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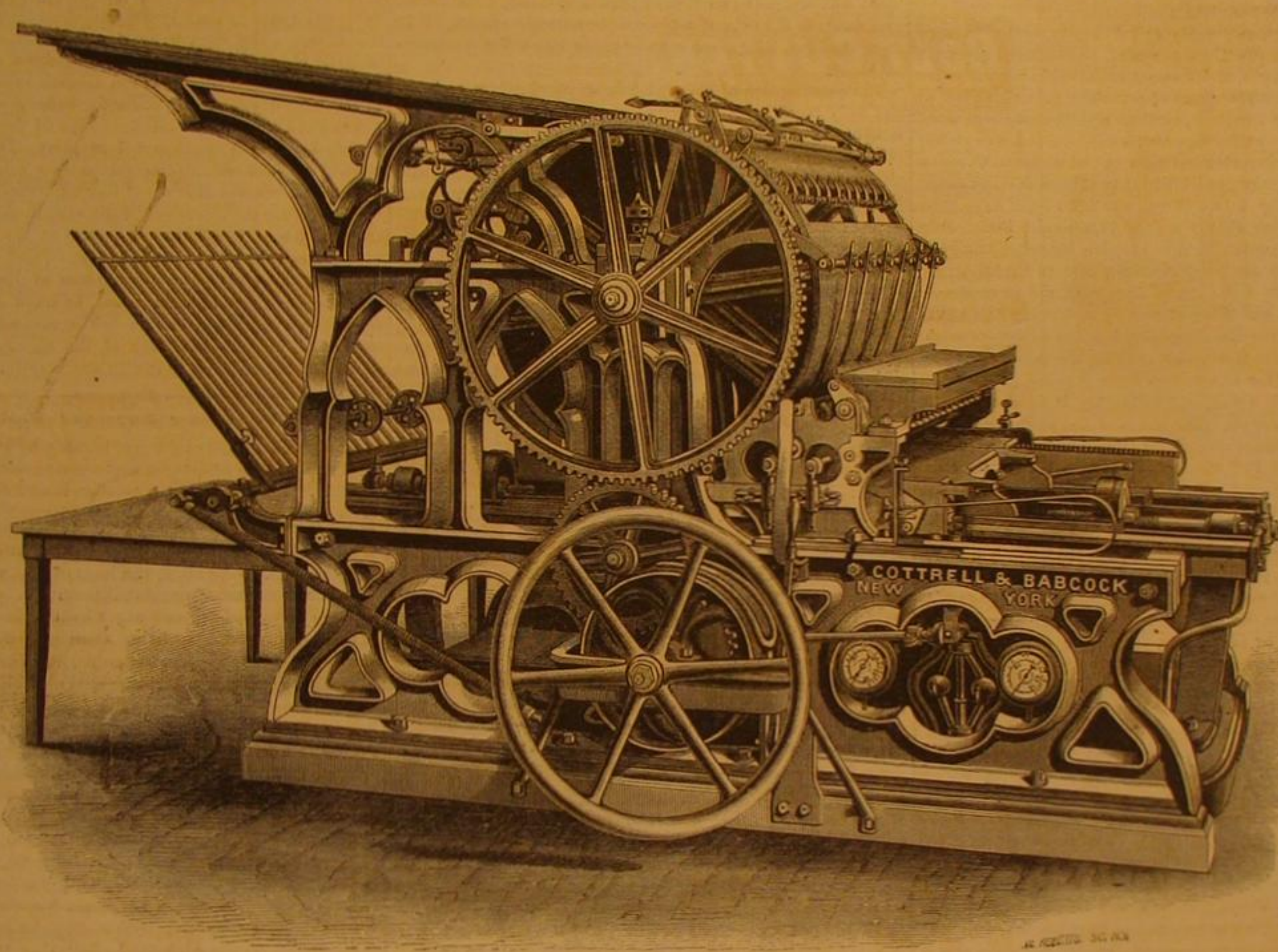
Air Spring Printing Press.

The old maxim, that "time is money," has never been better exemplified, perhaps, than in the multitude of efforts that have been made, in a variety of devices, to increase the speed of the flat bed cylinder printing press. To achieve this desideratum, it is of the greatest importance that the best system of resistance be employed to overcome the momentum of the bed of the press when in rapid motion. Wire springs have been tried but were found wanting, although for many years they have been employed almost exclusively.

Compressed air, however, has been for a long time universally acknowledged to be the best spring for that purpose, and it is our province here to show some important improvements which have lately been made in its construction.

The airspring heretofore in use was made with a solid or non-yielding plunger which caused much inconvenience and not infrequent damage, by carrying into the air chamber any sheet, tape, etc., that might accidentally have dropped on it. This was attended by the instant stoppage of the press, and vexatious delay and difficulty were incurred in forcing the plunger and its incumbrance from the air chamber; sometimes fracture of the bed and destruction of gearing took place. With the old wire spring, if enough pressure were exerted by it to properly overcome the momentum of the bed, it would be impossible to help it over the centers by hand and start the press; we may therefore infer that the resistance actually offered by it was never sufficient for the requirements of the press. In running at different speeds, the spring should be regulated to accord with them, which, in the old springs, could not be done with any certainty; and while the press is at rest, it is desirable that the spring should be inoperative, as without springs there are no centers. It now remains to describe the improvements and see how they meet the case presented.

The accompanying engraving (Fig. 1) represents a press supplied with the improved spring. The bed is provided with two cylinders to engage with the plungers seen at the ends of the frame, and the hollow rods of these plungers are connected by a pipe running along the lower part of the frame; which pipe is opened or closed by the valve of the governor shown through the opening in the framework.



COTTRELL & BABCOCK'S AIR SPRING PRINTING PRESS.

Fig. 2 represents a cross section of the plunger, A, which, it will be seen from the engraving, is arranged with springs so as to allow the outside packing to contract and expand; it thereby obviates, the inventor says, all difficulty arising from paper, tapes, or other matter falling on the plunger while the press is in motion. Fig. 3 shows a longitudinal section of the plunger, A, its hollow rod, and an automatic valve, B, at its extremity. This valve rises on the return motion of the bed and prevents a vacuum forming in the cylinder, whereby all strain or drag is prevented and power saved.

Fig. 4 represents the governor attached to the connecting pipe, with the plug valve, C, which it operates, and two spring gages to indicate the amount of condensation in the cylinders. The valve is shut by the motion of the press when running at speed, and is, of course, open when the press is at rest. This enables the press to be started at any point without helping it over the centers by hand. The spring gages perform an important function. As they indicate the pressure in the air cylinders, and as this is determined by setting the plungers backward or forward on their rods, there is no difficulty whatever in exactly adjusting the amount of spring to the speed of the press. Every press is furnished with a table showing the gage pressures, indicating the amount of spring required for the different speeds run. All the workman has to do is to adjust the plungers until the gages indicate the pressure laid down in the table.

As compared with the wire spring, it is stated, this spring admits of the press being run quite 25 per cent faster, and without the wear, consequent on the strain caused by the wire spring, and the accompanying jar and noise.

Patents were obtained through the Scientific American Patent Agency, May 2, October 17, and December 12, 1871, for the inventor, Mr. C. B. Cottrell, of No. 8, Spruce street, New York city. Further information may be obtained of Messrs. Cottrell & Babcock, at the above address, by whom the improved press is extensively manufactured.

Fig. 3

Fig. 2

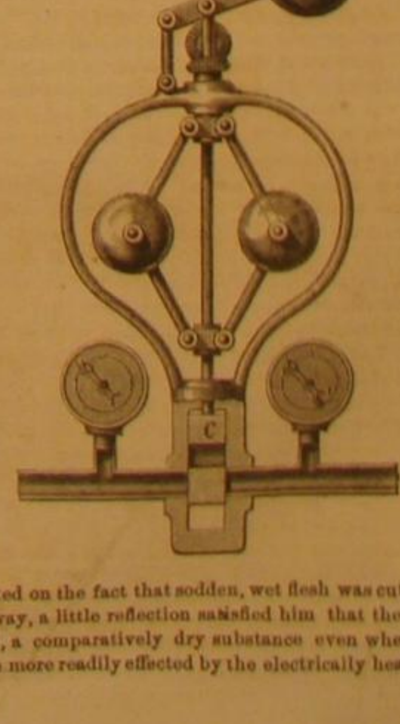
NOVEL MODE OF SAWING WOOD WITHOUT A SAW.

The dominion so long held unquestioned by ax and saw has been at length invaded. Electricity has been pressed into the service and threatens to drive these implements into banishment, while the muscular and other forces which were so largely expended in their use are replaced by the action of the galvanic battery in one of its most simple forms.

The invention we are about to describe, and which was patented through the Scientific American Patent Agency, on the 28th of last May, is that of George Robinson, M. D., of this city.

That gentleman was well aware that a galvanic current in sufficient quantity, when passed over fine platinum wire, would raise its temperature to a red or even white heat. The most important application of the principle had previously lain in the employment of the heated wire in certain surgical operations as a substitute for the knife or red hot iron. It was found that the red hot wire easily cut or rather burnt its way, through the living flesh, and tumors of considerable size were thus removed from the human body. The inventor's attention being fixed on the fact that sodden, wet flesh was cut through in this way, a little reflection satisfied him that the division of wood, a comparatively dry substance even when green, could be more readily effected by the electrically heated wire.

Fig. 4



This proved to be the case, and on gently pressing pieces of wood against the red hot platinum wire, especially when aided by a slight sawing movement, the wood was divided in any required direction as by a handsaw, and, of course, without any effort of skill or appreciable expenditure of muscular power. By arranging the wire with handles or other means, so as to guide it readily, the lumber, whether in trees, logs, or planks may be cut easily as desired. There is here, therefore, a simple and easily applied force, which, in a child's hands, may be employed to fell trees, divide them into logs, and, in short, perform all the operations of the saw and the ax. The surface of the wood where thus divided is, of course, slightly charred, but the black layer is very thin, and for many purposes not disadvantageous, as it is known to preserve timber. The battery employed need only be of the simplest character, as quantity, and not intensity, of current is required.*

THE KAOLIN OF THE UNITED STATES.

Dr. Lewis Feuchtwanger recently read, before the Polytechnic branch of the American Institute, a paper on this subject, from which we take the following:

The china clay, commonly called kaolin, occurs in very large deposits in the United States, particularly in South Carolina and Georgia, and its production offers remunerative results for the manufacturers of porcelain, manufacturers of paper and paper hangings, earthen and Rockingham ware, paint manufacturers, frame makers, molders, and many other artisans. The paper clay has been mined in South Carolina for a number of years, and brought to this market, where it always finds ready sale. More than 3,000 tuns have been landed here during this year, and 10,000 more are already engaged to be delivered for the extensive branches just mentioned. But there are many more deposits in that State capable of producing a million of tuns with the most simple *modus operandi*, consisting of cutting or digging the white clay, which is either directly exposed on the surface or within a few feet of the alluvial soil, drying the lumps by exposure to the sun for one or two days, packing into tierces holding about half a tun, and delivering it to the railroad within a mile of the pit. The range of the sand hills in the above States, which contain those extensive clay deposits, is, in a geological point of view, of great importance, for they are all usually found adjacent to the rivers, and more developed near the larger streams than the smaller ones; the sand hills appear to be accumulations of sand, produced by aqueous agency, during the period when the lower boundary of the primitive region constituted an ancient sea beach. The clay strata of various thicknesses are generally considered, by geologists, as the results of decomposition of the felspathic rocks, or of felspar, forming a component part of the granitic and gneissoid rocks of the azoic period during their alteration in the cenozoic time by means of Plutonic agency; while the sand hill formations arising from the decomposition of the tertiary and post tertiary rocks, and including the pleocine, miocene, and eocene formation, took place under Neptunic auspices, as the specimens exhibited, gathered in the sand hill regions, clearly prove. The granite is known everywhere to underlie the marl and clay beds, and we find the same phenomena over an extent of 1,500 miles, beginning in Vermont, crossing over to New York, forming large deposits in New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North and South Carolina, and Georgia. Further, while examining, in Alabama, the triassic rocks of the cretaceous period, we are fully convinced that the great supply of organic remains, the mineral composition and its interposition, prove their true position to be in the geological periods just mentioned.

It is a very remarkable fact that the white clay deposits are mostly found near the surface of the earth. But still more remarkable is the existence of those large clay deposits, so perfectly free from foreign admixture, and even of remains of the felspar from which it originated. Analysis of an orthoclase shows a composition of 65 silica, 17 alumina, 3 soda, 9 potash, and 1 water, while albite and oligoclase have about the same composition, with certain differences in the bases. None of the felspar contains over one per cent of water, while the analysis of the white clay from South Carolina shows the presence of 12 per cent water, and not a trace of potash or soda, and only 2 per cent lime and magnesia, and the silica and alumina in about equal proportion, namely, 44 per cent silica and 39 per cent alumina. In its physical character, the alteration is just as remarkable. Neither mica nor quartz can be detected by the eye or the touch. New Jersey clays and the English china clay have the same peculiarity, as proved by their analysis, and a grave question arises how this metamorphosis took place, and where have the alkalies of the pre-existing felspar gone, and how have they disappeared and been replaced by water? In looking among the elements for an agency, we find carbonic acid the only element that could have produced this metamorphosis: but we are puzzled to know by what process and at what period of decomposition such a change has taken place.

The white clay of South Carolina appears to be fully equal in quality to the famous English china clay, which is largely imported from Cornwall, England, and so extensively used in the arts. But there it is not found in such large masses as in South Carolina, where the writer examined a number of deposits of acres in extent, and from five to ten feet in depth. Since one yard square yields 300 cwts. of the fine and pure clay, the supply is inexhaustible. The peculiar appearance of a thin crust covering the sand hills is, to the observer, of great interest; for it gives undeniable proof that the transformation of the metamorphic or crystalline rocks, during the azoic period, took place under volcanic auspices, and that the result of the decomposition must have undergone several other alterations before the present condition of the sand and clay was attained.

A ferruginous sandstone, resembling fused masses from a great heat, and assuming thin crusts with fantastical figures, is seen all along the sand hills, just below the alluvial soil, and above the sand and clay hills, and I have seen the same crusts of oxide of iron on the railroad from Washington to Baltimore, lying over the sand strata in that neighborhood.

In Georgia, within the compass of the Blue Ridge, extensive deposits of blue or fire clay, resembling the New Jersey blue clay, are found, which are accompanied by a brown mineral, resembling amber, but properly a brown lignite, which, when freshly broken, has the odor of petroleum; and also accompanied by large quantities of oyster (*gryphea*) shells and other forms.

The burrstone or millstone grit is also found contiguous to the clay beds, or at the sand hills, where I found a large mass of several hundred pounds, composed all of silicious shells within the red sand strata.

A beautiful sandstone with oxide of manganese in black spots, and which is sometimes called leopardite, from its resemblance to the skin of a leopard, is here presented. It is from the Blue Ridge, and may be made into a fine ornamental stone.

The consumption of china clay or white clay is very large and daily increasing; statistics show that during the last six months about 2,000 tuns of English clay have been imported in this port. South Carolina has furnished for the paper makers and stainers in New York, Boston, Philadelphia, and Baltimore 2,000 tuns during the same period. The Trenton (N. J.) potteries consume 20,000 tuns per annum. The Ohio potteries in Liverpool and Cincinnati consume annually over 40,000 tuns. The price of the English clay averages $30 gold per tun, while the American can be had for a little over half that price in currency.

In the following analyses of the English china clay, Stourbridge and German clays, and that from South Carolina, New Jersey, and Missouri, we shall see that the Southern clay is in every respect equal to the Cornwall clay so largely imported into the United States:

English best white clay, washed.	
Silica	46·32
Alumina	39·74
Lime	0·36
Magnesia	0·44
Protoxide of iron	0·27
Water	12·67

South Carolina white clay, unwashed.	
Silica	44·46
Alumina	39·82
Lime and magnesia	1·96
Oxide of iron	0·60
Titanic acid	0·91
Water	12·10

South Amboy (N. J.) white clay, unwashed.	
Silica	43·21
Alumina	39·71
Water	14·25
Potash, zirconium, and iron	2·50

English Stourbridge clay for glass pots.	
Silica	65·10
Alumina	22·22
Potash	0·18
Lime	0·14
Magnesia	0·18
Protoxide of iron	1·92
Phosphoric acid	·06
Water	9·86

German clay for pots.	
Silica	50·20
Alumina	34·13
Potash	0·39
Lime	0·30
Protoxide of iron	·37
Water	13·70

Chemical Action of Light.

Professor Roscoe lately delivered the first of four lectures at the Royal Institution on the "Chemical Action of Light." He began by showing how a chemical change in certain gases, liquids, and some few solids will change their colors and their action upon waves of white light. He said that sometimes an approximation or separation of particles may be set up by mechanical means, as in the case of a mixture of chlorate of potash and sulphur, which gives a series of loud snaps when a little of it is struck with a hammer. It is dangerous to detonate this mixture in any but small quantities. Heat also will cause explosions in some cases; for instance, when a flame is applied to a mixture of oxygen and hydrogen gases. In like manner light, in some instances, has the power of promoting the approximation or separation of particles. The effect of light on various bodies is by no means the same, and its action on chemical substances can be mechanically explained by the aid of the law of the conservation of energy—the energy of the interstellar ether is expended in acting upon the substance molecularly changed.

As an example of a chemical change which could be produced by light, he placed a mixture of oxygen and chlorine enclosed in a very thin glass bulb, inside a cylinder of thick glass. The bulb had been filled in the dark, and kept in a dark box until required for the experiment. Then he placed a glass trough full of water behind the cylinder, and burnt some magnesium on the other side of the glass trough so that the rays of light had to pass through the water to get at the bulb. The light caused the mixed gases in the bulb to explode; it was not the heat of the flame which caused the explosion, because the water sifted out all the heat rays, with exception of the very small proportion contained in the visible rays from luminous sources. He said that green light will very slowly decompose a mixture of chlorine and hydrogen; the power of decomposition increases as the violet end of the spectrum is approached. Strangely enough, there are two points of maximum action in the chemical part of the spectrum, and between these two points the rays have less chemical action on the mixture.

Professor Roscoe next told how the action of light upon salts of silver gave rise to the beautiful and wonderful phenomena of photography. Although this chemical action of light was noticed as early as the sixteenth century, it was not until 1777 that the Swedish chemist, Scheele, explained the philosophy of it, and pointed out that the hydrochloric acid was set free, leaving a black deposit of finely divided silver; he first proved that the action took place in the blue and not in the red portion of the solar spectrum. The lecturer then proved by experiment that chloride of silver was blackened by the blue and not by the red rays.

He said that the decomposition of carbonic acid under the influence of light, by the green coloring matter of leaves, was another example of the chemical changes sometimes produced by light. The earliest experiments on this subject were made by Priestley in 1790. This acute reasoner proved by experiment that it was only in the presence of sunlight that the evolution of oxygen from plants takes place. He took a large inverted vessel full of water charged with carbonic acid and placed a living plant inside; then, in the presence of sunlight, bubbles began to form on the leaves of the plant, then to rise to the top of the vessel. On examination the gas thus produced was found to be pure oxygen. Priestley took a candle and burnt it in a closed volume of air under a bell-jar, until the candle went out after consuming most of the oxygen and liberating carbonic acid. He next placed a fragment of a growing plant in the jar and exposed it to sunlight; in course of time the air was rendered pure again, so that another candle could be burnt in it, and the experiment repeated over and over again an indefinite number of times. Professor Roscoe proved this by showing that a taper would burn brightly in a glass jar containing growing musk, though when the musk was first put in the jar, the air had been made so impure by the burning of a candle in the glass vessel that it would not then support combustion. Priestly tried many of his experiments with mint, and not a few of them with other vegetables; he found spinach to be most effectual in restoring oxygen to air under the influence of light.

The existence of the ultra red rays of the spectrum was first demonstrated by Herschel in 1800. The existence of ultra-violet rays was demonstrated later still by Wollaston and others. It was discovered that chloride of silver became blackened beyond the range of the visible rays of the spectrum. It was found that the lines of the chemical part of the spectrum could be photographed, and that the photographs of them, taken by Rutherfurd of New York, agree with the drawings of them made by hand by Kirchoff, although in a few cases they do not agree in breadth and in intensity. The chemical rays of the spectrum differ from each other solely in wave length and amplitude of vibration

$10,000 Reward for Improved Railway Signals.

An offer of the above amount is made by parties in Boston for the invention of devices that some of our ingenious readers can certainly supply. The offer is as follows:

To the Editors of the Boston Daily Advertiser:

There are in the United States several millions of persons, sick and well, living along the lines of the various railroads and near manufacturing establishments in populous towns, who are disturbed day and night by the discordant shrieks of the modern steam whistle. Owing to the gradual introduction of this apparatus, the public has learned to tolerate it, but we venture to assert that if it could have been introduced suddenly as we hear it to day, no community would have consented to its use. These unearthly sounds are made in manufactories at early dawn, at noon and at night, to call their operatives to work and to meals, and on the railroads to warn passengers on the highways, and to give notice to switch tenders on the approach of trains. It is not necessary to describe them, since they are familiar to all, and all are more or less affected by them. Is there no remedy for this increasing evil, or cannot a substitute be found which will answer all the purposes of the steam whistle, without annoyance to the public, and with safety to travellers on the railroad and on the highway? Believing that such a substitute can be found, and to encourage experiments in that direction, we hereby agree to pay the sum of ten thousand dollars to any one who shall, within two years from January 1, 1873, invent a system of signals which shall supplant the use of steam whistles on railroads, and which shall be pronounced by judges, hereinafter named, to be free from the evils of the present system, and which shall be attended with no discomfort to passengers on the trains, or the highways, or to residents along the line of the railroads. One fifth of the amount thus pledged shall be paid to the author of such invention at any time within the period specified, whenever its claims shall be substantiated by the said judges, and the balance whenever the invention shall be adopted and used by a majority of the railroad companies in New England, provided such adoption be previous to January 1, 1877. The judges in these premises shall be the Chairman of the Massachusetts board of railroad commissioners, the President of the Boston and Albany and Boston and Maine railroad corporations, the Professor of civil engineering in the Massachusetts Institute of Technology, and the chief locomotive engineer on the Boston and Albany railroad. If any of the above named gentlemen shall decline to serve as judges, the donors reserve to themselves the right of naming substitutes.

Communications may be addressed to "Committee on Railroad Improvements," care of *Boston Daily Advertiser*, Boston, Mass.

The Brewing Interests of the United States.

The twelfth annual convention of the chief association of the brewers of the United States was recently held in this city. From the opening speech of the President, Mr. Henry Clausen, we learn that there are at present three thousand breweries in the country, employing a capital of over one hundred million dollars and giving employment to thousands of people. The trade yearly consumes twenty-three million bushels of barley and over eighteen million pounds of hops. The revenue derived by the United States from this industry amounted in 1871 to seven millions eight hundred thousand dollars, being an increase of over six million dollars since 1863.

PORTABLE FRESCOES.

The process of frescoing in oils, invented by Mr. Charles T. Kemmer, is a novelty in its way, and, we think, is likely to entirely supersede the ordinary mode of frescoing. It is designed to do away with the expense and inconvenience always attendant on the usual processes, and, at the same time, to furnish artistic decorations of a most superior quality and durability.

We may describe the process briefly, as follows: Ordinary sheeting is dipped in soap and water and stretched upon a frame; it is afterward covered with a coating of gelatinous size, and allowed to dry. An oil painting of the nature required is then executed on the prepared sheet, and, after it is thoroughly dried, the gelatinous sizing between it and the sheeting is moistened, and the painting removed, bodily, from the sheeting. The painting is then attached to the plaster by a liquid cement of appropriate character.

In the production of the painting, whether it be merely a plain tint, an ornamental design, or a gilded decoration, about five coats of the best linseed oil fresco paint are used. This produces a tough, tangible film, about the thickness of good writing paper, which will bear washing with soap and water and a sponge as often as may be desired. When cemented to the plaster, it adheres with a tenacity entirely unknown where the paints are laid directly on, as in ordinary frescoes, which are liable to peel off. Cracks occurring in the plaster do not affect the film unless they are of large size.

In the manufacture of this portable fresco, plain tints, etc., are turned out in pieces 20 inches wide and 8 yards long, ready for attachment to the plaster. Where a ceiling or wall is to be covered with a decoration specially designed for the purpose and complete in itself, the painting is executed of the size required, and the film is cut into strips of a convenient size for cementing to the plaster: as the strips are cuttings from one piece, they of course match so accurately that no join is discoverable.

Among the advantages belonging to this process are the facility with which frescoes for distant use may be designed and painted, and the very short time which is necessary to fix them on the walls or ceiling after they are done. As an illustration of the latter, we may state that the film can be applied in one day to a ceiling which it would take three weeks to fresco in oil in the regular manner.

Mr. Kemmer has received patents for his invention both in this country and in Europe. Further information may be obtained by addressing Charles T. Kemmer & Co., Passaic avenue, East Newark, N. J., or at No 4 Warren st, New York.

A Recent Tornado.

Portions of our Western prairie country, by their comparatively level and unobstructed formations, present a fine field for the play of the winds, and for the formation of those remarkable spiral currents known as whirlwinds, from which great damage sometimes results. These spiral currents usually cover a very narrow pathway on the surface of the ground, but they operate with tremendous force, and might not inaptly be termed pneumatic plowshares. One of these aerial giants made its appearance at Quincy, Logan county, Ohio, on the 8th of June.

A sultry day was followed by the appearance of a cloud, in the West at 5 o'clock in the evening, which increased in blackness and size with fearful rapidity. A heavy wind soon set in, and at 5.30 o'clock the whirlwind struck the earth five miles from Quincy, moving in a northwesterly direction. The tornado reached Quincy in about five minutes and passed through the town, making a clean sweep of houses, trees and fences along a path which fortunately was comparatively narrow. In this village 50 or 60 dwellings and stores, two churches, and as many more shops, stables and outbuildings were unroofed, rocked from their foundations and demolished. The air was literally filled with flying weatherboards furniture, laths and plaster. A parlor stove was caught up by the wind and hurled through the air until it fell upon a woman and crushed her so that she died. The Baptist and Methodist Episcopal churches were completely destroyed.

The tornado on its way to De Graff struck Bogg's flouring mill, five stories high, and containing 3,000 bushels of grain. The building was moved nine inches upon its foundation, and the roof and the portion of the fifth story were carried away. The storm plowed its way through De Graff, carrying destruction in its path, but injuring fortunately fewer persons and a smaller number of buildings. After leaving De Graff it passed several settlements, and finally rose from the earth and was seen for miles, carrying in its funnel shaped form timber, rails, and *débris* which it had gathered in its destructive march. The newspapers give the names of some fifty persons killed and wounded by this tornado.

Car Starter.

William M. Stratton and William E. Stratton, of West Troy, N. Y., have recently patented an improvement in apparatus for storing up, in a spring or springs, the power expended in arresting the motion of a car, to be used in setting it in motion again; and it consists in having the drum, which is employed to wind the tension cord of the spring, made with such devices and arranged in such manner that it may be locked and held after being detached from the gearing connected with the axle to wind it up, so that the car may be allowed to run awhile before the power of the spring is applied; thus making the apparatus capable of retaining the power stored up in the spring while the car is going down a descending grade and using it on an ascending grade, the car running free between the grades. The invention also consists in certain novel devices, for thus detaching, holding, and locking the winding drum.

CINCINNATI EXPOSITION.

The commissioners announce in our advertising columns that the third National Industrial Exposition will be opened in Cincinnati, September 4th, next. It will remain open until October 5th, following.

The aid which such exhibitions afford to business and the advancement of knowledge is of the most important character, and fully entitles them to the interest of the whole nation.

We would wish to remind intended exhibitors that they are recommended to make immediate applications for space.

Extensive arrangements have been made for the transportation of visitors, at reduced fare, and it is expected that the large attendance of last year will be very much increased this season.

THE UNIT MEASURE OF ELECTRICAL RESISTANCE.

Since the electric telegraph has been in existence, quite a number of different units of electrical resistance have been proposed, but at the present time nearly all of these units have been adjusted to one standard, so that one of them may now be considered the basis of all.

Professor Wheatstone proposed, as a unit, one foot of copper wire weighing one hundred grains.

Professor Jacobi proposed a copper wire one meter long and one millimeter in diameter.

Professor Matthiessen proposed a copper wire one statute mile in length and one sixteenth of an inch in diameter.

Mr. C. F. Varley's unit is a mile of special copper wire one sixteenth of an inch in diameter.

Dr. Werner Siemens employed a glass tube filled with pure mercury. This tube was one meter in length and contained a column of mercury having a transverse section of one square millimeter.

The German, French, and Swiss telegraphers used a certain length of their standard sized iron wire, such as was used for the construction of overland telegraph lines, as a practical unit of measurement.

The British Association proposed and adopted a theoretical unit of resistance, in which a certain amount of work or mechanical effect is produced by a given amount of electricity in a given length of time, and this theoretical resistance is copied or represented by a certain length of wire.

This unit is beautiful in theory, but difficult and uncertain in practice. The principal source of difficulty lies in the accurate measurement of the mechanical effect of the electric current. Since this unit has been adopted by the British Association, some of the most expert continental physicists have, by experiment, arrived at the conclusion that it is about two per cent smaller than the copies distributed by the association.

The objection to the employment of copper wire of various sizes as a standard arises from the fact that no two specimens of copper, or of any other metal, possess precisely the same specific conducting power, and, therefore, measures of resistance thus defined are liable to vary, and, in fact, do differ from each other very materially.

This objection, however, says the *Telegrapher*, does not apply to mercury, which, in consequence of its fluid nature, is easily rendered chemically pure. In fact, experience has shown that resistances can be produced and reproduced by means of mercury, which do not vary among themselves more than two or three ten thousandths of a unit, or about as near as the finest set of silversmith's scales can be made to balance and weigh alike.

In deciding upon a standard of measurement, the first and most important consideration is to select one which is least likely to undergo change or variation, so that, when they become multiplied and brought into general use, one of them will always correctly represent another.

If we suppose, for example, that a person should undertake to construct a two foot rule: He first selects a standard as nearly correct as possible, and copies it with great care. Suppose he then destroys the first and makes a third from the second, and a fourth from the third, and so on until he has made a thousand, and all of his measures, except the last one made, have been destroyed.

Now, we will suppose that another person commenced making two foot rules in the same manner, and using the same original standard to copy his measures from, and in the same way copied one from another to the number of a thousand. If these two persons compared their final measures with each other, it is more than probable there would be a considerable difference—that is, they would not agree one with the other. In view of this disagreement, how could it be decided which was the most correct, as the original standard is no longer in existence? In some such condition would two persons be, each having British Association units of measurement. They cannot get at the original unit, because it never had a practical existence.

The mercury unit, on the other hand, has for its basis the meter measure, which is defined as the ten millionth part of the distance of the pole of the earth from its equator, and very nearly the length of a pendulum that beats seconds.

The British Association unit forms part of a system. The resistance bears the same relation to the other conditions that distance does in the definition of a horse power. A horse power is that force which will raise 33,000 pounds one foot in one minute. Similarly, a British Association unit is the resistance of the circuit producing a defined mechanical effect or work in a certain time, with the other conditions of quantity and intensity defined as units. As before stated, the great difficulty lies in the correct measurement of this mechanical effect. In order to accomplish this, the British Association made use of a magnetic needle, that is, a magnet held in its position by the magnetism of the earth, which is never in itself constant, and is at all times in a state of perturbation. It results from this that the force required to move this magnet equally, at different times, will not be the same. In addition to this, the magnet is affected by local causes, and in no two different localities can it be said to be affected precisely alike. From these and other reasons, German scientists of the highest rank, as the result of their investigations, have announced that the British Association unit, as distributed by their committee, does not approximate its true value within nearly two per cent.

It was after careful consideration of the defects in the different standards of electrical resistance, and with the desire to adopt the one which was least liable to objection, that the International Convention of Electricians, at Vienna in 1868, adopted the mercury unit as a standard, and all the European countries, with the exception of Great Britain, have adjusted their resistance scales to it. Mr. Varley has defined his unit, or "readjusted it to 25 mercury units."

Mr. Latimer Clark defines the B. A. unit, or Ohm, as "the resistance of a prism of pure mercury one square millimeter in section and 1·0486 meters in length at 0° centigrade," so that, in reality, the mercury unit is now the basis or standard of all the measures in use.

The average resistance of a statute mile of good No. 9 galvanized wire, such as is generally used in this country, is about 20 mercury units.

Masonry and Brickwork.

However gigantic may be the strides with which engineering science has advanced during the last few years, it cannot be denied that, so far as regards the special art of building in masonry or brickwork, the present race of architects and engineers are feeble in conception, timid in execution, and but dwarfs of utter insignificance as compared with the giants of former days.

It would be amusing, or more truly perhaps the reverse, to note in what manner an average architect or engineer of the present age would deal with some of the problems presented to the old masters: for instance, such a one as that successfully solved by the Saracenic builder of the justly celebrated tomb of Mahomet at Beejapore, India, which was as follows: Given a building 135 feet square on plan, and 110 feet high, required to cover the same with a circular dome 124 feet in diameter, and weighing some twelve or fourteen thousand tuns. It would be curious to observe how many hundreds of tuns of iron our men would consider it imperative to throw into the work. The Saracen, knowing the capabilities of his material, asked for no ironwork, but fearlessly trusted to his masonry, and skillfully corbelled out the square walls at the top to meet and support the circular dome, and to such a bold extent that, at the angles of the building, the projection of the corbelling measured no less than 46 feet.

How infantile appear the greatest exertions of our modern building in comparison with such mammoth works as these. The traditions of the art have been lost, and science has provided no substitute. Our professors, if they do not avoid the subject altogether, treat it in a perfunctory, *ignotum per ignotius*, manner, which only serves to make the "darkness more visible," or the "little glooming light"—which may already exist in the student's mind—"more like a shade." We may be taught, for instance, that the line of pressure in an arch must be included in the middle third of its depth, or the arch will tumble down, and we may be treated to many other equally shallow *dicta* based upon hypotheses evolved from purely theoretical considerations, which the bare existence of hundreds of buildings for hundreds of years conclusively demonstrates to be utterly false and untenable.

In recent times, no doubt, the introduction of iron work has had much to do with the extinction or suppression of nearly all that is true and expressive in the art of building. It is so very easy to multiply the span and divide by the depth, and to perform the other elementary operations incidental to the determination of the strength of an iron girder; and then, besides, the figures and diagrams look so clever as to induce, in the too often shallow performer, a glow of self complacency, leading him to fervently believe that an engineering feat has really been achieved. But if such work constituted engineering, the schoolmaster in the "Deserted Village" would be an admirable exponent of the science:

> The village all confessed how much he knew;
> 'Twas certain he could write, and cipher too.

Another advantage offered by ironwork as compared with masonry, and one to indolent or incompetent men peculiarly seductive—is that of shirking responsibility. With iron girders, the designer may devote the few minutes necessary to the conventional calculations, specify iron of a given strength, and so rid himself lightly of any further sense of being responsible. But if, on the other hand, his first consideration is his client's interest, and not his own ease, he will often be led to discard ironwork in favor of masonry, and he will find no royal road to learning in that direction, but must honestly and laboriously qualify himself, by theoretical and practical investigation and by comprehensive analyses of works already executed, to form a correct estimate of the capabilities of the masonry or brickwork with which he may dealing, and to shape his design accordingly.—*Engineering*.

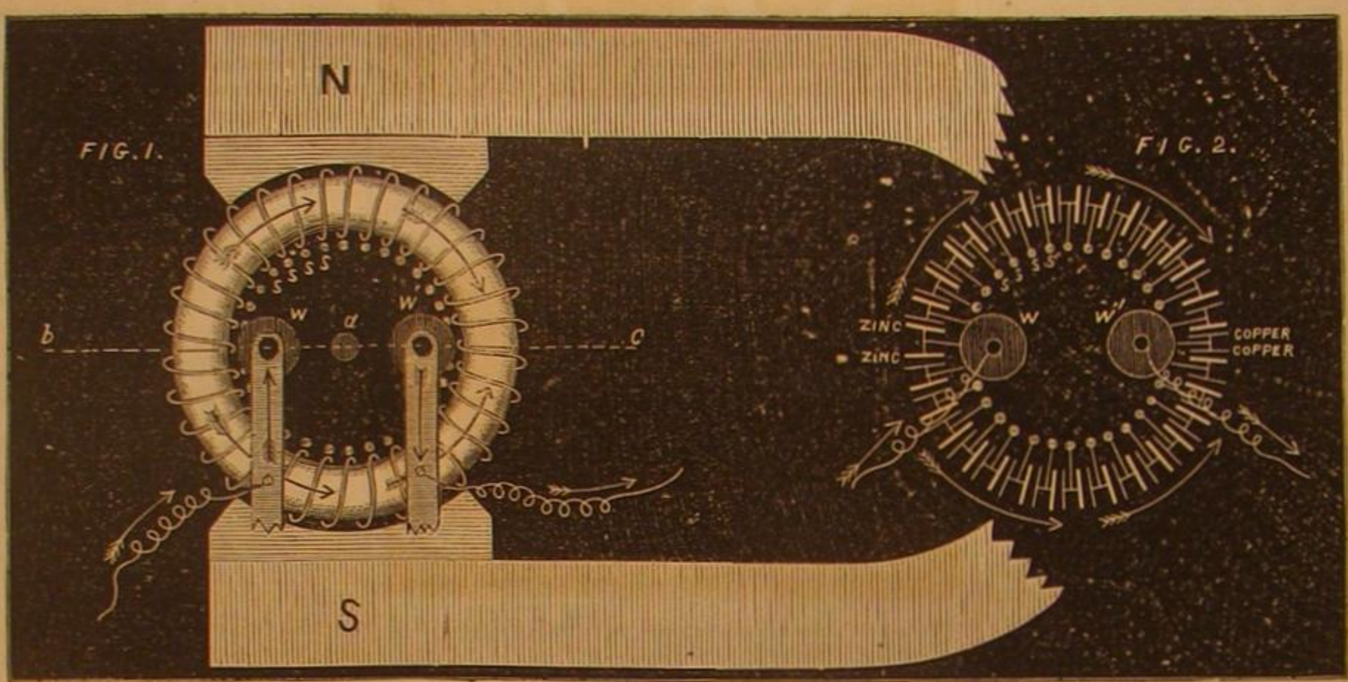
OZONE IN THE AGEING OF ALCOHOLIC DRINKS.—On running out wine drop by drop through a vessel filled with ozone, the essential oils and other substances which give the wine a "new" flavor are destroyed, and the wine much improved in quality.—*M. Loew*.

NEW MAGNETO-ELECTRIC MACHINE.

In all the magneto-electric machines hitherto constructed, only an approximation to a continuous current has been arrived at, and that either by making each machine a compound one, having several armatures arranged so that, when the current ceased in one, it was taken up by the next, and so on, or, in other machines, by driving the armature or armatures at a very high velocity, so that the interval between the cessation of one current and the commencement of the next became inappreciable.

In M. Gramme's machine, says the *Mechanics' Magazine*, the current, whether the machine be turned slowly or quickly, is continuous. Fig. 1 is a theoretical representation of this machine. It consists of a horseshoe magnet, N S, between the poles of which turns an iron ring with an insulated wire wound round it in one continuous length. The inner beads of the turns of this wire are connected with small studs, *s s s s*, insulated from one another. The edge of the faces of two wheels, *w w'*, press against these studs, as shown, so that as the iron ring with the wire wound around it rotates, three or more of these studs are always in contact with them. In the actual machines, each of the turns, as represented in the engraving, is really a separate coil of several turns of wire, the junctions between the ends of one coil and the next being connected with the studs; and the iron ring is not necessarily one of round iron, but may be, or rather is, a short and very thick soft iron tube, and the permanent magnet a proportionally broad compound one. The action of the machine may be explained as follows: Let us regard the turn of wire just above the line, *b a c*, on the left hand side of the ring. The portion of the iron ring above this turn, that is to say, the portion nearest the pole, N, has the same polarity as that pole, while the portion of the ring below the turn has southern polarity. Now as the ring rotates about *a*, the portion of the ring above the line, *b a c*, becomes more strongly north as it approaches N, and the part below less south as it recedes from S; and, finally, when it arrives at N, the polarity on both sides is the same, which is as much as to say there is no magnetism in it. This change causes a current of electricity to be induced in the wire. As the turn now moves on towards S, the iron in front becomes a south pole, and that behind a north pole, until it arrives at the line, *b a c*, when the difference of polarity is greatest. This change sends another current through the wire, which, as the turn has become turned over in position, will be in the same direction as the former one, or rather will be a continuation of the first current, so that the turn of wire, in changing from *b* to *c*, has a continuous current induced in it, as have in like manner all the turns before and after it. As now the turn moves further still, the magnetism becomes less and less, as at first, and finally, when at S, disappears, and on going still further becomes reversed as before; this causes a current to circulate through it in a reverse direction to the former one, and so also for all the turns before and after it; these currents together pass out through the studs, in contact with the wheel, *w*, and return when the circuit between the two wheels is completed (as they must be of course before any current can flow) through the wheel, *w'*, and thus a continuous current is kept up as long as the wheel is kept rotating. The circuits of the machine are precisely similar to two sets of cells joined up for quantity, that is to say, the last zinc plate of one set is joined to the last zinc of the other set, and also the last coppers are joined, as shown in Fig. 2, each cell representing one turn, or in the actual machine one separate coil.

It will be seen that as each wheel always presses against three or more studs, the coils between these studs are short circuited, and do not add their power to the others. The resistance of the wire in the machine will be the resistance of the length of wire between the stud pressing against the higher part of the wheel, *w*, and the stud pressing against the higher part of the wheel, *w'*, taken parallel with the length of wire between the studs pressing against the lower part of the wheels, which is equivalent to rather less than a quarter of the resistance of all the wire taken in one length. The resistance is not exactly a quarter, because the coils between the studs pressing on the wheels are in short circuit, and do not add their resistance to the other wire. By constructing the coils of thick wire, a current of great quantity can be obtained, or with a larger length of thin wire, one of great intensity. The electro-motive force of the current is directly proportional to the rate of rotation of the coils—that is, when the rotation is not extremely rapid, for the demagnetization of the iron requires a certain time. The machine, from its great simplicity, is likely to have an extended use for such purposes as electrotyping, the electric light, etc.



MAGNETO-ELECTRIC MACHINE.

Lac Anilines for Staining Paper, Leather, etc.

Springmuhl states that paper has hitherto been stained in two ways: either the material, previous to manufacture, was dyed with a substantive color, or an adjective color was applied to the finished paper. In the former case, a product was obtained colored through and through; in the latter, the color is only on one side. With a compound of resinous matter and aniline colors dissolved in alcohol, the paper can be rapidly colored at once, on both sides, in the most splendid manner and in an infinite variety of shades. The best resin for the purpose is shellac, to which a little sandarach or turpentine may be added. The resinous aniline solution interpenetrates the whole mass of the paper, giving it a completely even color, and a considerable luster. The two alcoholic solutions of color and of resin may, if needful, be kept separate till required for use.

Every kind of paper, sized as well as unsized, can be prepared in the same manner. The process is very simple: the sheets of paper are drawn through the solution placed in a shallow vessel, and afterwards hung up to dry. By wetting one side of the paper, the same result may be produced, if the texture is not too thick. If the paper is thoroughly interpenetrated with color, it becomes, when dry, so compact and dense that one side can be subsequently treated with a different color. By adding a small quantity of an essence, the paper may at the same time be perfumed. Leather, etc., may be treated in the same manner.

SAFETY KEROSENE LAMP.

Many of the accidents resulting from the use of kerosene arise from the breaking of the glass reservoir when the lamp is overturned by any cause. To obviate this is the intention of the invention we illustrate, and the object appears to be attained by means at once simple and inexpensive.

At A is shown the glass reservoir of the lamp, and at B a ring of india rubber which surrounds its largest circumference. A groove is formed in the glass, into which the rubber ring falls far enough to be kept securely in place, while, at the same time, it projects a sufficient distance from the reservoir to form a protective cushion on every side. Upon the lamp being overturned, the india rubber cushion receives the force of the concussion and preserves the glass from injury. We have upset the lamp from which our cut is made a great many times, to test its strength, without effecting any damage whatever.

Patented through the Scientific American Patent Agency, April 16, 1872. Further information can be obtained of the inventor, Mr. Adolph Otto, whose present address is 76 Ann street, New York city.

PENCIL LEADS.

Graphite, clay, and water are the ingredients of the leads used in the ordinary forms of pencil cases sold by jewelers and stationers. The graphite, or blacklead, as it is commonly termed, that is employed for the purpose is of the finest quality. After being ground to a powder, it is mixed with a peculiar dark blue clay, which is imported from Bavaria, and the whole is kneaded with water until it assumes the consistence of putty.

The apparatus used in the manufacture consists of an iron cylindrical vessel, which is usually of about seven inches in diameter, and constructed of sufficient strength to withstand heavy pressure. In the center of the bottom of this vessel, a small round hole is pierced, and inside the cylinder is a closely fitting movable steel plate which also has an aperture in its center, so that, when it is placed on the bottom of the vessel, the two openings coincide. The hole in the plate, however, is the smaller, being of a diameter equal to that of the leads to be made—so that larger or smaller apertures and, consequently, different plates are required for the various sizes of leads.

Into the above mentioned vessel, after the plate on its bottom is adjusted, the mixture is packed, which, on being forced down by a heavy pressure, is driven out through the hole in long flexible threads. These are received on sheets of metal, and each sheet, as soon as filled, is placed in an oven. The length of time occupied in the baking depends upon whether the leads are to be hard or soft; if the former, they are kept in the oven for some time, if the latter, a short period suffices. This process completed, the threads are broken up into short pieces and arranged according to their sizes. There are nine of these sizes in the trade, numbered from 1 to 9 according to the length of the pieces.

The finished leads are sent to the market packed in little boxes. The latter are either turned from wood or else pressed by dies from thin sheets of tin or brass. Large numbers of them are manufactured at Waterbury, Conn.

Leads at wholesale sell at three dollars per gross. The trade, which is supplied mostly from manufactories in Philadelphia, is, we should judge, of rather limited proportions, as one of the largest dealers in this city informs us that his sales rarely exceed three thousand gross per annum.

Scarlet Dyeing on Wool and Silk.—Jegel proposes the following method of dyeing wool and silk scarlet by the simultaneous action of magenta and dinitronaphthol or naphthaline yellow. The less magenta is employed, the better. The method is to heat a dilute aqueous solution of naphthaline yellow to near boiling, add so much magenta as amounts to two per cent of the naphthaline yellow, and then dye. The dye liquor must not be mixed when cold. If this is done, all the magenta is thrown down in an amorphous flocculent state. If this has taken place, the subsequent application of a boiling temperature does not remedy the mischief, since a part only of the magenta thus precipitated is redissolved, the rest melting together into a greenish golden mass. In this state, the liquid is quite unfit for dyeing, and even if filtered gives no good shades.

Preparation of pure Indigotine by means of Carbolic Acid.—According to Mehu, carbolic acid, with the aid of heat, has the power of dissolving indigo blue readily. On cooling, the greater portion is deposited in a crystaline state. The cold solution has an intense purple blue color. In order to prevent the carbolic acid from congealing as it cools, a little alcohol may be added, which causes the greater part of the color to be deposited. Instead of alcohol, camphor may be used to the extent of one-fifteenth, or benzine. By using 500 grammes of carbolic acid, we can obtain two grammes of pure indigo blue (indigotin) in crystals which, under the microscope, appear remarkably regular. Mehu employs indigo which has been previously washed, first with water, then with very dilute hydrochloric acid, and then repeatedly extracted with boiling alcohol.

Coating Zinc with Iron.—The objects should first be plunged into a hot solution of 160 gms. ferrous sulphate and 90 gms. sal ammoniac in 2,500 c.c. of boiling water. After two minutes' exposure, they should be removed and brushed off in water. This has for its object simply the cleansing of the surface. They are then again placed in the bath and heated, without brushing or washing, until the sal ammoniac fumes are gone, then washed, and this operation repeated three or four times, when a coating of iron will be formed on the zinc, which takes a fine polish under the brush.—*M. Puscher.*

Miners' Unions in Prussia.

The oldest associations amongst working men for mutual aid, of which modern trades' unions are the youngest off spring, are unquestionably the "Knappschaften," or miners' unions of Germany. They date back more than 600 years and were established wherever German miners migrated; they had written rules and regulations, and generally received corporate rights from the respective sovereigns who wished to encourage mining enterprise within their own dominions, particularly for the sake of winning precious metals. The German miners' unions exist over all Austria, Russia, Norway, and Sweden, where the art of mining was introduced from Germany; and the technical terms, still in use by the profession in these countries, bear witness to their German origin, as well as the general mining laws which regulate the acquisition of mining property from the State and the obligations of mining proprietors towards the sovereign, who holds all mineral treasures under regal rights. In no other country but Prussia, miners' unions or "Knappschaften" have been developed with so much care by legislation for the general benefit of the working miners; and though they are still capable of improvement, they can fairly be pointed out as models which are worthy of imitation for the benefit of the other working classes. The report on the miners' unions in Prussia during the year 1870 has lately been published, and we find in it data which may prove of value to the mining interests of this country, where the improvement of the social condition of a large population of miners is just now being eagerly discussed.

The war of 1870 has not failed deeply to affect the condition of the "Knappschaften," as over 30,000 members were forced by it to leave their peaceful calling and to enter the ranks of the army. The direct object of the miners' associations is to render immediate assistance to its members when they are in need of it, so that, if injured by an accident or if taken sick, they receive assistance during the duration of their illness, besides free medical treatment and medicine. If their case should make it desirable, they are received without cost at one of the unions' infirmaries; and in the event of death, the union furnishes the funeral expenses. If, through any accident or through age, they become too infirm to gain any wages by their work, they receive for life a pension out of the common fund; and according to the degree of their infirmity, they are classed as pensioners, or half pensioners, and obtain help accordingly. If a member leaves a widow and children behind him, the former receives a monthly pension until she dies or marries again, while the children are assisted until they are 14 years old, besides free school to the same age. There are two classes of union members, permanent and temporary, the latter only acquiring personal rights, while the former, after 5 years membership, have their rights extended to all the members of their family; but both classes forfeit their rights when they leave their union without permission, or cease to pay their contribution, which, as a rule, is 3½ per cent of wages earned. The property of the union is thus principally derived from contributions of the members, but also to no small extent from voluntary donations, as well as from contributions of 1 per cent on their incomes, which the mine owners are legally obliged to pay. This fund is under the management of a committee of trustees, "Knappschafts Aelteste," who are freely elected by the members and placed under the control of the Government mining engineer of the district, who is made responsible, to prevent defalcations and to see that members always obtain justice.

On the 1st of January, 1870, the miners' unions comprised 202,562 members, of whom 102,174 were permanent and 100,388 temporary. The number of persons supported by the unions during the year was 45,057, namely, 9,267 pensioners, 277 half pensioners, 13,883 widows, and 21,630 orphans, and school money was paid besides for 45,402 children. The total income of the union was $1,600,000. During the year, medical assistance was rendered to 117,025 persons, sick wages were paid for 1,436,826 days, and 9,486 members received, in all difficult cases, free medical treatment at the hospital. Most of these cases were the results of accidents. —*Engineering.*

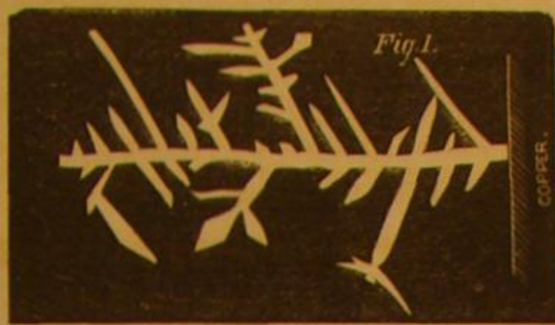
FAST RIDING.—At Dexter Park, Chicago, recently, Charles Bettiker, "the California Boy," undertook the feat of riding on horseback 200 miles in twelve consecutive hours, being at an average speed of sixteen and two thirds miles per hour. The track used was the circular one, seven eighths of a mile in length. Fresh horses were used for each round. On the the twenty-fifth round, the horse bolted the track and leaped the rail, falling upon its rider, who, however, not being much hurt, remounted and finished the round. On the 198th round, the race came to a sudden termination, as the horse again jumped the fence and threw his rider with such force that he was obliged to be taken from the park in a carriage, and he now lies in a very low state, although the physician has some hopes of his recovery. He had made 172½ miles in nine hours and twenty minutes, and but for the accident would undoubtedly have accomplished the feat.

GALVANIC ACTION ON IRON SHIPS.—It is an alarming fact in practice says the *Engineer*, and one that, being so perfectly in accordance with theory, ought to awaken no surprise, that should even a minute piece of copper come into contact and so remain, with the inside bottom of an iron ship then wetted with bilge water, as under the circumstances of the case, it, necessarily must be, active galvanic energy is established between the two metals, and iron being the sacrificial metal of the couple, the bottom will, sooner or later—and sooner rather than later—be eaten through in a hole somewhat larger than the superimposed copper.

CRYSTALLIZATION OF SILVER, GOLD, AND OTHER METALS.

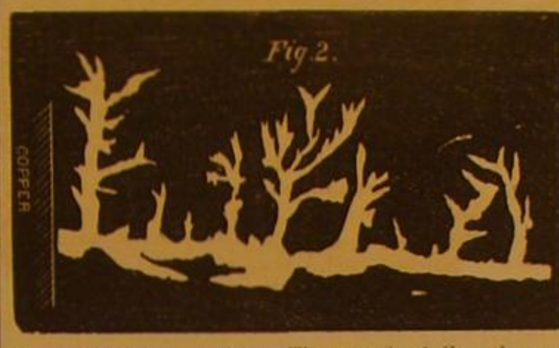
BY DR. JOHN HALL GLADSTONE, F.R.S., F.C.S.

There are few chemical experiments so well known as the growth of the lead tree, a specimen of which is on the table, together with a silver tree that is said to have been made by the late Professor Faraday. These carry our minds back to the time of the alchemists, who called the first, *arbor Saturni*, and the second, *arbor Dianæ*; and they may be looked upon as the types of a large number of phenomena, in which



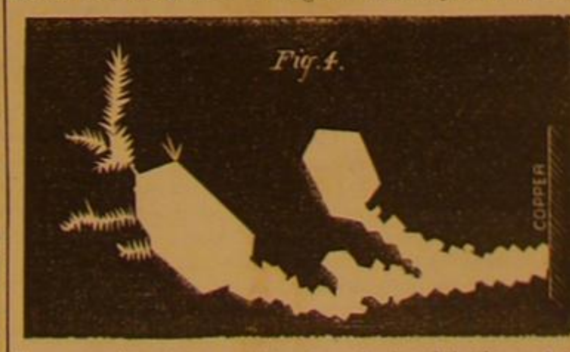
the salt in one metal in solution is decomposed by some other metal. My assistant, Mr. Tribe, and myself have been lately examining these replacements, the metallic crystals which are thus produced, and the forces that act through the liquid.

Our more special attention has been given to the action of

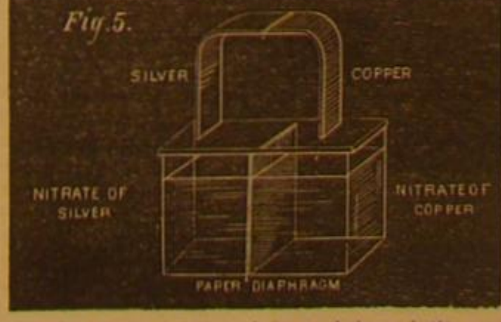


copper and nitrate of silver. The crystals of silver thus produced differ both in color and form, according to the strength of the solution. If it be very weak—say one per cent—the copper is fringed with black bushes of the metal, which, in growing, change their color to white without any alteration of crystalline form that can be detected by a powerful mi-

croscope. A stronger solution gives white crystals from the commencement, which frequently assume the appearance of fern leaves; the analogy between crystals and growing plants is a most superficial one, but it is convenient to draw our names from the garden. Stronger solutions yield a crystal-



line growth rather resembling furze bush, while those of 15 per cent or upwards give a steady advance of brilliantly white moss. In all these cases, however, when the solution in front of the growing crystals has been somewhat exhausted, certain prominent or well circumstanced crystals seem to mo-



nopolize the power, and to push forward through the remaining portions of the liquid. This gives rise to beautiful branches, which assume a variety of graceful forms, but, as a general rule, the weak solutions give feathery and pointed crystals, as in Fig. 1: the moderately strong solutions tend towards jagged forms, as in Fig. 2; while the strongest grow branches that terminate, not in sharp points, but in rounded leaflets, as in Fig. 3. Besides this, there occur all kinds of crystalline combinations, as for instance, the spray sketched in Fig 4. It is very beautiful to watch the growth of these silver crystals round a piece of copper under the microscope; a blue glass underneath adds to the effect, but they are best seen when they reflect a strong light thrown upon them. If, instead of putting a piece of copper into a drop of nitrate of silver, a piece of zinc be placed in one of terchloride of gold, there is at once an outgrowth of black gold, which speedily changes to an advancing mass of yellow, or perhaps of purple metal; and it is very apt to form beautiful fringes, or to shoot its yellow branches rapidly round the margin of the drop. Acetate of thallium yields a forest of thorny crystals; and chloride of tin causes a luxuriant growth of large flat leaflets, or of symmetrical structures resembling fern leaves, except that the smaller fronds are arranged at right angles to one another. The new metal indium gives thick white crystals upon zinc; while bismuth and antimony form black fringes resembling the first action of gold.

The forms assumed by native metals resemble those produced by this process of substitution. In some cases, indeed, it seems almost certain that the deposition of these minerals was effected in the same way, as for instance, the silver which occurs sometimes in tufts, sometimes in large crystals, on the native copper of the Lake Superior district. Gold is frequently found in cubes more or less rolled, but the leaf gold from Transylvania bears a striking likeness to the crystals that form in our laboratory experiments. Silver is often found native as twisted hairs or wires of metal—a form that never occurs in the decomposition of its nitrate by copper, but which can be artificially produced in another way.

There has been noticed a singular tendency in old silver ornaments and coins to become crystalline and friable. Here is an ancient fibula from the Island of Cyprus, supposed to be at least 1,500 years old, which, through the greater portion of its substance, presents a fracture something like that of cast iron, and its specific gravity has been reduced in round numbers from 10 to 9. It contains a little copper. This property of certain metals, or their alloys, to change in condition and in volume, is worthy the attention of those whose duty it is to make our standards. Experiments should be instituted for the purpose of learning what metals or combinations of metals are least subject to this secular change.

These metallic crystals are Nature's first attempt at building. The material is the simplest possible—in fact, what chemists look upon as elementary. But how is the building carried on? What are the tools employed? Where are the bearers of burdens that bring the prepared pieces and lay them together according to the plan of the Great Architect? We must try to imagine what is taking place in the transparent solution. The silver, of course, existed at first in combination with the nitric element, and for every particle of silver deposited on the growing tree, an equivalent particle of copper is dissolved from the surface of the plate. The nitric element never ceases to be in combination with a metal, but is transferred from the one metal to the other. On the polarization theory, the positive and negative elements of the salt constantly change places and enter into fresh combinations, one consequence of which would be a gradual passage of the nitric element from the growing silver to the copper. This actually takes place, and there is a diminution of the salt at the ends of the silver branches, giving rise to an upward current, and a condensation of nitrate of copper against the copper plate, which gives rise to a strong downward current. These two currents are seen in every reaction of this nature. In the case of silver and copper, however, it has been proved that the crowding of the salt towards the copper plate is more rapid than would follow from the polarization theory. The instrument employed for determining this point was a divided cell in which two plates, one of silver and the other of copper, connected together by a wire, are immersed each in a solution of its own nitrate, contained in each division of the cell, and separated from one another merely by parchment paper. The crystals of silver deposited on the silver plate in this experiment are very brilliant.

There are other indications of the liquid being put into a special condition by the presence of the two metals which touch one another. Thus zinc alone is incapable of decomposing pure water, but if copper or platinum be deposited on the zinc in such a manner that the water can have free access to the junction of the two metals, a decomposition is effected; oxide of zinc is formed, and hydrogen gas is evolved. At the ordinary temperature, the bubbles of gas rise slowly through the liquid, but if the whole be placed in a flask and heated, pure hydrogen is given off in large quantity. We have also found that iron or lead similarly brought into intimate union with a more electro-negative metal, and well washed, will decompose pure water.

As might be expected, the action of magnesium on water may be greatly enhanced by this method; and a pretty and instructive experiment may be made by placing a coil of magnesium in pure water at the ordinary temperature, when there will be scarcely any effect visible, and then adding a solution of sulphate of copper. The magnesium is instantly covered with a growth of the other metal, and at the same time the liquid seems to boil with the rapid evolution of hydrogen bubbles from the decomposed water.

When, however, the force of the two metals in contact has to traverse a layer of water, the resistance offered by the fluid prevents its decomposition. This must also be an important element in the decomposition of a metallic salt dissolved in water, and, in fact, we have found that the addition of some neutral salt, such as nitrate of potassium, increases the action—apparently by diminishing the resistance of the liquid. If, too, we increase the quantity of the dissolved metallic salt, we get more than a proportional increase of deposited metal. Thus, in an experiment made with the different strengths of nitrate of silver on the table, the following results were obtained in ten minutes, all the circumstances being the same except the strength of the solution: 1 per cent solution dissolved ·025 grammes copper; 2 per cent dissolved ·078 grammes, and 4 per cent dissolved ·224 grammes.

In fact, it had been found that, in solutions not exceeding 5 per cent, twice the amount of nitrate of silver dissolved in water gave three times the amount of chemical action; and this was true with other metals also in weak solution. It is likely that this is not the precise expression of a physical law, but it agrees at least very closely with the results of experiment.

The power arising from this action of two metals on a binary liquid may be carried to a distance and produce similar decompositions there. This is ordinary electrolysis. Metals have been crystallized from their solutions in this way, and Mr. Braham has made excellent preparations of crystalline silver, gold, copper, tin, platinum, etc., by using poles of the same metal as is intended to be deposited upon them. The forms thus obtained are precisely analogous to those produced by the simple immersion of one metal into the soluble salt of another, and illustrate still further the essential unity of the force that originates the two classes of phenomena.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

A Plea for the Classics.

To the Editor of the Scientific American:

In your issue, dated May 25, I noticed, in an article entitled "How to Conduct Scientific Investigations," this sentence: "Not only are physics and mechanics more pleasant studies than Latin, and chemistry more interesting than Greek grammar, but we assert that a man may make more money, by applying a mere superficial knowledge of these sciences, than by a much more profound knowledge of the dead languages." From the above, one would draw the conclusion that money making was the chief end of man. If that be so, perhaps the writer is correct. But man was born for a higher purpose than the simple attainment of wealth. I maintain that every man who comes into the world was put here to make humanity better for his being in it, and not only for his own aggrandizement; and he who fails in this, fails to do his duty. Society demands some benefit from all, in order that it may advance. And fine literature will cause this advancement. I challenge any man to bring forth writings on any scientific subject whatever, chemistry or botany, natural history or mineralogy, and in them will be found derivations from the dead languages. Ask any eminent lawyer what advantage he has gained from the study of Latin and Greek; the universal answer will be "almost every thing." Look at his law books, and you will find nearly every alternate word to have derivation in the ancient languages. Although I do not wish to depreciate Mr. Bryant's translation of Homer, yet I assert that no one can fully appreciate the work until he has read the original Greek. A man may have the most "profound knowledge" of any science, and yet it would be almost impossible for him to deliver a lecture on that subject and not make some stupendous grammatical mistakes, provided he is ignorant of the classics, thereby making himself the laughing stock of the community. Not long since, a case came under my personal observation, in which a young man who never had looked into an English grammar, yet had a tolerable knowledge of the classics, was placed in an examination on that subject (English grammar), with several who knew nothing of Latin or Greek, but had always studied English; the consequence was that the one understanding Latin passed better than three fourths of the rest. This only goes to prove how utterly dependent our own language is on the classics. When a boy or girl is striving to obtain an education, he or she should not only study what will be of practical utility, but what will prepare the learner for the battle of life. The study of these languages gives the brain a thorough drill that can be obtained in no other manner; it compels the mind to think, and think correctly; to rely on its judgment, not on its memory; whereas mathematics and natural sciences give exercise only to the latter, which, too often, is fickle. Step into the Senate chamber of the United States, count the noses, and you will find that a majority of the members are classical scholars and college bred men. From the foregoing remarks, no reasonable man can fail to see that, while the sciences have their uses, they are still dependent upon language for their elucidation. And granting that more money may be made by their immediate use, nevertheless the classics lend influence to the "pen," which rules the world, and which, as all men know, is more "powerful than the sword." In conclusion, allow me to quote the memorable passage of Cicero: "*Idem ego contendo, cum ad naturam eximiam atque illustrem accessit ratio quædam conformatio doctrinæ, tum illud nescio quid præclaram ac singulare solere existere.*"* G. L. F.

Testing Turbines.

To the Editor of the Scientific American:

As a well written communication by Mr. A. M. Swain, in the SCIENTIFIC AMERICAN of June 1st, on the subject of turbine wheels, pointedly alludes to a short article of mine, on page 228 of the current volume, and somewhat misconstrues me, I beg to say a few words in reply, not defensive, for my impression is that such are not needed, nor controversial, for I have not the time even if you had the space.

The inference seems to have been formed that the test of which I spoke was made in raising water. I did not intend to say this. I suppose in every test, if its commercial aspect is to rule, the water discharged, time, and the net result, are the elements of calculation. In this case, the head was 110 feet, the water discharged by the hydraulic engine—not a ram—about 42 per cent of what the turbine used for the same work in raising a weight. If there is a more simple method, a more accurate one than this, I would like to know it. In Mr. Swain's communication, overshot wheels are instanced. I propose to follow them up as proof. If an ordinary over shot receives pressure earlier than at 45° away from a vertical line through its shaft, it discharges it enough earlier, than at the corresponding angle below the shaft, to render it next to certain that the full weight of the water utilized cannot be greater than what is due to the capacity of the buckets between these points. This quantity would be represented by the 90° remaining between them, or 50 per cent of the weight of water the buckets would contain if the whole diameter of the wheel were effective. How then could 70° of the discharge be raised to its head, even if taken from the tail-race? And much less could it be done if taken from a mine.

There is, doubtless, some "inaccuracy" about the process. A parallel holds good as between an overshot wheel, using about 90° of its circumference, and a hydraulic engine. In each, if the instrument is withheld from movement, the power is retained; but with a turbine, a forcible total stop page only checks the flow, and power is lost. If in the most approved turbines, 8 per cent of water under pressure is intentionally freed, is it not done to give the best effect to the balance? And if so, does it not go to show that my use of the word "speculation" was not loosely taken?

This loss by a turbine, I hold to be a fair representation of the disparity between the two systems; but it is very much understated in the 8 per cent; and the 12 per cent is demanded as a reasonable allowance for other things. Wherever allowances are asked, that have not been, perhaps cannot be, proved to be precisely right, I must still call them speculation. Only the weight of the water can be used as power, and a turbine does not use the whole. I cannot say that 86 per cent of the power of water upon an overshot wheel has not been utilized, but I am incredulous for the reasons stated, even though the buckets were made to trip, after a vertical passage the distance of the diameter of the wheel. Your correspondent, in speaking of the test I suggested, to wit, that of forcing back to its head as much water as the power would raise, has apparently overlooked the allowance I proposed for every necessary mechanical obstacle. This allowance need not complicate the process; the difference between the quantity discharged and that replaced would measure the exhaustion of power; then if the "necessary obstacles" were or could be measured, and added to the replacement effect, raising it to its original condition in the reservoir, my case would be lost. I have no arguments against turbine wheels; they are excellent devices and are doing immense service; but I only do not believe that they have ever used the percentage of power claimed. R. H. A.

Baltimore, Md.

The Cherokee Tribe of Indians—A Subject Interesting to Antiquarians.

To the Editor of the Scientific American:

If I am correct in memory, it was near twenty years ago when I met with Henry E. Colton in Macon county, North Carolina, and his business seemed to be an inquiry after the ancient relics, as well as traditional history, of the former inhabitants of the country, to wit, the Cherokee tribe of Indians. Mr. Colton directed one enquiry to myself: "What could have been the intentions of the Cherokee Indians in building so many large earth mounds that were met with in the low grounds of these mountain valleys?" My reply was that "the Cherokee tribe of Indians disclaimed all knowledge of the origin of those earth mounds, as well as the purposes for which they were built; and, furthermore, that I had evidence, satisfactory to myself, that these mountain valleys had once been inhabited by some race of people antecedent to their occupancy by the Cherokee Indians; and that this fact I inferred from the wide diversity in form, material and quality of their pottery, as well as their edged or cutting utensils, but more particularly as regarded their mode of sepulture, which, in all races, is permanently fixed; and in pursuance of this subject, I related to Mr. Colton the following incident: After the Cherokee Indians abandoned the country in the year 1821, I, in a spirit of romance, became a small farmer in a wild and picturesque valley in the country the Cherokees had left; and while plowing, in a low ground or bottom fields, in passing over a certain spot the plow produced a rumbling hollow sound, and this led to digging—rather scraping away the earth—in quest of the cause; at the depth of fourteen inches I met with charcoal, and then a clay slab that had been so highly indurated by burning that it had the hardness of a brick. An effort was made to take this slab up entire, as it was but seven feet in length and four in width; but this we failed to do, as it broke in turning it over. But what was our astonishment to find, on the reverse or under side, the complete cast of a human body, not a vestige of which was to be found! From all the appearances, the opinions I formed at that time (and these opinions have not changed) were that at some remote point in the world's human history, some peculiar race of people inhabited this country, whose mode of sepulture was to place the body of their dead in a shallow grave in a nude state and on its back, with the limbs extended at full length, cover it with soft clay mortar, pile wood upon it and consume the body with fire. Furthermore, the problem was suggested: May it not be that this race, so far back in the history of man, were the mound builders? In my farming, I found but two other of these burnt clay sepulchres. All of these facts I narrated to Mr. Colton, and about thirty years after their discovery, and after the abrasion of time and the wear of the plow share in farming my lands had reduced these casts in the clay slabs to fragments.

For the first time after the delivery of the above narrative to Mr. Colton, I met with him at a Cherokee Indian ball play, and this was in the year 1860; and he addressed me, as I then thought, somewhat rudely, in these words: "Mr. McDowell, some years ago you described to me some peculiar Indian sepulchres you had found in your fields—have you, since then, discovered any more of these?" My reply was "I have not." He rejoined: "The reason why I now name this subject is this: I published your narration, and archæologists and antiquarians give no credit to your story, because, they say, it is contradictive of all the modes of sepulture yet discovered among the various tribes of Indians on this continent, and it is due to your reputation as a man of truth to find and exhibit one other of these sepulchres." I was wilted by Mr. Colton's words and manner, because, not knowing for why, I felt as though I were half a villain. I made him, I fear, an unmannerly reply that was more practical than pious, and have not seen Mr. Henry E. Colton since, nor have I searched for another sepulchre for the purpose of redeeming my lost reputation as a man of truth.

And yet a kind Providence has saved me, from going down to my grave disgraced, in this way: The 16th day of this month was the recurrence of my seventy-seventh birthday, and a team of oxen were pulling a deep running plow through my field, when the point of the plow struck upon the side of one of these burnt clay sepulchres and rent from it a small portion of an arm. I had the plowing stopped, and the locality marked, and it shall remain intact until some scientific individual arrives who can superintend the delicate process of raising the sepulchral slab without injury to the cast of the human figure impressed upon it. I have intrusted the procurement of the proper man to direct this delicate operation to Colonel C. W. Jenks of St. Louis, now superintending, for the American Corundum Company, the working of the Cullasajah corundum mines in this county.

Franklin, Macon county, N. C. SILAS MCDOWELL.

P. S. Since the 25th inst., when Colonel Jenks and myself conversed publicly on the above subject, eleven of these sepulchres have been reported to me, found in different localities. S. McD.

Do Snakes Charm Birds?

To the Editor of the Scientific American:

In taking a morning stroll by a board fence, I discovered a cat bird fluttering along on the edge of the top board, which was about one inch in thickness; and walking closely up to it, say within four or five feet, I discovered a black snake, about four or five feet long, lying well balanced on the edge of the top board. Neither the bird nor his snakeship seemed at all disturbed at my proximity; but the former, crying and with hanging wings, would advance and retreat, each time seeming to approach nearer to the glistening eyes of its charmer. My sympathy was at once aroused for the bird, and fearing that in its next advance it would be taken captive, I took off my hat and held it on the fence about two or three feet from the snake's head "to break the charm;" but to my surprise, as before, here came the bird towards the hat; it flew over it and lit on the fence near to the serpent's tail. I then armed myself with a cudgel about two feet long, and stepped back about a rod from the parties to observe strategic movements. The bird continued the same movements at the tail which it had done at the head, advancing and retreating, drawing nearer each time, until finally it lit on the tail, then off on the fence, still fluttering, chirping and crying. His snakeship did not seem to fancy an attack in the rear, and slowly lowered about one foot of the tail end, and let it hang down the side of the board. The bird, encouraged by this move, again and again lit on the back part of the body toward the tail and once struck it with its bill. The snake not being able to turn its head back and keep its balance on so narrow a base, it retreated from the bird, coming towards me (it seems that I was not worth its notice), moving slowly along until it reached the post, passing it far enough for the middle of its body to rest on the post. I began to think that it had given up the chase; but not so, for, with all the wisdom of the serpent and the calculations of a civil engineer, he turned his head, doubling himself until his head was within about six inches of the end of the tail, head slightly elevated, and seemed to say: "Now, birdie, come on." Sure enough, it came, fluttering and crying as before. I advanced to within about three feet of the snake, stick in hand, ready for the "clash of arms." The bird approached so near before retreating, I feared to let it advance another time, and immediately made battle in its behalf, and so slew the "sarpint." A darkey, witnessing the conflict, took the snake, saying: "I will hang him up wid his belly to de clouds to make de rain come." And now I cannot tell whether or not a snake can charm a bird; can you?

H. L. EADES.

South Union, Ky.

The Nebular Hypothesis.

To the Editor of the Scientific American:

Your comments on the "Nebular Hypothesis," page 345, current volume SCIENTIFIC AMERICAN, are very interesting, but I differ from you. I am confident that the equatorial zone cooled first and that the mighty force of that shrinking belt was resisted by no other force. The central mass was

*Similarly, I assert that when reason adds, to an exceptional and enlightened nature, some system of education, the celebrity and distinction that there may lie in is unknown.—Eds.)

too light and powerless; we cannot rotate an inflated bladder and burst it by the weight of air contained therein, as the air would escape through the pores of the bladder, but we can burst it by the weight of the bladder itself.

If any portion of the nebulæ was left behind, it was the lighter portion, which, owing to that irresistible shrink, spiralled to either pole and like smoke from a pipe streamed on the solar orbit. True, the action of gravitation would be greatest at the poles, but the spiral would reduce it to a minimum, as in a jack screw. Nebulous rings could have formed in no other manner; spheres could have been formed by shrinking belts. TIRE.

Paris Green and Potato Bugs.

To the Editor of the Scientific American:

Much has been said, and a great deal written, concerning the use of Paris green for the destruction of the potato bug. Many advise the use of it dry, mixed with flour. Last year, I tried another way, which I think is safer and cheaper; and it proved very effectual. As it may be a benefit to many, I give it as follows:

Take one large table spoonful of Paris green and mix it with ten table spoonfuls of flour. These must be mixed very thoroughly, till the mass is of one shade ofc olor throughout. Take of this mixture, two table spoonfuls, and put it into a gallon of water. Stir this till it is all well mixed through the water, and stir it occasionally to keep it from settling,—for if it is not kept stirred, it will settle. Put the water thus prepared into a sprinkler, and apply when the plants are dry and the larvæ are at work. In a very few minutes, the larvæ will have gone to "that bourne whence no traveler returns."

The liquid applied this way, twice or three times during the season, will be sufficient to protect the plants. Used in this way, while it will destroy the insects, there is no danger of its hurting the plants; nor does sufficient go into the ground to do any harm. X. PERRY MENTOR.

Sans Souci, Ohio.

THE NEW STATE CAPITOL AT ALBANY, N. Y.

After three years labor, and at a cost of two millions of dollars, one third of the new capitol at Albany, the design for which we illustrated on page 242 of Vol. XXIII., may be considered complete. The foundations are laid, and the water table, and four feet of the first story walls, is in position.

The structure covers about three acres of ground, its width being three hundred feet, and its depth, four hundred. The cellar is excavated 26 feet and its floor is covered with a solid bed of concrete four feet in thickness. On this rest the piers of massive brickwork which, surmounted by groined arches, bear the weight of the structure. Long vaulted passages are thus formed which, intersecting each other, traverse the entire cellar, some leading to apartments in the corners of the building, others to the large hall in its center. The last mentioned division of the cellar is designed for an engine room, and is to contain four large furnaces and two engines, to be used for warming and ventilating the edifice. The ceiling of this apartment is, like those of the passages, formed of groined arches. These are 20 feet high, their spans varying from 11 to 20 feet, and are considered the finest specimens of masonry of their kind ever constructed.

The foundation of the main tower is the heaviest piece of solid stone work in the building. It is pyramidal in shape, its base being 150 feet, and its top, 80 feet square. It is sunk six feet below the surface of the cellar, and its extreme strength is necessitated by the immense superincumbent weight of tower which will be constructed entirely of stone and iron, and will reach a hight fifty feet above that of the dome of the Capitol at Washington.

The exterior foundation walls are 20 feet thick; their lower courses are built of a species of blue limestone of great hardness, obtained in Essex county in this State. The upper portions, which are more liable to be affected by frost, are constructed of Saratoga granite, and the lintels, of a very coarse granite from Fall River. The water table is built entirely of Dix Island granite, the company supplying that stone having had a contract to employ it exclusively in that part of the structure. On the completion of the water table and the consequent expiration of the Dix Island Company's contract, new proposals were invited from other quarries to supply the stone for the rest of the building. Sixteen competitors entered, and, in the end, the work was awarded to a company in Yarmouth, N. H., who agreed to furnish the stone at 75 cents per cubic foot delivered at Albany. It seems, however, and the fact will account for the delay in the progress of the work which the daily press have lately made the subject of unfavorable comment, that the Yarmouth Company failed to carry out their contract, sending only some eighteen or twenty carloads of stone around by land at considerable expense. The Keene quarry, of Keene, N. H., offering to supply their stone at 85 cents per cubic foot, the commissioners have agreed to take the balance of the material from that source.

Of these three varieties of granite—the Dix Island, the Yarmouth, and the Keene—the Dix Island is much the coarsest in texture; the Yarmouth and Keene stones resemble each other very closely, both being white, fine, and hard. The Keene, however, is found to be slightly the most brittle under the cutting tool.

The stone is quarried in enormous blocks, some weighing as much as thirty tuns. They are so cut as to make all the angles of the building solid, or, in other words, there is no angle on the outside of the building where two stones meet and form a joint. The manipulation of these ponderous masses was, of course, at first a matter of no slight difficulty, but lately a form of derrick has been devised by which they can be raised or transported from place to place with the utmost facility. The apparatus consists of a heavy platform mounted on trucks and resting on a track, the rails of which are some sixteen feet apart. On this platform is a ponderous crane, secured by strong wooden stays. To the crane, heavy tackles are attached, the falls leading to a hoisting apparatus worked by a five horse power engine, situated on the rear end of the platform. This engine, being geared to the wheels of the latter, supplies the motive power; so that a stone can be lifted by the crane and the whole machine moved bodily to any desired point.

Seven hundred men are now at work upon the building, the majority being engaged in cutting the stone, which is supplied in the rough, into the required forms. Two large sheds serve as workshops, movable derricks running on tracks transporting the stones to any required locality. The work is systematized with the greatest care. Each man is required to work his stone through from beginning to end. The stone is numbered and the work measured, so that it can readily be seen whether the full day's work has been properly performed or not. The hands are paid by the hour. They struck some time since on account of some workmen from another State being put to work with them, and at the same time demanded $4.50 for eight hours work. A short time had elapsed, however, before the union in this city informed them that it could support them no longer, and consequently they compromised at 45 cents per hour, and signed an agreement to find no more fault either in their wages or in the fact of non-union men being put to work with them. When the present excitement commenced, a committee endeavored by threats and other means to induce another strike, but on the wages being raised to 50 cents per hour, the men declared themselves satisfied and refused to resort to any further coercive measures.

A Monster Cannon.

The Russian government has lately constructed and tested an immense smooth bore cast iron cannon, made after the method of the American Rodman guns. The *Engineer* says that the weight of this weapon in a finished state is 44 [illegible] tuns. The weight of the projectile to be employed—a cast iron spherical one—is 900 lbs. In trying the gun, in all 313 rounds were fired, the normal charge of prismatic gunpowder being about 117 lb. The experiments of firing were conducted on the river Rama, the high bank across the stream serving as a butt, which was at a distance of about 1,400 yards of the gun. The weapon was placed under an iron plated covering of a peculiar construction. On the discharge of the piece, the concussion of the air was so great that in the village of Matoriloro, situated at a distance of one third of a mile, the chimney stacks fell in when the wind was blowing in that direction. The sound itself, although loud, was not deafening, and persons standing even under the iron plated covering were able to support both the noise and concussion of the air. The iron gun carriage weighs $6\frac{1}{2}$ tuns. The breech of the gun is elevated and depressed by means of a screw ratchet key. For facilitating the running forward of the gun, a system of cog wheels is introduced, and for the diminution of the recoil and the hoisting of the charge and projectiles, special appliances are provided. The moving of this enormous mass of iron can be effected easily by three men.

After the introduction into the military art of rifled cannon, the conviction became established of their unconditional superiority over the smooth bores. As regards guns of small caliber, this opinion may very likely be correct; but with respect to naval guns of the largest calibers, it would be difficult to give the preference either to the one or the other system. Without going into particulars of the merits or demerits of the one or the other description of weapon, we will point to one important difference in the effect of the spherical projectiles of the smooth bores and the oblong ones of the rifled guns; the latter will hit an iron plated target at a greater distance than the former, and, so to say, pierce it through; on the other hand, the former will produce a far greater amount of concussion, shaking loose the rivets of the plates and bolts of the target, and bounding on the plates and cracking them. Besides the difference in the destructive action of these weapons, there is an enormous difference in the cost of production. Thus, for instance, according to a statement of Mr. Grasshof, the price of a 20in. smooth bore gun will be, when produced in quantities, about $8000, whereas an 11 in. steel rifled piece corresponding to the same could not be produced under $30,000.

New Fishing Smack.

A marine novelty worthy of attention was lately exhibited in Glasgow. It was a model of a welled fishing craft, 4ft. long, with 19 in. beam, clinker built and neatly finished. The exhibitor was Mr. Dempster, of Kinghorn, who is well known for his advocacy of deep sea fishing, and who proposes to convert ordinary open decked fishing smacks into well decked boats, by laying a well caulked deck or flooring from stem to stern, at a hight of 2½ft. from the keelson, the space beneath this deck forming the well, which is filled with sea water from several small circular holes in the bottom of the boat. At a hight of 5ft. or 6ft. above the well deck there is another deck, which rises to within a foot of the gunwale, and which, being water tight and comfortable, is adapted for the quarters of the crew. Mr. Dempster has proved the advantages of this style of fishing craft by actual results in practice; and he claims for his system the advantage that, no matter what seas the boat may *ship*, it is impossible for it to be swamped, as the water immediately makes its way out at the bottom.

New Theory of Atmospheric Electricity.

A correspondent, Mr. G. Wright, of Rock Falls, writes as follows:

"The earth is surrounded by an electrical atmosphere which is subject to the law of gravitation, and is consequently more dense near the surface of the earth, and more rare in the higher regions. All the phenomena of electricity are due to the disturbance of this electrical atmosphere, in connection with the resistance of different substances to the passage of the electric fluid. When any substance has more electricity than another substance near it, it is in a positive or charged condition; when it has less, it is in a negative condition, and the attraction which negative substances exhibit for the positive is only the tendency to restore the equilibrium.

If a bladder be filled with air near the surface of the earth, and then elevated to a considerable distance, the confined air will burst the bladder and escape, because the atmosphere which surrounds it in these higher regions is of less density. So if a metallic ball, having the electrical condition natural to the surface of the earth, be suddenly elevated, its natural electricity becomes a charge, which may be drawn off by a spark. This fact can be demonstrated, on a still day when the air is free from moisture. Now, what better evidence do we want to prove that the earth is surrounded by an electrical atmosphere, more dense near the surface of the earth, and that the charge on the ball which was elevated is due to the lesser density of the electrical atmosphere which there surrounds it? When we add to this the chain of evidence which results from the explanation, of electricity in the clouds, the causes of *aurora polaris*, the daily variation of the magnetic needle, and every other electrical phenomenon, on this hypothesis, the proof is as positive that the earth is surrounded with an electrical atmosphere as that it is surrounded with an aerial one. I have spent several years in experiments and observations to demonstrate the truth of this hypothesis, and upon it to establish a theory that shall be applicable to all electrical experiments and phenomena, and am astonished at the facility with which all questions pertaining to this subject can be solved."

Refractory Clays.

Bischoff finds that the analysis of a clay gives a distinct indication as to its power of resisting extreme heats. The temperatures were measured by keeping the clay at a white heat till wires of iron or platinum were fused. The value of a refractory clay is found by the proportion of the alumina to the fusible matter, and again by that of the alumina to the silica. The more alumina a clay contains in proportion to the fusible matter (iron, alkalies, etc.,) the more refractory is it. Silica, on the contrary, augments its fusibility. Of two clays containing alumina and fusible matter in the same proportions, that which contains least silica is most refractory. Save in certain determinate cases, the clays containing alumina, silica, and fusible matter in equal proportions have an equal power of resisting fire. If we give to clays the general formula—$m\,Al^2O^3 + n\,SiO^2 + RO$, the degree of resistance to fire is measured by $\frac{m}{n}$. The higher the value of this fraction, the more refractory the clay.

PUT UP YOUR JAM WHILE HOT.—It is said that ordinary jam—fruit and sugar which have been boiled together for some time—keeps better if the pots into which it is poured are tied up while hot. If the paper can act as a strainer, in the same way as cotton wool, it must be as people suppose. If one pot of jam be allowed to cool before it is tied down, litttle germs will fall upon it from the air, and they will retain their vitality, because they fall upon a cool substance; they will be shut in by the paper, and will soon fall to work decomposing the fruit. If another pot, perfectly similar, be filled with a boiling hot mixture, and immediately covered over, though, of course, some of the outside air must be shut in, any germs which are floating in it will be scalded, and in all probability destroyed, so that no decomposition can take place.

HYDROFLUORIC ACID.—Mr. A. P. S. Stuart remarks that every one who has prepared hydrofluoric acid knows that sulphuric acid and fluor spar form an exceedingly hard, rock-like compound, and that it is very difficult to remove this from a platinum retort. The inconvenience may be avoided by mixing with the fluor spar about an equal weight of gypsum and the proper quantity of sulphuric acid. After the hydrofluoric acid has been expelled by heat, the mass in the retort is found to be of a pasty nature, and is easily removed by water.

FATHER CLEVELAND.—Charles Cleveland, a respected clergyman of Boston, Mass., widely known for his useful and faithful labors, died recently in that city, at the remarkable age of one hundred years—less sixteen days. He retained his faculties up to the moment of his death, and continued in the exercise of his peculiar ministrations as city missionary until within a few weeks. After attaining his majority, he spent forty years in mercantile pursuits. His work for the past forty years has been remarkable. He devoted his whole time to ministering to the poor, and his labors were highly appreciated.

STRETCHING OF CHAINS.—Professor Trowbridge, of Yale College, has stated that at the Novelty works, N. Y., he once made a chain one thousand feet long, to be used for pulling a load of ten tuns up an incline five hundred feet long and one hundred feet high. In one year he took out, little by little, sixteen feet of slack caused by stretching. The chain got stretched out in time, though, and then did not alter.

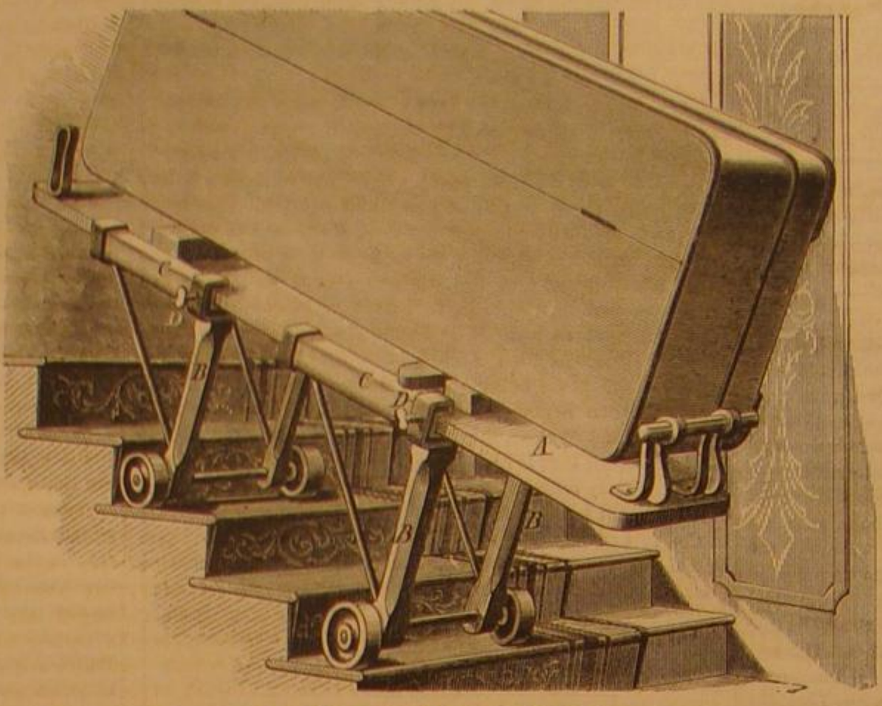
Improved Piano Truck.

The improvement we illustrate consists in making the trucks adjustable in regard to the bed which carries the load, so that they can be fixed at any required distance apart, by which means they may be fitted to stairs of various forms, and used to run pianos, or other heavy goods, up and down them. They are also readily detached from the bed when required, to facilitate loading or unloading.

Our engraving represents the improved truck while conveying a piano up (or down) stairs.

A is the bed, which is furnished at one end with the handle shown, and at the other with two straps, one of which is seen in the engraving. It is also furnished with four cushions, two fixed and two adjustable, on which the piano rests; three of these are partly shown between the bed and the piano. The trucks, B, are provided on both sides with grooved slides, as at C, by means of which they are made to travel on, along, or off the bed, A. They are fixed to the bed in any desired position by the screws, D.

In ascending or descending stairs the trucks are adjusted to the position shown in the drawing, so that, when one pair of truck wheels are snug against the riser of one stair, the other pair are rolling on the tread of another. By this adjustment one pair of wheels is always in position to be raised or lowered to the next stair. When required to put the piano into a wagon, the truck is raised by the straps until the handle end touches the ground, the piano resting on the handle; the upper truck is next slid off the front of the bed, which is then let down into the wagon; the other truck is then removed, and the bed and piano slid in. In taking it out, the bed is pulled out far enough to have one of the trucks put on it; the inner end is then raised until the outer end rests on the ground, when the other truck is put on; it is then gently lowered until the bed stands on all four wheels. While moving the piano over floors, sidewalks, etc., the spring of the bed between the cushions on which it rests prevents all jar to the instrument.



FRENCH'S PIANO TRUCK.

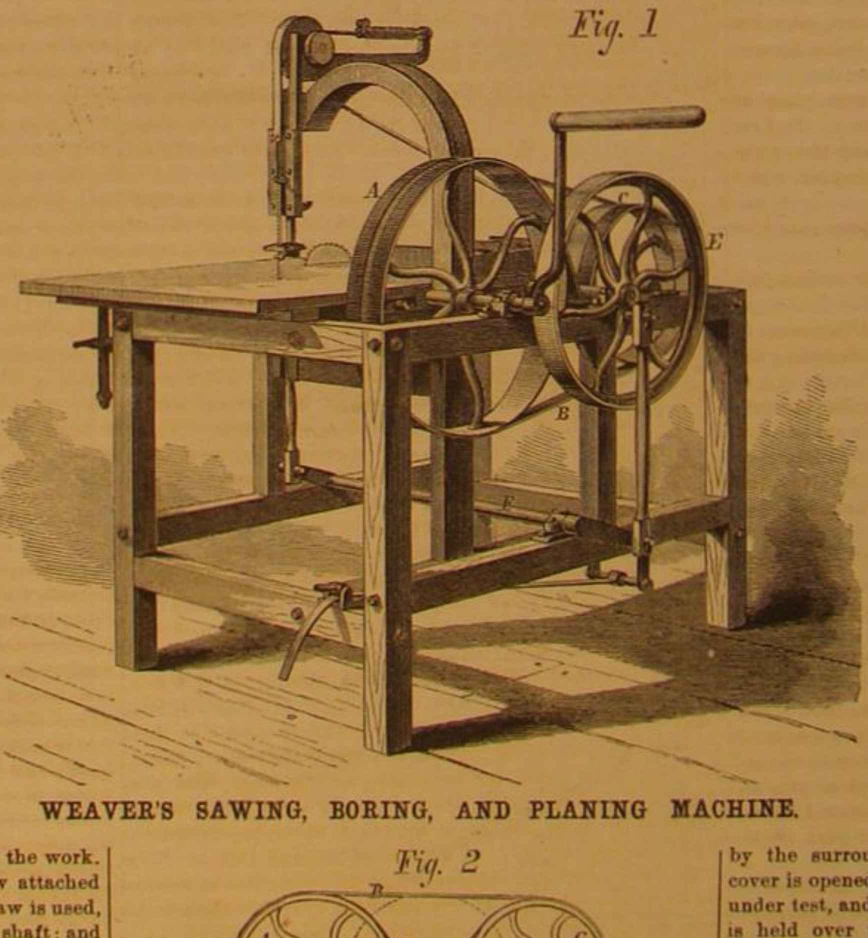
Altogether this seems to be a very useful as well as an ingenious invention. It is protected by patents issued March 16, 1869, and September 19, 1871. Further information may be obtained of the inventor, Mr. Charles A. French, of Davenport, Iowa.

Sawing, Boring, and Planing Machine.

The invention we illustrate supplies workers in wood with a useful machine that can be readily adjusted for service either as a scroll saw, a circular saw, a planer, or a boring machine, and which may be run by hand or by power, as desired. Its most important feature is a skillful and effective contrivance by which the speed is multiplied and the power conveyed from the driver to the tool.

The machine is represented in Fig. 1, and Fig. 2 shows, in detail, the peculiar arrangements of pulleys and belting for conveying the power, etc. A is the driving pulley or drum. B are belts which pass around it, and around the loose pulleys, C. These belts are drawn inward, on opposite sides, as shown in Fig. 2, so as to surround the shaft or small pulley, D, and communicate motion to the same. The loose pulleys, C, run on a shaft attached to the upper ends of two levers, one of which is partly shown in Fig. 2; the lower ends of the levers are connected by a crossbar, to which is attached a strap that admits of being secured to the frame of the machine, as shown in Fig. 1. By this arrangement the tension of the belts is adjusted. The shaft, D, extends across the frame, and carries at its outer end the fly wheel, E; this is attached by a pin to a connecting rod which gives motion through a crank to the rock shaft, F, the crank being adjusted so that the revolution of the fly wheel only rocks the shaft. This motion of the rock shaft is conveyed through slides to the scroll saw, causing it to make its downward stroke; the recoil is secured by the band, pulleys, and spiral spring seen at the top of the machine.

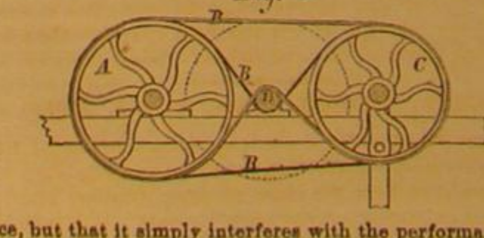
Fig. 1



WEAVER'S SAWING, BORING, AND PLANING MACHINE.

To the shaft, D, may be attached a circular saw in the ordinary manner, and to its inner end (not shown in the engraving) a cutter head, suitable for light planing or molding, or a boring tool, may be affixed. The table is provided with gages, and is adjustable to any elevation required by the character of the work. Our engraving shows both scroll and circular saw attached to the machine, but, in practice, when the scroll saw is used, all the other tools should be detached from the shaft; and when either circular saw, planer, or boring tool is employed, the crank pin of the fly wheel should be detached from the connecting rod, and the operation of the scroll saw prevented. The position of the belts on the pulley or shaft, D, puts equal pressures on opposite sides of the same, and does away with all side strain. Almost the entire periphery of the shaft is in contact with the belts, and a very large surface contact, as compared with the size of the shaft, is obtained. This, and the absence of the usual intermediate belts and pulleys employed for attaining speed, insure the utilization of the power applied and prevent its waste. We are informed that the hand power machine has been employed to saw three inch hard oak felloes and other carriage work with perfect success. It is manufactured extensively by the Greenwich Mowing Machine Company, of Greenwich, N. Y., of whom further information may be obtained.

Fig. 2



Patented through the Scientific American Patent Agency for the inventor, Mr. William Weaver, October 3d, 1871, and January 30, 1872.

Impurities in the Air.

Carbonic acid is not a poison by reason of any action on the blood. When it is present in the atmosphere in large amount, the glottis spasmodically closes, and death ensues from asphyxia. When in small proportion, it is still not taken into the system, but it interferes, to the extent of its presence, with the absorption of oxygen, and the elimination by respiration of the blood. Essentially, therefore, its action is that of a ligature to the trachœa. Thus I put this mouse into a jar of pure carbonic acid gas, and you observe that the animal dies in a few seconds. This other I place in an atmosphere containing forty per cent of carbonic acid, and death takes place after a longer interval, but still in essentially the same manner as in the first instance. If, however, as in the next experiment, I remove the animal before death takes place, and expose it to a free current of atmospheric air, recovery follows very promptly. It is hence apparent that carbonic acid gas is not a directly poisonous substance, but that it simply interferes with the performance of processes which are essential to life. When its influence is removed, provided the animal is not *in articulo mortis*, respiration goes on again as in health; just as, when a man hangs himself, and is cut down before life is extinct, recovery can generally be effected.

Phosphuretted hydrogen—a form of phosphide of hydrogen—is given off from all animal bodies, and especially fish; phosphorus abounding in these animals. It is the element which renders luminous the emanations from decomposing substances, and is frequently seen in the form of masses of luminous vapor over graveyards and other places where phosphorized bodies are undergoing decomposition. It is exceedingly poisonous, and acts with great energy on the living animal body when absorbed into the blood through respiration.

Sulphuretted hydrogen is still more poisonous, and is a constant emanation from decomposing animal matter. Dupuytren found that $\frac{1}{800}$ part of this gas in the atmosphere was sufficient to kill birds in a few seconds. In my own experiments, I found that small animals died after a few minutes when the $\frac{1}{1000}$ part of sulphuretted hydrogen was present.

As you see now, I place this mouse under a large bell glass, and introduce a very small amount of sulphureted hydrogen. The animal dies quietly, after an exposure of less than five minutes.

This was probably the chief agent in causing death in several cases which have occurred in churchyards and dissecting rooms.

The ammoniacal compounds and carbureted hydrogen are also highly deleterious, and when inhaled in concentrated forms are speedily fatal.

But, besides these, there is reason to suppose that there are present, in the atmosphere contaminated with animal emanations, certain living organisms.

The Diamond Fields of South Africa.

On the geological questions connected with these diamond fields, Mr. John Paterson has propounded some new views based on a minute and careful examination of the appearances which presented themselves to him on a visit to the diamond fields. He discredits the theories which would refer the presence of diamonds in Grequaland West to any distant sources, and thinks the evidence incontestable that the marl soil, as he named it, in which the gems are now found, is the true matrix soil of the diamond. This marl soil, he considers to be the metamorphosed carboniferous shales of the country, and the change which has worked upon these shales, by which they have been transformed from the black carboniferous shale into the whitish ashy marl in which the diamonds are found, he attributes to intrusions of greenstone trap, which traverse the country from N. E. to S. W. in continually recurring dykes. Mr. Paterson gave some very interesting details of the extent and richness of the diamond diggings in South Africa, and in his picture of the Gong-Gong and Delport Diggings as "Great Rushes" in diggers' phrase, resembling in extent and richness Colesberg Kopje, but now nearly worked out, not by the hand of man in a few years, but by the angry waters of the Vaal River through many ages he found much groundwork of hope that the diamond discoveries of South Africa are to be no fleeting passing industry, but a continuous employment, not only for many years but for many ages.

Testing Burning Fluids.

Pethuel Millspaugh of Kent, Conn., has obtained letters patent for an improved test for burning fluids.

This invention provides an improved instrument for testing kerosene oil and other illuminating fluids, and also for determining the specific gravity of fluids generally. The apparatus consists of an upright glass cylinder which is supported in the top of a chamber formed in the upper part of the base. A lamp is placed in the base, the heat from which is transmitted through the chamber to the lower part of the glass cylinder, and the chamber may be made to contain air, water, etc., as required to regulate its intensity. The glass cylinder contains a thermometer, which is fixed therein, and is closed at the top with a brass cover. The burning fluid to be tested is made to completely fill the glass cylinder, so that the thermometer is entirely submerged, and cannot be affected by the surrounding atmosphere. An orifice in the brass cover is opened to allow the escape of vapor from the fluid under test, and, when necessary, the lamp is lighted. A flame is held over the orifice, and at the moment the evolved vapor is ignited the temperature of the fluid is correctly indicated by the thermometer. In ascertaining specific gravities by this instrument a hydrometer is also placed within the glass cylinder in such a manner that its scale tube is free to move up or down through a hole in the brass cover. The surface of the fluid tested is plainly visible through the glass cylinder, and the scale may be accurately read.

QUICKSILVER has been found near Austin, Texas.

Scientific American.

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VOL. XXVI., No. 26. [NEW SERIES.] *Twenty-seventh Year.*

NEW YORK, SATURDAY, JUNE 22, 1872.

Contents:

(Illustrated articles are marked with an asterisk.)

A NEW PATENT LAW IN CANADA.

We have the pleasure of announcing that the Parliament of the Dominion has just passed a new patent law, which, among other judicious provisions, grants to American citizens the privilege of obtaining patents in Canada on very favorable terms.

We hail the passage of this law as an indication of real progress on the part of the people of Canada. Its practical operations can hardly fail to prove advantageous to the material interests of the Dominion.

A valued correspondent in Canada furnishes the following *resumé* of the provisions of the new law, which goes into effect on the first day of September next:

The law provides that all inventors, or their assigns, may receive patents, provided a foreign patent for the invention has not been in existence for more than one year prior to the application being made for the Canadian patent. Improvements on existing patents may also be patented.

The applicant shall, for the purposes of the act, elect his domicile in some known place in Canada—this being a mere formality.

The patent will be issued for five, ten, or fifteen years, at the option of the applicant; but, at the expiration of the first five or ten years, the patent may be extended for another term of five years; there is no provision for extension after the fifteenth year.

In case of error or defective description, the patent may be reissued, as is the case in the United States.

In case of an assignment of a patent, such assignment must be registered in the Patent Office.

The law provides for remedy in case of infringement of patents—and also for the impeachment of patents before the courts.

Every patent will be subject to the condition that the patentee shall manufacture the invention in Canada within one year from the date of the patent; and the patent is to be void if, after the expiration of one year from its date, the patentee or owner causes the importation in Canada of the invention for which the patent is granted.

The fees payable to the Patent Office for each patent are at the rate of $20 for each period of five years. When the patent is refused, half the fees may be returned to the applicant. This rule is always acted upon.

Inventors may file caveats, to be kept secret and of record for one year.

Patents may be refused when the alleged invention is not patentable in law, or when it is already in the possession of the public, or when there is no novelty or utility in the invention, or when it has been described in a book or printed publication, or when it has already been patented in Canada, or elsewhere by the inventor for more than one year previous to the application.

When a patent has been refused, appeal lies to the Governor in council within six months after notice of such refusal.

In case of interfering applications, the case may be referred to three arbitrators, one to be appointed by each applicant and the third by the Commissioner of Patents—their decision to be final. The fees of arbitrators to be a matter of agreement, except those of the arbitrator appointed by the Commissioner, which are to be paid equally by both parties.

Patented articles are to be stamped as such, and a fine of $200 is imposed for false marking.

By reference to a card in another column, it will be seen that Messrs. Munn & Co. are now ready to receive applications for patents in Canada.

PROGRESS OF THE EIGHT HOUR STRIKE.

The many acts of violence, to which the workmen supporting the eight hour movement in this city have taken recourse, seem to have culminated in the shooting of James Brownlee, a carpenter and non society man, who was quietly at work in a shop on Forty-first street, near First avenue. It appears that two of the strikers threatened him with personal assault if he did not at once quit work and join them in the strike. Fearing that they would carry out their threats, Brownlee left the shop and passed into the street, when one of the men who had followed him drew a revolver and shot him through the cheek, saying at the same time "That's the way we treat such as you are." This atrocity, although promptly disavowed and condemned by many of the organizations, has produced a powerful effect on the community at large, and has resulted in a marked diminution of public sympathy for the cause. The threats of abandonment of work, on the part of the men employed at the gas works, have caused, during the past few days, considerable apprehension throughout the city lest the streets at night should be left in darkness, but the danger has been happily averted by the gas companies acceding to the terms demanded.

The small number participating in the procession, which was intended to exemplify the great strength of the movement, has been a source of disappointment to its advocates. The working men for some reason viewed the idea with disfavor, so that, instead of an army of thirty thousand men, barely twenty five hundred paraded through the streets. There was no disturbance along the route, nor any cheering, but simply a lack of enthusiasm which fell like a pall on the sanguine expectations of the strikers. During the remainder of the past week, the desertion and returning to work of a large number of employees of Singer's sewing machine factory has rendered the movement still weaker; and although a considerable number of men still hold out, it is the general belief that it must eventually fail.

Advices from out of the city inform us that the strike is but little felt, and that its effect has been rather beneficial to manufacturers in other States. The reason is that the better class of workmen who have no sympathy with the movement find themselves compelled by the action of their trades' unions to leave the city and obtain labor elsewhere, while the malcontents throughout the country flock to New York in hopes of getting increased wages.

On the part of the manufacturers, the position adopted in the beginning has been steadfastly maintained. The piano forte makers publish a series of resolutions which clearly and forcibly define the stand they have taken. They state that, in case they are forced to raise the price of the goods thirty-three per cent, they cannot compete with the makers in other parts of the country, in whose productions there has been no corresponding advance. Nor, since the trade in the smaller sizes of pianos is mainly local, can they afford to raise the price of their instruments, as the cost of an ordinary piano would then be so great as to be without the reach of a large majority. As far as this branch of manufacture is concerned, it is claimed to be evident that concession to the terms demanded by the working men is absolutely impossible; and we have been assured by the leading firms in the city that if they did yield to the exactions of the strike, the result then would be no worse than if they abandoned their business and sought investment for their capital elsewhere.

The carriage makers, although forming no combinations among themselves, agree in substance with the views of the pianoforte men. The proceedings of the workmen from the establishment of Brewster & Co., of Broome street, are the most incomprehensible of the many vagaries to which the strike has given rise. This manufactory has been carried on on a coöperative principle; that is, the employees owned an interest in the profits of the business. They were fully represented in the management of the internal economy of the concern, had a voice in the regulation of their own pay and hours of labor, and received dividends proportioned to the amount of wages paid them. Three days before the strike they declared themselves satisfied with the existing arrangement, and actually, as we are informed, refused to vote themselves eight hours as a day's work. In spite of all this, suddenly, at the instigation of a few malcontents among their number and intimidated by the trades' unions, they joined the strikers, and, in addition to leaving their work, deliberately forfeited a dividend of several thousand dollars, which was shortly to fall due them.

As to the final result of the movement, we consider that there is but little doubt. Want of support from other cities, the firm front presented by employers, together with the convictions, which are evidently being brought home to the minds of the more intelligent workmen, of the impracticability of the scheme, will end in its abandonment.

It is our belief that coöperation is the most efficient means by which the laboring classes can hope to secure the privileges which they now claim as rights.

WEIGHT, PRESSURE, FORCE, POWER, WORK.

The fact that the above words are often confounded together, for the simple reason that their true meaning is not well understood, has been the cause of many fruitless attempts at mechanical inventions and improvements. Most searchers for perpetual motion make no distinction between pressure and force, and are under the delusion that mere pressure can produce work, and we have seen writers on mechanics and we have even heard lecturers on scientific subjects speak of a force of, say, two tuns weight. Weight alone is not force, neither is pressure equivalent to work; and it may therefore be useful to attempt some clear definitions of the above terms, in order to protect inventive minds against mistakes in mechanical reasoning.

Weight is simply the measure of an amount of matter referred to a certain standard accepted as a unit. This unit may be a gramme, a pound, a tun, or our whole earth, which the astronomers use; but, in either case, it conveys to the mind nothing but the conception of an inert mass, or a certain amount of matter, for the determination of which gravitation gives us the means of measuring and comparing. Therefore we may say: To have "a mass of two tuns," but not "a force of two tuns."

Pressure is a result of this gravitation, and a mass of two tuns will exert a pressure of two tuns; in this way, we may estimate the effect of a spring, hydraulic press, or other similar contrivance, by saying its pressure (not its power) is equal to two tuns, meaning thereby that it has the effect, on the material to be pressed, as if two tuns weight were placed upon it; but we have in pressure neither force nor power. These conceptions of the latter require other elements, as we shall soon see.

Force is matter in motion, nothing more, nothing less; the abstract idea of force without matter is a nonentity. All the modern discoveries in science tend to prove this more and more plainly. Without matter, force would have no existence, but it may be hidden in matter as molecular invisible motion in the form of heat, electricity, etc. The steam engine, electromagnetic engine, etc., are there to prove how this molecular motion, or hidden force, may be changed into visible force or motion of matter. Inversely, the caloric friction machine changes motion into heat; the ordinary and also the Holtz electric machine change motion into electricity. In any case, we are driven to the conclusion that all force proceeds from motion of matter, and is finally resolved into motion of matter, either of masses, or into molecular motion, generating one of the so-called imponderable forces.

Chemistry has proved since the last century that the amount of matter in the Universe is a constant invariable quantity, and that we cannot create or destroy a single material atom, but can only change its form from solid to liquid or gaseous, or *vice versâ*. So the modern philosophy of mechanics proves that the amount of force (that is, motion of matter) in the Universe is a constant quantity, and that we cannot create or destroy the slightest amount of this force, but can only change it from mass motion to molecular motion, that is, heat, electricity, etc., or *vice versâ*.

The measure of force is thus the product of the mass with the distance through which it moves; and as the unit of measure of ordinary masses is the pound, and of distances, the foot, we have adopted the foot-pound as the standard unit of force, meaning "one pound *lifted against gravitation* one foot," not "one pound moved one foot," as we have seen and heard it stated, which of course gave rise to the most absurd calculations in regard to the immense power obtained to drive a steamship or railroad train.

If one pound weight is raised one foot, one unit of force is expended; if, inversely, we cause one pound to descend one foot, we obtain a unit of force back, and may transform this into other mass motion, or into molecular motion. We may cause this mass of one pound to be raised slowly if we have little power to apply, or rapidly if we have greater power; and, inversely, we may cause it to descend slowly, as is done in the weight of a clock, and spend itself gradually during a long period of time, producing slight effects throughout that time; or we may cause it to descend quickly, as is the case with the blow of a hammer, and spend itself during a very short period of time, almost instantaneous, producing a powerful effect for that short time. So the driving in of a nail, which often the pressure of a tun weight would not accomplish, the blow of a hammer of one pound, lasting a small fraction of a second, will accomplish easily. This remark points out forcibly the difference between the weight of masses at rest and of masses in motion, in other words, the immense difference between mere pressure and force.

RUBBER GRAPHITE PAINT.

A waterproof paint, for metal roofs, fences, bridges, ships, and every kind of wood structure, which, at the same time, could be relied upon to reduce the corrosive influences of exposure to the atmosphere, is an article for which the demand would appear to be almost without limit. A patent has just been issued, through the Scientific American Patent Agency, to Mr. Samuel F. Mathews, of Harrisburg, Pa., on an invention intended to meet the wants of the community in this respect; and from the ingredients he uses, we think his paint will answer a good purpose.

The rubber graphite paint is a solution of pure india rubber in linseed oil, which is ground with graphite into a thick, elastic, smoothly flowing paint. Compositions of which india rubber forms a part possess in the most eminent degree the quality of resisting the action of moisture and of corrosive gases carried in the air. In the graphite, we have a pure form of carbon; and it appears to be well known that paints containing carbon in any form last longer than other kinds not having it as an ingredient—holding their body and color when the other paints are totally destroyed. We do not see why this compound, combining as it does these two valuable elements, should not form a paint of great durability and highly protective qualities.

All shades of color from black to gray, or cream color and the drabs, can be made as desired. A company under the title of the Rubber Graphite Paint Company has been formed, and has commenced the manufacture of the article at Harrisburg, Pa.

Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—OCEAN CABLES.—I would like to know if the Atlantic cable lays on the bottom of the ocean? Or if it is only part of the way down, what keeps it there?—H. F. H.

2.—LARD IN TIN CANS.—Is lard injured by being stored in bright tin cans? If so, what is the chemical action which causes the injury? W. H. C.

3.—PLASTER CASTS FROM DEAD BODIES.—I wish to know how to take a plaster of Paris cast of a tumor on a face, so as to represent the face and the tumor? What will give to the plaster a glossy finish? I can take a very good cast, but fail to get as good a finish as I have seen.—J. A. D. Jr.

4.—PAINT FOR IRON.—Can any one inform me if there is any substance that can be applied easily, say with a brush or otherwise, in a thin coat to iron, that will stand heat to redness without melting, peeling off, or cracking?—E. J.

5.—CEMENT FOR LETTERS ON GLASS.—How are the gilt letters put on glass signs, so as to have the polished appearance that all such gilt letters do? The painters here do not know how to do it, although one of them is a subscriber to the SCIENTIFIC AMERICAN.—J. F.

6.—SEPARATION OF OILS.—By mistake one barrel raw linseed oil and one barrel West Virginia lubricating oil got mixed in our oil tank. Is there any means of separating the two oils?—R. K.

7.—DIMENSIONS OF BELT.—Can any one of your readers inform me what width of belt I require to convey one, two, or three horse power?—W. J. S.

8.—WEEVIL.—What will prevent the weevil getting into Indian corn? What will exterminate it from a lot of corn, shelled and in bags? How long will the corn keep safe from getting musty, when stored in open casks or common grain bags in piles, the bags standing on end on floor?—J. B.

9.—GOLD SOLUTION.—Will the gold solution to be applied by brush, mentioned in SCIENTIFIC AMERICAN, Vol. XXVI. page 280, adhere on the plating of buggy dash rims or harness mounting, as on iron or steel not so plated? If so, how long will it retain its brilliancy? Will it not soon come off? How are the mountings of harness plated with gold or silver? Must a battery be necessarily used in such plating, whether white or golden? —J. B.

10.—TEST FOR ZINC.—What is the best test for zinc in wells where galvanized pipes are used? What per cent or how many grains in a gallon of water is sufficient to injure health?—J. B.

11.—SLACK COAL AND SAW DUST.—At our saw mill, coal is used under the boiler; and upon exposure to weather, it slacks and, unavoidably, we have much coal dust, and of course we have much saw dust to spare. Is there any way to utilize them, and so reduce the cost of our fuel? A way that would not be very expensive—all the machinery and parts of the process being of home manufacture—is needed.—J. F. T.

12.—METAL LINING IN CAST IRON VESSELS.—How can I prevent the lining metal in cast iron boxes from becoming loose? After they have run some time, the lining becomes loose, and I have to refill them. Would tinning the boxes prevent the metal from getting loose? If so, what would be the best process to tin boxes that are cast on the frame so that they cannot be removed The lining metal used is Babbitt's metal, *minus* the antimony.—W. A.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

MEDICAL COMPOUND.—John Frechette, of Chicago, Ill.—This invention furnishes an improved medical compound or tonic bitters for invigorating the system when reduced or weakened by sickness. In preparing the compound are taken one pound of orange peel, three quarters of a pound of calamus, one quarter of a pound of ginger, one quarter of a pound of bayberry bark, and four lemons. These ingredients are ground and put into two gallons of pure spirits, diluted to not less than seventy-five per cent of spirits. The compound is allowed to stand for thirty-six hours in a warm place, and is then reduced to forty per cent of spirits, sweetened to taste with crushed sugar sirup, and filtered. It is then ready for bottling for use or for market.

VELVET REEL.—Peder Jürgens, of St. Paul, Minn.—This invention consists of a pair of oval or cylindrical blocks of wood and another block, of square or other form, placed between them, with a wide board attached to each end of the blocks so as to form a reel. On this reel, velvet ribbon is wound by fastening one end to a pin in the central block and whirling the reel on a pivot at the lower side which may be placed on the counter. The reel is whirled by a handle or key affixed to the upper side, and the pin is so placed in the central block that it will not penetrate the layers of ribbon as they are wound on.

ROTARY PUDDLING FURNACE.—Joseph Davies, of Knoxville, Tenn.—In this invention, the revolving puddling furnace is mounted on rollers and rotated in the ordinary manner; it has a large central opening at one side to receive the fire from the combustion chamber, to which it is closely fitted, and another opening on the other side discharging into the flue which leads to the chimney. A flat puddling table is placed upon one part of the interior wall of this puddling furnace, with a hole through the side of the cylinder, arranged in such relation to the table as to allow of balling the metal on it in small balls adapted to be worked into blooms in the squeezer at one operation, the same as it is balled in the stationary furnace. A passage through the flue provides for removing the balls.

DOG FOR SAW MILL.—Denison Chase, of Orange, Mass.—This invention relates to apparatus used in saw mills for holding logs to be sawed. The dog consists of a bed plate fixed to a head block, to which is attached a slotted upright, against which the log rests when partly sawed. In rear of the upright is a stand or round bar which carries the dog proper. This stand is attached rigidly to the bed plate, and the dog is fitted to it so that it will slide up and down on it. In either direction from the central sleeve of the dog are two arms, each furnished with a claw or finger for entering the log. The dog slides up and down in the slot of the upright, and when not in use is raised above the upright and turned round out of the way.

HYDROSTATIC SAFETY LAMP.—Hampton S. Whitfield, of Tuscaloosa, Ala.—This invention relates to that class of well known lamps where the oil is forced up by another liquid. The body of the lamp consists of an upper reservoir, a lower reservoir, and a connecting neck or partition. The neck has two holes formed through it, one to receive a pipe which extends nearly to the bottom of the lower reservoir, and the other to receive a flattened tube which extends up to the top of the upper reservoir, and which is designed to receive the elongated flattened wick tube attached to an ordinary burner. The lower end of the tube projects a little below the bottom of the neck or partition that separates the upper and lower reservoirs, so that there will always be a stratum of air in the upper part of the lower reservoir which cannot escape, and which keeps the oil from penetrating the partition.

SPRING BED BOTTOM.—Donald McMurchy, of Jeffersonville, Ind.—This invention furnishes an improved spring bed bottom, simple in construction, effective in operation, and durable. The posts, side rails, and end rails of the bedstead are as ordinarily constructed. To the inner sides of the end rails are attached bars in which are formed notches or sockets to receive the ends of spring slats. Each spring slat is placed between and connected with two slide slats which should also be elastic. The side slats are made of such a length that when pressed downward their ends come in contact with and rest upon the bars. Various appliances, which cannot be explained in detail, are added to keep the slats in position. With this construction, should the central spring slats become permanently bent or set they may be removed and reversed, making the bed bottom again as good as new; light weights will be supported by the elasticity of the central slats, but heavy weights will bring the ends of the side slats into contact with the bars, so that the weight will be supported by the elasticity of the three slats, the bed bottom being thus equally easy and elastic, whether supporting light or heavy weights.

NEW PATENT LAW IN CANADA.

By the terms of the new patent law of Canada (taking effect September 1st, 1872) patents are to be granted in Canada to American citizens on the most favorable terms.

The patent may be taken out either for five years (government fee $20), or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

In order to apply for a patent in Canada the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with Munn & Co., 37 Park Row, N. Y., who will give prompt attention to the business and furnish pamphlets of instruction free.

Messrs. Munn & Co., have had twenty-five years experience in the business of obtaining American and Foreign Patents for inventors; they have special agencies in nearly all countries where patents are granted. Moderate charges and prompt attention may always be expected.

MUNN & CO., 37 Park Row, N. Y.

[OFFICIAL.]

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For which Letters Patent of the United States were granted

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20,447.—WHITEWASH BRUSH.—D. W. Shaw, W. Magraw.
20,492.—PLATFORM SCALES.—J. F. Keeler.
20,515.—HARVESTING MACHINE.—W. H. Seymour, D. S. Morgan.
20,522.—GRAIN SEPARATOR.—A. J. Vandegrift.

DISCLAIMERS.

20,503.—BREECH LOADING FIRE ARM.—G. W. Morse.
2,182, whole No. 33,186.—THRASHING MACHINE.—D. M. Cochrane.

DESIGNS PATENTED.

5,911.—CARPET.—T. Barclay, Lowell, Mass.
5,912 to 5,916.—CARPETS.—R. R. Campbell, Lowell, Mass.
5,917.—CARD BASKET.—G. D. Dudley, Lowell, Mass.
5,918.—VASE.—N. L. Glauber, A. Schlank, New York city.
5,919.—CAMPAIGN BADGE.—E. W. Harrison, Jersey city, N. J.
5,921.—CARPET.—L. Jullien, Passy, France.
5,922.—CARPET.—C. S. Lilley, Lowell, Mass.
5,923.—CARPET.—D. McNair, Lowell, Mass.
5,924.—TRUNK CORNER CLAMP.—W. Bruen, Newark, N. J.
5,925.—BUCKET.—H. Everett, Philadelphia, Pa.
5,926.—PICKLE STAND AND BOTTLE.—G. Gill, Taunton, Mass.
5,927.—BADGE.—J. Hartman, Jr., Ormsby, Pa.
5,928.—FIREPLACE STOVE.—W. J. Keep, Troy, N. Y.
5,929.—HEATING STOVE.—W. J. Keep, Troy, N. Y.
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5,933.—COOKING STOVE.—F. H. Root, Buffalo, N. Y.
5,934 and 5,935.—HOT AIR REGISTER.—E. A. Tuttle, New York city.
5,936.—STOVE.—N. S. Vedder, Troy, T. S. Heister, Lansingburgh, N. Y.

TRADE MARKS REGISTERED.

852.—WINES AND LIQUORS.—A. W. Balch & Co., New York city.
853.—PRESERVED FISH.—J. H. Doxsee, Islip, N. Y.
854 and 855.—BRANDY.—J. Hennessy & Co., Cognac, France.
856.—BISCUITS AND CRACKERS.—J. B. Kupfer, Kenosha, Wis.
857.—SALVE.—M. A. Paullin, Philadelphia, Pa.
858.—CRUSHED WHITE WHEAT.—F. E. Smith & Co., Brooklyn, N. Y.
859.—POLISH FOR METALS.—F. J. Tinkham, New York city.
860.—ELASTIC WEBBING.—J. Twamley, New York city.

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

15,696.—LINKS OF HORSE POWERS.—A. W. Gray. August 21, 1872.
21,352.—RAILROAD CAR SEATS.—C. M. Mann. August 14, 1872.
21,416.—COFFEE ROASTER.—T. Heermans. August 21, 1872.
21,436.—RAILROAD CAR COUCH.—F. R. Myers, F. H. Furniss.—August 21, 1872.
21,443.—MACHINE FOR TURNING HUBS.—A. Richart. August 21, 1872.
21,465.—SEWING MACHINE.—S. C. Blodgett. August 21, 1872.
21,474.—JOURNAL BOX.—H. H. Thayer. August 21, 1872.
21,541.—PIN STICKING MACHINE.—C. W. Van Vliet. August 28, 1872.
21,828.—FURNACE FOR TEMPERING STEEL.—P. G. Gardiner. October 2, 1872.

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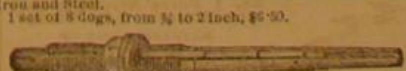

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