClO_3$)? A. There is. 2. Could it not be produced in the same way as the $KClO_3$? A. The simplest method of preparing sodium chlorate is by treating hydrofluosilicic acid with potassium chlorate, giving rise to free chloric acid, and then saturating the chloric acid thus formed with sodium carbonate. 3. In my Barker's Chemistry I find the formula for saltpeter to be $KNO_3$. In the encyclopedia it is marked $KO,NO_5$. Why is this difference in oxygen atoms? Which is correct? A. $KNO_3$ is correct; $KO,NO_5$ is the old nomenclature. 4. Could not a temperature sufficiently high be produced (and by what) to cause the combustion of nitrogen in oxygen or air? A. Nitrogen will burn in air or oxygen when an electric spark is passed through the mixture. 5. Ought unwashed nitroglycerine to explode under the hammer? A. If pure nitroglycerine is placed upon an anvil and struck with a hammer, only the particle receiving the blow explodes, scattering the remainder. 6. In attempting to make nitroglycerine I put the three ingredients together and agitated them, when a brownish-red gas came out and left a brown liquid. What were these, and why did I not succeed in getting the nitroglycerine? A. The gas was the vapors of the decomposed nitric acid, and the coloration of the liquid was due to the same cause. See Manufacture of Nitroglycerine on page 3874 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 243. Any large book dealer will have on hand or obtain for you a work of so standard a character as Watts' Dictionary of Chemistry.

(29) W. M. G. asks the reason why salt adds to the freezing qualities of ice, and if there is anything known that will draw out as much coldness without melting the ice. Also the ingredients used in ice manufacturing. A. Salt has an affinity for water, and in exerting this characteristic feature causes the ice to melt, which then absorbs heat in the action of liquefying. In the SCIENTIFIC AMERICAN for June 21, 1884, we give, in answer to query 4, a number of freezing mixtures. By consulting this you will find several substances which act similar to salt in this respect. There are various machines for making ice, and they are described in different issues of the SCIENTIFIC AMERICAN SUPPLEMENT, such as Nos. 85, 32, 73, 171, etc.

(30) H. D. H. writes: 1. We are making a phonograph according to instructions in SUPPLEMENT, No. 133; would like to ask if there is any substance better than mica and ferrotype tin of which to make the diaphragm? A. No. 2. What improvements have been made on the phonograph since your SUPPLEMENT, No. 133, was published? A. No material improvements have been made on the phonograph since its invention. 3. Has any invention yet been made that will duplicate the vibrations on the tin foil, so that you could transfer a copy of the vibrations on to another piece of tin foil, and make it repeat what had been said on the first? A. We think not. Possibly they might be electrotyped.

(31) D. C. S.—Every chimney, gable, tower, and salient point of your building should be protected by a lightning rod. It is well to have a ground connection at each corner of the building, and all of the metallic parts of the roof and tower should be connected with the rods. The lower ends of the rods should extend to a sufficient depth in the earth to reach a stratum that is constantly wet. It should be laid in a trench extending away from the house from ten to fifteen feet, and should be surrounded with metal scraps, or better with coarsely granulated coke. Rods may be of copper five-sixteenths of an inch in diameter, or of iron double this diameter. All the joints should be soldered as well as screwed together. Insulators are worse than useless. For information on finding a latitude consult SUPPLEMENT, No. 316.

(32) E. F. S. asks: 1. What telephone has the most extensive use? A. The Bell telephone is used almost exclusively. 2. What telephone would be most suitable for use in a village? A. Any of the electric telephones will answer your purpose. 3. Is a non-electric telephone good for distances of a mile or two? A. Acoustic telephones will work well for a distance of a mile in a still day. 4. Can the telephone be made to pay in a village of 2,500 or 3,000 inhabitants, and what is the usual plan of charging or receiving payment for its use? A. It would probably pay. For full information on the management of central offices, you should write to some of the telephone companies.

(33) J. P. C. asks: What speed will a cannon ball have if when fired the cannon is on a train moving at the rate of 1,000 feet per second, and the ball is fired in the same direction with sufficient powder to give it also a velocity of 1,000 feet per second? A. Apart from the additional friction by the train moving against the air at a speed of 1,000 feet per second, which would somewhat retard the velocity of the ball, the ball would have a velocity due to its discharge from the gun added to the speed of the train, or 2,000 feet per second, and in one second would be 1,000 feet ahead of the train, less what would be due to the friction of the air.

(34) W. W. H. asks: What is the best process for ebonizing wood. A. SCIENTIFIC AMERICAN SUPPLEMENT, No. 207, gives several methods for dyeing wood black. A recent process consists in pouring 4 quarts of boiling water over 1 ounce of powdered extract of logwood, and when the solution is effected add 1 drachm of potassium chromate and stir the whole well. Continue the application until the wood is dark enough. When the work has become dry, sandpaper down the grain to get a smooth face; and as the work to be ebonized must be quite free from holes, oil and fill in any of them with powdered drop black mixed in a filler. Then give it a coat of quick drying varnish, and rub down with finely pulverized pumice stone and linseed oil until a good surface is acquired. A good wholesome varnish for ebonized work is obtained by dissolving black wax in spirits of wine.

(35) R. M. C. asks: How many gallons of water per minute will be discharged through a nozzle of ¼, ⅜, and ½ inch diameter, under a pressure of 60 pounds to the square inch, pressure fully sustained? A. Discharge for ½ inch nozzle, 3½ gallons per minute; do. for ⅜ nozzle, nearly 2 gallons per minute; do. for ¼ nozzle, ⅞ of a gallon per minute. 2. Will the water meters in use reduce the pressure on the stream passed through? If so, how much? A. If the water meter is of sufficient size to pass the above quantity per minute, it will not lessen the pressure.

(36) A. J. D. asks: What is the dark bluish crocus used by burnishers for polishing? A. It is rouge. 2. What is the best record for a 100 mile go as you please? A. The best time for 100 miles is 18 hours 8 minutes and 15 seconds, in London. The best time in United States is, 150 miles 850 yards in 24 hours. Hazael made 600 miles 220 yards in 6 days.

(37) W. R. H. writes: 1. I wish to run a sewing machine by power; would you advise weight or water power? A. We advise water power, if it is available; but if you are obliged to pump up the water to secure the power, it would be better for you to procure some form of small motor. 2. Could you give me directions for making a very small turbine wheel, say 1 inch or so, which would run my machine 2 hours with a hogshead of water at a height of about 20 feet? A. You can secure small turbine wheels from any of the makers who advertise in our columns. 3. Is the Backus water motor a plain breast flutter wheel? A. It is a plain fan wheel. 4. Please give me directions for coloring gold the Etruscan color. A. Etruscan is made by eating the alloy from the surface of the gold by a chemical or electrical process.

(38) E. C. B. asks the number of cubic feet of water and the number of pounds of coal engines of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 horse power would need to run at 60 pounds pressure. A. Engines and boilers, in their modern variety of kind and economy, present so many and variable features of construction that no special data can be given that will apply to any two varieties; ½ to 1 cubic foot of water per horse power per hour are about the extremes, using about 3 to 6 pounds coal per hour per horse power.

(39) T. H. B. writes: Suppose the cylinder of an ordinary steam engine to be lengthened out to twice its present length, no matter what that may be, and reduced to a corresponding extent in diameter, so that the cubic space in the cylinder will remain as large as before and hold the same amount of steam; will the lifting power on the end of the piston rod be the same as in the shorter and wider cylinder? A. No; the lifting power, or force upon the piston rod, is proportioned to the area of the piston. The larger diameter exerts the greater force. The length of the stroke is the measure of work done under that force.

(40) A. E. M. asks: 1. What could I use in bookcases, closets, and wardrobes to get rid of wood lice, book worms, and small spiders, etc., which keep getting in continually? A. Use camphor gum in small boxes set upon the shelves or among the books of your case, for insects. 2. Could sulphuric acid, carbonate of potash, or some other absorbent of moisture be used safely in bookcases to prevent mildew? A. Carbonate of potash or quick lime in open glass vessels will absorb moisture. Use no acid. 3. There is an idea prevalent among the country people here that trees should be felled for timber when the moon is waning, as the sap has then descended. I, myself, am inclined to rank this among the many superstitions concerning the moon, and should like to get your opinion on the subject. A. The moon has no influence upon the time of cutting timber. Always cut at the wane of the sap or fall of the leaf. I wish to carry a lightning rod into a well close to the walls of the house; but I have a pump set over it which works in all kinds of weather, and I fear it would be dangerous to handle it during a storm. Do you think there would be any risk to the attendant? A. Carry the lightning rod several feet underground to the well, and then down to the bottom without touching any part of the pump. It will be safe to keep away from the pump during a violent thunder storm, and still safer to make a water connection at a distance of 2 or 3 rods from house and well. We do not know who makes the wagons you ask about.

(41) C. M. asks: 1. Would a bullet or other missile thrown perpendicularly into the air, fall to the point of starting with the same velocity and force as it received upon starting? A. Theoretically yes; practically only if in a vacuum. 2. Can electricity be used for the purpose of heating and warming houses, and for other domestic purposes? A. Heating rooms by electricity has not yet been practically realized, though it is certainly possible. 3. Would a steamboat made upon the catamaran, or double hull, plan require a greater or less force to propel it at a given velocity through the water, carrying a given load, than would be required to propel a single hull steamer with the same load on a steamer of equal displacement with the first, if both boats are made of the best shape of their kind? A. The steam catamaran has not thus far been shown equal to single hulled boats in the utilization of power.

(42) B. W. S. says: Many makers of mowing machines claim they get rid of side draught by means of a rod running from shoe to the whiffletree connection on pole. Will you inform me if this is good reasoning, or possible? A. If by the arrangement designated the power is applied at the center of resistance, side draught will of course be obviated.

(43) J. K. says: I have a lens 5 inches in diameter, 24 inches focus, for the camera obscura to enlarge photographs, but cannot reflect it on paper as given in one of your SUPPLEMENTS. I put the lens in a tin tube, one sliding within the other, so as to give it the right focus; my box is 12x12 inches and my mirror is 12x14 inches. Please let me know where the defect is. Is it on account of my tube being too bright? A. Your tube should be blackened inside. See direction in recent number of SCIENTIFIC AMERICAN for blackening tubes. 2. Does it make any difference if I put the 24 inches in the tin tube or in the box? Does my mirror want to be of the same size as the lens magnifies or can I have it smaller, that is, if my lens magnifies up to 14 inches, must my mirror also be 14 inches, or can I have it smaller? A. If your tube is large enough, it will answer as well as if the box were extended to that length. Your mirror may be much smaller than the projected image, but to get the best results you should have a condenser in the form of a double or plano-convex lens to concentrate the light on the picture. 3. Could I also copy pictures with the "blue process of copying tracings" in the camera obscura, that is, could I copy pictures by putting the sensitive paper in the box and reflecting the image on it? A. The blue process of copying cannot be utilized in this way.

(44) W. S F. asks how the water proof blacking, or more properly speaking "liquid gloss," for ladies' and children's shoes is made. Kindly give composition and quantity of each. A. A fine liquid blacking consists of ivory black and molasses, of each one pound, sweet oil and sulphuric acid, of each four ounces. Rub together the first three until the oil is perfectly killed, then gradually add the sulphuric acid, diluted with three times its weight of water. Mix well and let it stand for three hours, when it may be reduced to a proper consistency with water or sour beer. A number of recent shoe polishes and varnishes are described on page 150 of SCIENTIFIC AMERICAN, for March 10, 1883, to which we refer you.

(45) R. P. Y. asks: Does the telegraph cable sink the full depth of the ocean, which I believe is five miles, and if so, what sort of grappling machinery is it that will work at that depth? A. There may be narrow chasms in the ocean bottom over which the cable is suspended, but generally the cable rests on the ocean bottom. We have in the back numbers of our paper described several forms of grappling apparatus for raising ocean cables. The depth of the Atlantic reported by the cable soundings between England and France and Newfoundland, was nowhere over 15,000 feet, the bed consisting of two valleys separated by a broad ridge running from the Azores to Iceland, and the depth on this ridge being generally about 9,000 feet. A depth of about five miles has been reported south of the Grand Bank of Newfoundland, but all the cables run on the higher plateau to the north of this.

(46) A. C. C. asks: How many cells would it take of a Grenet fluid battery, zincs 5 x 2½ x ½ inch thick, carbons same dimensions, to heat to incandescence 2½ inches or 3 inches No. 38 platinum wire, and how long will each zinc last, if used 5 hours every evening? A. Six cells would probably do it. If the zincs are kept well amalgamated, they might last for two months.

(47) T. W. H. writes: The reservoir of our water works consists of a stand pipe 6 feet in diameter and 160 feet in height. In the winter we are bothered more or less with ice forming around inside of the pipe. We have a large cylinder stove at the base; don't you think if we would run about a four inch gas pipe up through the water on the inside, then keep a good fire at the base and let all of the heat go up through, that it would keep the pipe free from ice? A. Better run a second inlet from the pump to near the top upon the inside, and pump the water to the top during very cold weather. This will keep up a circulation, and tend to prevent freezing.

(48) G. C. P. asks: 1. Can I build a dam of cement and sand by making a box to hold the mortar until it hardens? A. Yes. 2. Can I use small stones to help fill up and save cement, stones to be from 8 inches to 18 inches diameter, dam to be 7 feet high, 7 feet thick at bottom and 2½ feet thick at top, front side perpendicular and pond side slanting? A. Use as much large stone as possible. Make the filling with coarse sharp sand and Portland cement. 3. What proportion of small stone can I use and have it strong? The dam is to be built on ledge the whole length, and is on a small stream and is 50 feet long. A. Use as much small stone as will make solid filling between the large stone. 4. Which will be the best stones to use round cobble stones or ledge stone got by blasting? A. Fragments are better than cobble stones, and will resist water and ice cut. The top of the dam should be capped with a layer of the largest stone that you can get, laid inclined a little toward the pond, so that ice will not push them off. Back the dam by a filling of sand and stone for several feet level with the top for flood protection. Make an ample sluice way of plank or with two walls and a covering of large stone for the stream while building the dam. Make the top perfectly level and as long as possible, for the possibilities of a flood, and protect the ends thoroughly against leakage through the soil if the banks are not rocky. Lastly, a dam of this kind will be stronger if slightly arched up stream, say 4 or 5 feet in a 50 foot dam.

(49) J. S. asks for a receipt for removing water bugs or red roaches. A. Borax is considered one of the very best roach exterminators. It should be pulverized and sprinkled around the infested places. A solution of 1 oz. poke root boiled in 1 pint of water until the strength is exhausted, and then mixed with molasses and spread on plates and placed in localities infested with these pests, is "sure death." Paris green is likewise used, but undesirable, as it is poisonous. A paste made of 1 part powdered chloride of lime and ½ part of some fatty matter is said to be effectual in driving cockroaches away.

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