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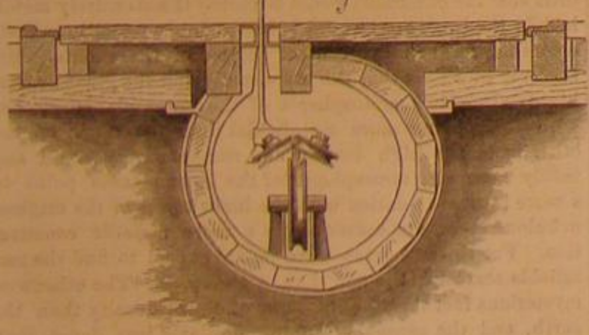
WIRE ROPE TRACTION STREET RAILWAY.

This system of street railroad, the invention of Mr. A. S. Hallidie, has been adopted by the Clay Street Hill Railroad Company, in the city of San Francisco, Cal., and is said to be adapted to all kinds of metropolitan railroading, especially where the surface of the streets has to be kept free from obstructions, where locomotive steam engines are not permitted, or where the streets are so steep as to preclude the use of horses, locomotives, or steam traction engines.

The system consists of an endless wire rope placed in a tube below the surface of the ground, between the tracks of a railroad, and kept in position by means of sheaves, upon and beneath which the rope is kept in constant motion during the hours the cars are running, by a stationary engine. The power is transmitted from the motor to the rope by means of grip pulleys, and from the rope to the cars on the street by means of a gripping attachment attached to the car, which passes through a narrow slot in the upper side of the tube.

HALLIDIE'S WIRE ROPE TRACTION STREET RAILWAY

Fig 2



From the illustration, Fig. 1, which is prepared from a photograph of a portion of the route in San Francisco, it will be seen that the ground is exceedingly irregular. The average grade is 580 feet, and the steepest 850 *feet*, to the mile. The entire length of the endless rope operated, which is of steel wire, three inches in circumference, is 6,800 feet, and the line is supported in the iron tubes, every 39 feet, on 11 inch sheaves. Other sheaves hold up the rope in turning angles, etc. By referring to Fig. 2, which shows a cross section of the tube, will be seen the opening or slot, seven eighths of an inch wide, in the upper side of the tube, which enables the foot of the gripping attachment to pass by and under the upper sheaves and over the lower sheaves. This attachment is shown in Figs. 3 and 4.

Fig. 3 shows a perspective view of the attachment from above, and Fig. 4 represents the wheel by which it is operated. A vertical slide, A, works in a standard, and is moved up and down by a screw and hand wheel. This screw is shown on the dummy, Fig. 1. The small upper screw, going down through the large screw, operates it. At the lower end of this slide is a wedge-shaped block, which actuates two jaws, B, horizontally, which open and close according to the direction in which the slide is moved, closing when the slide is moved upwards. These jaws have pieces of soft cast iron placed in them, which are easily removed when worn out, and which are of proper shape and size inside to grip the rope when they are closed over it.

On both sides of the jaws, and attached to them, are two small sheaves, C, which are held by means of rubber cushions sufficiently in advance of the jaws to keep the rope off from them, and, at the same time, to lead it fairly between them, allowing it to travel freely between without touching them. When it is required to grip the rope, the slide is drawn up by means of the small screw before described, and the wedge at the lower end closes the jaws over the rope, at the same time forcing back the small guide sheaves on to the rubber cushions.

The standard containing the slide, etc., is inclosed in a cast iron bracket, and raised and lowered bodily through an opening in the tube from above the surface of the street to the rope in the tube by means of a worm and nut or rack and pinion. The dummy 's coupled to the passenger cars, at the bottom of the incline, and uncoupled at the top, and *vice versâ*, horses then being coupled to the car for the level road. In order to stop the car, the jaws of the gripping attachment are opened slightly; when they release the rope, the guide sheaves take it, and the car stops. All the essential working and wearing parts of the gripping attachment are made of steel.

The turntable at the foot of the incline is double. The available space at this point was very limited; and in view of this, some ingenuity had to be employed. When the traction car reaches the foot of the incline, it is uncoupled from the car, and run on a turntable, the slot in the turntable allowing the shank of the grip to pass down freely. The table is then turned around one quarter of its circumference, and the track and slots are then brought in the same line. The traction car is then run on a second table, which is turned back, and the traction car is run on the up track. The car is then transferred in the same manner and coupled to the traction car, ready for the ascent. This course is necessary, as there are double tracks; ar.d the traveling wire rope runs down beneath one pair and up under the other. As the gripping attachment passes down under the street through the slot, it is necessary to have a slot in each turntable, to allow the traction car to be turned.

The method adopted at the upper end of the road is more simple. A turnout is made for the car, and it runs down to a common single turntable. The dummy is turned as follows: A circular table connects both tracks, with a slot described around a center. A small iron triangle connects the dummy at two points with the center of the slot and tube. By pushing on the dummy, the center of this triangle being held in position by appropriate means, the dummy turns around in a very small circle, and is ready for the return trip when attached to the car, which has already been turned on the turntable.

The road has a gage of 3 feet 6 inches. An ordinary 20 pound T rail is used, which is set flush with the street and and presents a neat, smooth appearance. The rope runs at the rate of about four miles per hour, and the ascent is made, including stoppages, in about 11 minutes, the distance being 3,300 feet. The motive power is supplied by a steam engine of 30 horse power.

The road has run regularly since its completion in September, 1873, and during the period of one year and four months its actual running expenses per day, including wear and tear, and interest on cost at 15 per cent per annum, are estimated at $123.

Fig. 3.

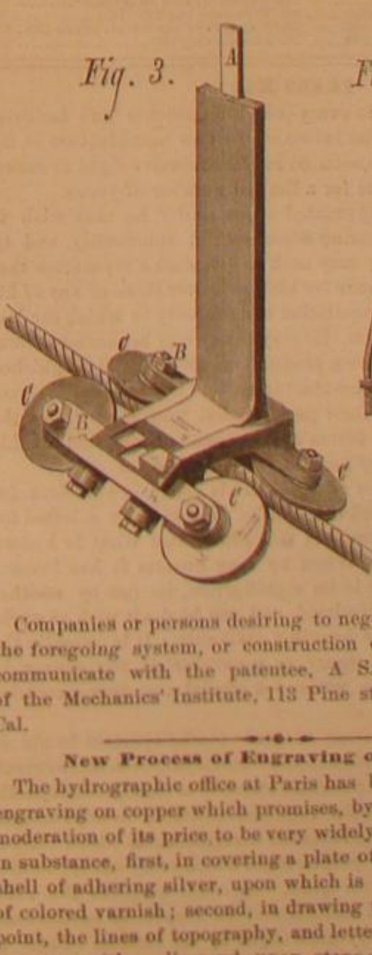
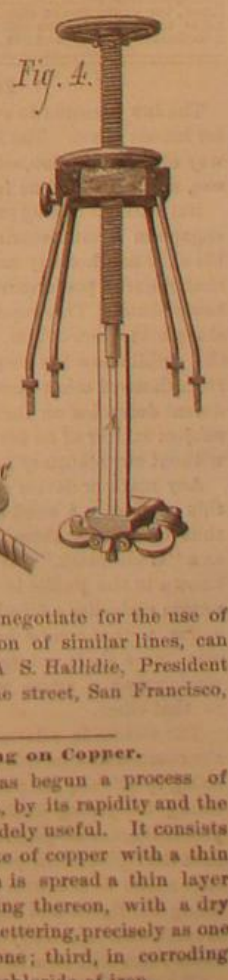


Fig. 4.



Companies or persons desiring to negotiate for the use of the foregoing system, or construction of similar lines, can communicate with the patentee, A S. Hallidie, President of the Mechanics' Institute, 113 Pine street, San Francisco, Cal.

New Process of Engraving on Copper.

The hydrographic office at Paris has begun a process of engraving on copper which promises, by its rapidity and the moderation of its price to be very widely useful. It consists in substance, first, in covering a plate of copper with a thin shell of adhering silver, upon which is spread a thin layer of colored varnish; second, in drawing thereon, with a dry point, the lines of topography, and lettering, precisely as one engraves with a diamond upon stone; third, in corroding the traced parts by means of the perchloride of iron.

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VOLUME XXXII., No 16. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, APRIL 17, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

TRADE MARKS.

The law presents to every one inducements and facilities for honest effort. The inventor of a new manufacture is, by way of compensation, secured in the exclusive right to make, use, and sell the same for a limited number of years.

But without having created a new entity, he may wish to engage in manufacturing some special commodity, and by his skill and honesty may seek to establish a reputation that shall secure a preference for his goods over those of any of his competitors. This reputation is a property in which the law also aims to protect him. He may, in any way he pleases, inform the public how his own productions are to be distinguished from those of other manufacturers, and any attempt at fraudulent deception on their part, in that respect, will be the subject matter of an action at law against them, and all this without any statutory regulation on the subject.

Any mark or device attached to his goods is sufficient for this purpose. A word or a symbol is generally selected for thus designating them, and this constitutes what is known as a "trade mark." When by long custom it has become known to the public in its signification, its use by another person embodies a falsehood, and can be dealt with as such, so far as that can be done in a civil suit. It is morally the same as a theft, a forgery, or a counterfeit, but cannot be punished as a crime without a special statutory provision to that effect.

The statute in relation to trade marks operates in aid of the common law on this subject—modifying it to some extent, fixing specifically the penalties attached to transgression, facilitating the giving of the requisite testimony in any remedial proceedings, and providing for a registration which fixes at once the rights of the proprietor, of which every one is bound to take notice at his own peril. In other respects the rules fixing the rights and liabilities of the respective parties seem to remain substantially unchanged by the statute. Some of these rules will now be briefly considered.

The Commissioner of Patents is prohibited from receiving and recording any proposed trade mark which cannot lawfully become such. This condition refers to the rules and principles on this subject which are dictated by reason, and especially those which have been adopted by the courts.

One of these rules prescribes that the name sought to be used as a trade mark should not be descriptive. If one should seek to appropriate the word "inexplosive" as a trade mark on his preparation of an illuminating fluid, or the word "indelible" on a new marking ink, such a trade mark would not be received or recorded at the Patent Office, or sustained by the courts as legitimate. Any other person who had contrived preparations for such purposes would have a just right to commend them to public favor by like designations respectively. Any law or regulation that should prohibit him from the exercise of such a right would be wholly tyrannical and unjust.

Again it has been held that the name of any particular locality could not, as a general rule, be selected as a legal trade mark. A party who had sought to appropriate the name "Lackawanna" as a trade mark for his anthracite coal, was not sustained in that attempt by the highest of our courts (*see Canal Company vs. Clark*, 1 *Official Gazette, p.* 279.) The ground on which this decision chiefly rested was that no other person who should be engaged in mining coal in the Lackawanna district could legally be prevented from designating it by that name.

For a similar reason, the statute prohibits the registration of a trade mark which is merely the name of a person, firm, or corporation, unless such name is accompanied by a mark sufficient to distinguish it from the same name when used by other persons. And also, as a matter of manifest justice, no one is permitted to select as a trade mark a word or symbol which so nearly resembles one, previously appropriated by another person, that it will be likely to deceive the public.

But it must not be supposed that any one can with impunity attach a name to his productions, although such name could not have been appropriated by any other person as a trade mark. The great underlying rule that fraud will not be allowed to achieve success, wherever it can be detected, will interpose to prevent the consummation of an effort to compass its ends by falsehood or deception. If, therefore, a salt manufacturer at Onondaga should adopt the word "Onondaga" as his trade mark—although that trade mark would be wholly invalid as such, unless at all events he had monopolized all the manufacture of salt at that locality—still, if another manufacturer at Saginaw or Kanawha should label his commodity "Onondaga salt," he would be liable to an action by the Onondaga manufacturer. This would not be on account of the trade mark adopted by the latter. He might maintain such an action irrespective of his trade mark, and so might any other person who had sustained an injury by the fraud.

A trade mark then should be novel, that is to say, so far differing from any one previously attached to a like commodity that there will be no danger of causing deception; it should not be descriptive of the quality of the goods to which it is attached; it should not consist merely of the name of any person, firm, corporation, or locality; and finally it should not be attempted to be used for an immoral or illegal purpose. Subject to these conditions, it may consist of any device, symbol, or word—no matter how arbitrary or unmeaning in itself—that the proprietor sees proper to select.

These rules are believed to be sufficient to serve as guides in most of the cases which shall present themselves to the mind of the honest inquirer.

HOME NEWS BY WAY OF THE SUN.

"Go abroad to learn the news" is a very old saying. Just now the study of the sun's constitution furnishes a remarkable verification of the correctness of the proverb: that far away orb affording a better and closer view of the early stages of the earth's development than could possibly be gained at home, and furnishing at the same time an altogether unexpected means of estimating the relative character of the earth's chemical structure as compared with the other members of the solar system.

It is well known that the elements which compose the earth and its atmosphere are very unequally distributed. Of the part which we are acquainted with, oxygen constitutes by weight fully one half. Silicon makes up a quarter. Aluminum, calcium, magnesium, potassium, sodium, iron, and carbon, in decreasing proportions, constitute nine tenths of the remaining quarter. There is left only one tenth of a quarter to be made up of the other fifty-five non-metallic and metallic elements. Nor are these various elements uniformly mixed in the parts of the earth open to our investigation. The outer portions, being mainly sedimentary strata, derived from an original nucleus of primary rock, are of no assistance in determining the primal distribution of the elements. For this we must interrogate the basic rocks. These are naturally divided into two great divisions, holding on the whole a definite relation to each other. The upper mass consists of granite and other plutonic rocks rich in silica, moderately rich in alumina, and poor in lime, iron, and magnesia. Below are basaltic and volcanic rocks poorer in silica, equal in alumina to the upper series, and much richer in iron, lime, and magnesia, and containing also a great variety of other elements as occasional constituents: the proportion of the denser metals increasing downward. These relatively precious constituents of our earth, as we all know, reach the surface only through veins which traverse the outer layers.

How did it happen that a few of the elements are provided so plentifully for us, while there is such a scanty provision of the rest? And why are the useful metals chiefly hidden in the depths?

The Pope, the Turk, and—not the devil, as the old litanies ran, but his chief opponents—the clergymen, (some of them at least) reply: "It is the will of God," and that ends the inquiry with them. But Science rests with no such thought-repressing dogma. Present conditions are, because some other conditions were: what were those conditions? In pursuit of the answer to this question scientific men stop at nothing short of "interviewing" the Universe. Naturally the ruler of our planetary system is the most instructive witness in regard to the genesis of his family, the earth included.

It appears to be pretty conclusively shown, by spectroscopic analysis of the sun's light, that the following twenty terrestrial elements (with indications of perhaps two otherwise unknown elements which need not be taken into this account) exist in the sun's atmosphere:

Aluminum	Chromium	Lead	Sodium
Barium	Cobalt	Magnesium	Strontium
Cadmium	Copper	Manganese	Titanium
Calcium	Hydrogen	Nickel	Uranium
Cerium	Iron	Potassium	Zinc

These various substances are not indiscriminately mixed in the vapors which surround the sun. Thanks to the interposing face of the moon in total eclipses, it is possible to study the sun's atmosphere in sections, so to speak: by which study it appears that, by virtue of the high temperature which prevails there, and the varying specific gravity of the different elements, the latter are enabled to arrange themselves in layers, in spite of the storms and gaseous outbursts which would tend to disturb their positions. It is observed too that, in the main, the number of elements increases downwards. The outer "coronal" atmosphere contains cooled hydrogen. The "chromosphere" shows incandescent hydrogen, magnesium, and calcium. The "reversing layer," which lies next the photosphere, exhibits sodium, chromium, manganese, iron, nickel, and the rest, with the probable exception of aluminum, the place of which has not been determined by observation, but which most likely lies between magnesium and calcium.

Theoretically the metalloids should lie, as a group, outside the metallic atmosphere: and Mr. Lockyer has submitted some evidence to show that they probably do, explaining why, under the conditions which prevail, their record among the Fraunhofer lines should be a feeble one, and insisting that, in the lack of such lines, we have no argument against the presence of some quantity of the metalloids in the sun, although that quantity may be small. As collateral evidence it is proper to add in this connection that, in the spectra of granite, greenstone, and lava, no trace of metalloids is seen, notwithstanding the (chiefly) non-metallic character of those rocks.

Assuming, in accordance with the nebular hypothesis, that the earth was once in the condition which the sun now presents, we can readily understand why its chemical constitution should be what it is. From the known behavior of the elements, it is inferable that, as the external metalloidal vapors cooled, they would condense and fall upon the underlying layer forming those binary compounds capable of existing at a high temperature, such as the vapors of water and hydrochloric acid, silica, carbonic acid, and others.

As the cooling went on, the precipitation of these binary compounds would give rise to numerous reactions, forming silicates, chlorides, sulphates, etc. With still further cooling, the condensation of water and the formation of minerals would ensue, and the consolidation of the outer shell would begin. The condensation of the metals would come much later and nearer the center.

The same line of facts and reasonings give a clue to the probable constitution of the planets. Assuming the solar nebula to have once existed as a nebulous star at a temperature of complete dissociation, and to have contracted with loss of heat, throwing off the planets successively, we may infer that the outermost would be chiefly if not entirely metalloidal; the inner ones would be increasingly metallic as their orbits approached the central portion of the nebula. Mr. Lockyer considers that the low density and the gigantic and highly absorbing atmospheres of the outer planets accord with their being more metalloidal than the earth: on the other hand the high density and comparatively small and feebly absorbing atmospheres of the inner planets point to a more intimate relation with the inner layers of the original nebulous mass, and consequently a more metallic constitution. For the same reason we should expect to find the metalloids scarcer in the sun than in the earth. The otherwise mysterious fact that the moon is of lower density than the earth, and the moons of Jupiter similarly less dense than their primary, is easily explained by this hypothesis.

The news which we have briefly summarized awaits confirmation, though (as the newspapers say) it comes direct, and from a trustworthy source. It is certainly good enough to be true, commending itself, as Professor Prestwich observes in his review of the present aspects of geology, not only by the simplicity and grandeur of the views presented, but for their high suggestiveness for future inquiry and research.

GERMAN PATENT LAW.

At present the various States, comprising the German Empire, have each a separate patent law. At the time of the Vienna Exposition it was proposed to initiate a general patent law, and to abrogate the State laws. For this purpose the German Patent Protective Association was formed, and they have prepared the details of a new law, which has been presented to the Federal Council, with a petition for its enactment.

The proposed new law is substantially a codification of existing provisions, and embodies the current continental notions about patents and inventors. The latter are regarded as interlopers or trespassers, who must be watched, surrounded by restrictions, and compelled to surrender their property to whoever demands it.

In this country, the inventor is regarded as a public benefactor, enjoys entire freedom in the possession and working of his patent, is encouraged in his work, and honored by the people. It is chiefly when he goes before Patent Office officials that he meets with rebuffs and discouragements.

The proposed German law provides for a commission who shall decide as to the propriety of granting patents. Official fees small. Duration of the patent, 14 years. Annual payments to be made; neglect to pay forfeits the patent. Within six months after the application is made, but before the patent is granted, the applicant must show that the invention has been actually worked within the Empire. The Patent Office may extend the term for working to a year in special cases, and will then decide whether or not to grant the patent. Patentees are compelled to grant the right of use to any persons who desire; and if the parties cannot agree as to terms, the Patent Tribunal shall name the price which the inventor must accept. The government may use any invention, without negotiating with the patentee; the Tribunal will name a sum, which the patentee must accept, or get nothing.

A STREET RAILWAY IMPROVEMENT WANTED.

We publish in another column a note from the president of the Third Avenue Railway of this city, inviting the attention of inventors to a needed improvement in the joints of the rails of street railways. The Third Avenue Railway is one of the most extensively patronized roads in the world. Its length is eight miles, and it carries about thirty millions of passengers per annum. Its rails are spiked down upon longitudinal wooden beams, with an iron plate under the ends of the rails. In addition to the enormous traffic of the company, the rails are subjected to much wear and tear from heavy street vehicles. The improvement called for must be of such a nature as to be readily applied to existing rails.

A NEW DODGE.

We have frequently had occasion to warn patentees against the persistent efforts of designing persons in all parts of the country to abstract money from their pockets under various pretexts. The most numerous class of these impostors have hitherto been those who send circulars and letters to patentees, announcing their extraordinary facilities for selling patents, insinuating that they have a customer for the invention, etc., and all they require to consummate the sale is a power of attorney and a small fee in advance.

Our exposure has very nearly effected an extermination of their operations in this line, but now they turn up in a new *rôle*.

Instead of sellers of patents, they now appear as solicitors. They look through the list of patents each week, and write to the patentees, stating that their claims do not appear to cover the whole of their inventions, and advise reissues in each case, and set forth special facilities for obtaining these reissues. We have before us a letter from one of these reissue solicitors which a gentleman has sent us, with the usual enquiry as to what we know of the writer. The solicitor's letter goes on to state that his only means of judging of the *strength* of the patentee's claims was from the published report. The writer had not even read or seen the gentleman's patent, but he has written advising him to apply for a reissue, stating that for $70, including all fees, payable when the order is given, he will do his best to get broader claims; but, he adds, the inventor must take all risk of failure. The writer is evidently a novice at this new dodge, and is either very stupid or has a streak of inherent honesty left; for he admits, as before stated, that he has never seen the patent, and he also frankly states in another portion of his letter that he does not know whether the patent can be strengthened, adding truthfully that the result would depend altogether on what had been done in this line before the patentee made his application. But he winds up by stating that he believes that better claims can be "engineered through." What is meant by "engineering through" is not explained; but the expression would seem to be a part of the means used for impressing the patentee as to the magnitude of the solicitor's influence in getting allowed such claims as he may ask for.

It is not a large number that will be deceived by such specious communications; but some will be made nervous, and wonder to themselves if they have a valid patent. We would advise such persons to consult their own agents for information, but under no circumstances to place their business and money in the hands of these letter-writing solicitors, with whom they have no acquaintance.

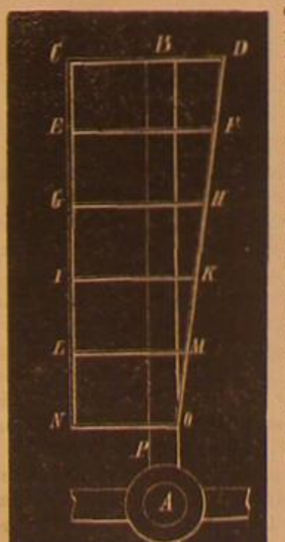
It is not often that unsolicited advice from a stranger is worth very much, and the motive that prompts it may usually be looked upon with suspicion. We do not assert that advice thus tendered is necessarily given from pernicious motives; but we believe that it is not wise to follow the advice of strangers whose opinion is volunteered; and that those who place their business in the hands of such persons will be likely to find the experiment an expensive one.

HOW TO BUILD A WINDMILL.

The principal data connected with windmills were discovered by experimenters early in the present century, the best proportions for sails being ascertained, and most of the important details of construction being worked out. We do not mean to say that manufacturers have made no improvements since that time, only that nothing of any great novelty has been produced. We must refer the reader to some standard treatise on mills and millwork, and to the circulars of manufacturers, for information in regard to the various details and patents, and will content ourselves with a description of a standard mode of construction and proportion. Windmills can be either horizontal or vertical, but the latter are almost exclusively employed. In the vertical windmill, the shaft is inclined to the horizon at an angle of from 5° to 15°, when the wheel is placed at the top of a tower; so that the wheel will clear the sides of the building, and allow space for the action of the wind. If the wheel is supported by a post, the shaft may be horizontal. The connection of the shaft with the pump or other mechanism may be made either with gearing, or by means of a crank and connecting rod. The shaft must be free to swing around in any direction, so that the wheel can always face the wind. It is moved, in the case of small windmills, by the use of a weather vane on the end of the shaft opposite to the wheel. With large windmills supported on towers, the top of the tower is generally arranged so that it can be rotated, and a small auxiliary wind wheel, connected by gearing, moves it into the proper position as the direction of the wind changes. The wheel of a windmill may be covered with cloth, or with slats of wood or metal, the cover in either case being technically known as the sail. It is frequently necessary to reef the sails, when the force of the wind increases; and windmills are often arranged so that this reefing is performed automatically. A common method of effecting this is to make the sail of a series of jointed slats, that present a close surface to wind of the ordinary velocity, and open, thereby decreasing the surface, as the velocity of the wind increases. A good number of the windmills in use, however, are covered with cloth, and reefed by hand as occasion requires. The best velocity for a windmill is such that its periphery moves about $2\frac{2}{3}$ times as fast as the wind. Thus, if the wind is moving at the rate of 20 feet a second, the tips of the sails should move at the rate of 52 feet a second, so that, if the wheel were 12 feet in diameter, it should make about 83 revolutions a minute. Of course, if the velocity of the wind varies greatly, it will be impossible to keep the speed constant, so that windmills are not ordinarily well suited for work requiring steady motion; although they answer very well for moving pumps, if an intermittent supply of power is not a serious obstacle. In some sections, however, the prevailing winds are quite steady, and in such cases windmills can be applied with advantage to grist mills and other useful work. The force and velocity of the wind can only be determined by experiment, but the results of previous experimenters may be useful to our readers, and we give below a summary of the most recent and reliable:

Velocity of wind.		Perpendicular force, in pounds per square foot.	Common expressions of the force of the wind.
In feet per second.	In miles per hour.		
10	6·82	0·83	Gentle pleasant wind.
20	13·64	0·91	Brisk gale.
30	20·56	2·04	Very brisk.
40	27·27	3·92	High wind.
50	34·09	6·25	Very high.
60	40·91	9·25	Very high.
70	47·73	12·75	A storm.
80	54·55	16·34	A storm.
90	61·36	20·74	A great storm.
100	68·18	25·28	A great storm.
110	75·02	30·89	A great storm.
120	81·84	36·75	A hurricane.
130	88·65	43·26	A hurricane.
140	95·47	50·82	A violent hurricane.
150	102·29	57·56	A violent hurricane.

In the accompanying figure is shown one of the four sails of a windmill, it having been found that four sails of proper proportion produce the best effect. The piece, P B, is called the whip of the sail; C D, E F, G H, etc., the bars of the sail. The bars are inclined to the plane of revolution, at different angles, the angle made by any part of the sail with this plane being called the weather of the sail. Making the distances A O, N L, L I, etc., each equal to $\frac{1}{12}$ of the diameter of the wheel, the best values for the angle of weather are as follows:



For C D—7°
For N O—18°
For L M—19°
For J K—18°
For G H—16°
For E F—$12\frac{1}{2}$°

The sail stretched over these bars will be a warped surface, somewhat resembling the blade of a screw propeller. The part B D O, called the leading sail, is triangular, and B D is $\frac{1}{15}$ of the diameter of the wheel, B C being $\frac{1}{10}$, and C N, $\frac{5}{12}$, of the diameter. The main body of the sail, B C N O, is commonly rectangular. A windmill of the best proportions, running under the most favorable circumstances, utilizes about $\frac{29}{100}$ of the energy of the wind that acts on an area equal to a circle having the same diameter as the wheel. It would not be advisable to count on realizing more than half this power in general practice; and on this assumption, we have the following empirical rule, for determining the diameter of a wheel, to give a certain amount of power, with an assumed velocity of the wind:

Divide the required horse power by the cube of the velocity of the wind in feet per second, take the square root of the quotient, and multiply it by the number 2024·8. The product will be the required diameter in feet. An example illustrative of the preceding principles is appended. A windmill is to be erected in a locality where the general velocity of the wind is about 20 feet per second. It is to be attached to a pump, the work required of it being to raise 1,000 gallons of water per hour through a hight of 20 feet: 1,000 United States gallons of water weigh about 8,320 pounds, and, taking into effect the resistance of the pump, the power required will be about $\frac{1}{6}$ of a horse power, or 0·167 horse power. Dividing this by 8,000, the cube of the velocity of the wind, extracting the square root, and multiplying by 2024·8, we obtain $9\frac{1}{4}$ feet as the required diameter of the wheel. Referring to the figure, we find that, in this case, C N is 3 feet $10\frac{1}{4}$ inches, B D, $7\frac{5}{8}$ inches, and B C, $11\frac{1}{32}$ inches. The velocity of the tips of the sails should be 52 feet per second, or the the wheel should make about 108 revolutions a minute. These explanations will probably be sufficient to enable any of our readers who desire it to construct a wheel, and we shall be glad to hear of the success of their efforts.

SCIENTIFIC AND PRACTICAL INFORMATION.

NITRO-GLYCERIN.

Professor Mowbray, in a recent lecture before the Stevens Institute of Technology, on the subject of explosives, stated that nitro-glycerin is now largely made from the fatty waste of stearin and soap factories. Its density, which is 1·6, water being 1, enables it to exercise its tremendous force; for in a given bulk, there is 60 per cent more gaseous matter than would be contained in it were it only of the density of water.

NEW IMITATION SILVER ORNAMENTS.

In several stores in Munich various objects of art have lately been displayed, which are remarkable for their brilliant silver hue. It appears that they are mere plaster models covered with a thin coat of mica powder, which perfectly replaces the ordinary metallic substances. The mica plates are first cleaned and bleached by fire, boiled in hydrochloric acid, and washed and dried. The material is then finely powdered, sifted, and mingled with collodion, which serves as a vehicle for applying the compound with a paint brush. The objects thus prepared can be washed in water, and are not liable to be injured by sulphuretted gases or dust. The collodion adheres perfectly to glass, porcelain, wood, metal, or *papier maché*. The mica can be easily tinted in different colors, thus adding to the beauty of the ornamentation.

NEW PROCESS OF GILDING ON GLASS.

Professor Schwarzenbach, of Berne, has recently devised the following new method of gilding on glass: Pure chloride of gold is dissolved in water. The solution is filtered and diluted until, in twenty quarts of water, but fifteen grains of gold is contained. It is then rendered alkaline by the addition of soda. In order to reduce the gold chloride, alcohol saturated with marsh gas and diluted with its own volume of water is used. The reaction which ensues results in the deposition of metallic gold and the neutralization of the hydrochloric acid by the soda.

In practice, to gild a plate of glass, the object is first cleaned and placed above a second plate slightly larger, a space of about one tenth of an inch separating the two. Into this space the alkaline solution is poured, the reducing agent being added immediately before use. After two or three hours repose the gilding is solidly fixed, when the plate may be removed and washed.

The Clark Revolving Shutter.

It is announced in the advertising columns of this issue that Messrs. Clark & Company, of London, Eng., patentees and manufacturers of self-coiling shutters made of steel, iron, or wood, have an agency at 218 West 26th street in this city. Messrs. Clark & Company's shutters are to be found in all parts of the world, and are known for their ease in working, security against burglars, and finished and ornamental appearance. The firm have other branches at Boston, Mass., Dublin, Edinburgh, Manchester, Liverpool, Melbourne (Australia), Paris, Berlin, and Vienna, their headquarters in London being a very large and complete manufacturing establishment. In New York city, the Clark shutters are to be seen on the new building for the Lenox library, 100 of them having been put into the structure; and the Delaware and Hudson Canal Company's new building and the *Tribune* offices are also being supplied with them. They are to be seen in many other of our principal cities, and there cannot be two opinions as to their convenience and efficacy in use and light and ornamental appearance.

NEW subscribers to the SCIENTIFIC AMERICAN will hereafter receive the papers from the time of our receiving the order, unless they specify some other date for commencing. All the back numbers from the commencement of the volume (January 1) may be had if requested at the time of sending the order, or on request, after receipt of first number.

PREPARING SOIL FOR POTTING.—We find the following under the heading of "House Plants" in a popular and excellent family magazine: "Ladies who find their efforts to raise house plants frustrated by worms may be able to win success by boiling the earth before setting the plants. Use little water, and allow it to simmer away after a few minutes of hard boil."

THE New York city authorities, who once peremptorily refused to allow the American Telegraph Company to lay its wires underground, are now seeking to compel all the companies to bury their wires.

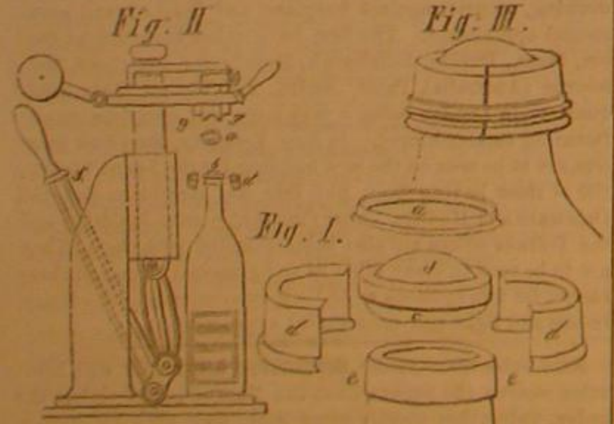
NEW MODE OF SLAUGHTERING CATTLE.

The present mode of killing cattle, by striking the animal with a hatchet or ax, is a cruel operation, as in most cases repeated blows are required to produce the death of the animal. Different methods have been recommended and tested for the purpose of executing the operation with the greatest possible dispatch, so that the animal be not unnecessarily exposed to protracted suffering.

The device represented in the illustration is a French invention, and promises to meet all requirements, being so simple in construction that it may be readily employed anywhere. The head of the animal is covered by a mask of suitable material, which closes the eyes entirely, and is at the center provided with a circular plate of sheet iron, riveted thereto, which guides in a central perforation a strong steel bolt or pin, in a direction vertical to the plate. The inner end of the sliding bolt faces the head of the animal, and is made hollow, while the outer projecting part is provided with a large knob. The masked or blindfolded animal has no idea of his fate, a single blow of the hammer or club on the knob being sufficient to drive the bolt into the brain, and produce the instant dropping of the animal as if struck by lightning. The theory is that the small quantity of air in the hollow end of the bolt is forced with the same into the brain, and, being heated by the compression, exerts a pressure on the brain, and causes thereby almost instantaneous death. The whole operation is completed within half a minute. Several cities of Germany and France have provided by special ordinances for the introduction of this device, which recommends itself to the attention of all humane persons.—*Science Record for* 1875.

IMPROVED BOTTLE STOPPER.

We publish herewith an illustration of a stopper now in use in Europe for corking bottles containing mineral waters, which was exhibited at the recent Vienna Exposition. It is the invention of M. J. de Becker, of Paris, France. It consists of a metallic ring, *a*, two semicircular parts, *d d*, and a cap piece, *b*, which last is provided at the underside with one or more cork disks, *c*. A disk of parchment paper is placed below the cap, *b*, over the mouth of the bottle, the cap and paper being then forced in by suitable pressure, for which purpose the small corking machine, shown in Fig. 2, can be employed. The forcing-in of the cork admits the application of the semicircular sleeve parts, which bind, by their upper flanges, on the cap piece, and by bottom collars on the rim at the mouth of the bottle. The ring, *a*, is then placed over the sleeve parts and carried down by the lever, *g*, of the corking machine, producing thereby a strong and perfectly airtight closure of the bottle. The machine enables three or four bottles per minute to be corked, the stopper being able to resist, according to trials made at the Conservatoire des Arts et Métiers, an interior pressure of thirty atmospheres (450 lbs. to the inch), which makes it applicable to the bottling of aerated waters.



The opening of the bottle is accomplished by simply placing the thumb on the cap piece, and pulling the binding ring, in an upward direction, with the forefingers. The sleeve parts and cap piece are then taken off, and the bottle is open. For sparkling wines and other carbonic acid beverages, the cork is driven in far enough to produce a report on opening.

The advantages of this stopper are that it requires no corkscrew, and allows the utilization of smaller pieces of cork, as only one tenth part of a common cork is necessary for the cap piece. The bottle is closed in about one third of the time required for corking, wiring, and tin foiling, as in the present style; and the device gives a neat and ornamental appearance without adding to the expense. It may be used over again by applying it to the bottle by hand, the parchment paper preventing the contents from taking up any taste of metal or cork, which is of importance in the bottling of liquid beverages.

EXTERMINATION OF THE PHYLLOXERA.

The best results thus far gained, in the repeated efforts made in France to rid the vineyards of the phylloxera, have been obtained by the use of alkaline sulphurets, and more especially the sulpho-carbonate of potassium. The latter substance decomposes slowly, giving off hydro-sulphuric acid and sulphide of carbon.

Fig. 2.

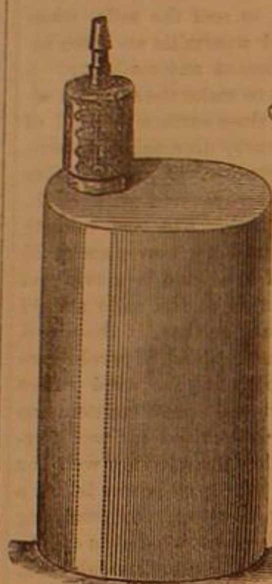
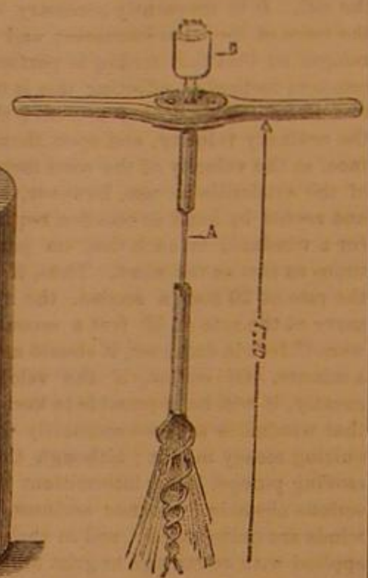


Fig. 1.



It has been proved that the earth, in the vicinity of the infected roots, must be thoroughly poisoned. Solid poisons, however, are of no avail, and liquids are apparently shed from the covering of the insect, which seems to be waterproof. The action of water and carbonic acid in the soil is sufficient to disengage gases, from the materials named above, which exterminate insects, while the potash acts as an excellent fertilizer for the injured vine.

Fig. 3.

Root of vine, covered with phylloxera, in an advanced stage.

Fig. 4.

Swollen roots of vine, caused by phylloxera.

Fig. 5.

Swellings of root fibers of vine—commencement of the disease.

The instruments used for introducing liquids, from which poisonous gas is to be developed, are represented in Figs. 1 and 2. Fig. 1 shows an auger, having a hollow shank and perforated just above the cutting portion. This is provided with handles, above which is placed a small cylindrical vessel, shown separately, enlarged, which serves as a measure into which the liquid is poured in determined quantities. These last are measured by means of the vessel shown in Fig. 2. The insecticide is placed in the large receptacle, and thence, by tilting, the latter is allowed to fill the smaller can above. The orifice between the two is then closed, and the smaller can removed, and its contents turned into the hollow portion of the auger, as represented at B, dotted lines.

The effect of the ravages of the phylloxera upon the roots of the vine is represented in Figs. 3, 4, and 5. At the beginning of the attack, the radicles swell, as shown in Fig. 5, and also enlarged in Fig. 4. When the disease is far advanced, the roots appear as shown in Fig. 3.

Phylloxera Prize.

It will be remembered that several months since we published the text of the law passed by the French Assembly, decreeing a prize of $60,000 to any person who should invent a means of effectually exterminating the phylloxera. To this large sum, various vine growers, corporations, and municipalities throughout France added other amounts, forming a total, the aggregate of which, though not definitely known to us, might certainly be placed as a very handsome fortune for the lucky discoverer. The report of the committee, to whom the descriptions of the various plans have been sent for adjudication, has recently appeared; and although some six hundred schemes have been considered, no one is awarded the prize. The offer, however, remains open, and for this reason the advice of the committee is valuable to intending future competitors. The report says that "the Commission is authorized to conclude that the communications which have been submitted to it have in no instance been accompanied with the record of sufficient experiment and application to the soil over a long enough period," and therefore the prize cannot be decreed. The document then calls particular attention to the following, from the observations made by M. Dumas, President of the Commission, when the offer of the award was first announced:

"Processes imagined but not tried are no longer of interest, since it would be very difficult to indicate, at the present time, any method not already suggested. The fact of tobacco, sulphur, ammoniacal gas water, coal tar, petroleum, sea water, etc., being urged as sovereign remedies, twenty times or more, adds nothing to the confidence in such means. Experience alone can teach us their value, and unhappily the occasion for inventors to try their processes is anything but wanting. In order to compete with a chance of success, it is necessary that the experiments be repeated, prolonged, and authentic, and they must prove, beyond doubt, that the means tends either to cause the phylloxera to disappear from the vines by an economical process, or to preserve healthy vines against the ravages of the pest, or to check its inroads while insuring the life and fructifying the attacked plant.

"The prize cannot be awarded until after an absolute demonstration, sufficiently prolonged, of the reality of the discovery."

About Spiders.

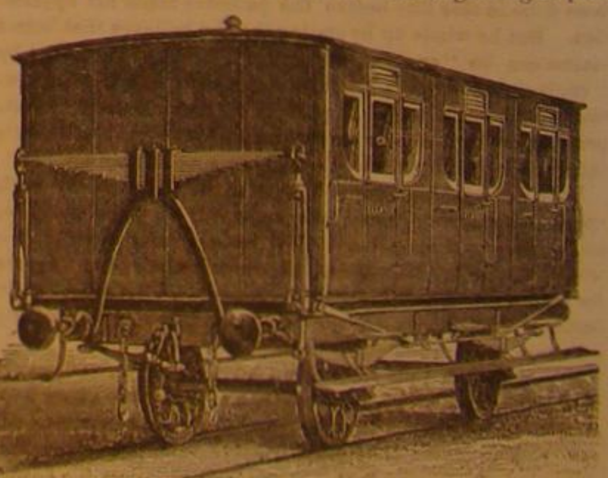
Professor E. S. Morse says: Only the female spiders spin webs. They own all the real estate, and the males have to live a vagabond life under stones and in other obscure hiding places. If they come about the house so often as to bore the ruling sex, they are mercilessly killed and eaten. The spiders skin is unyielding as the shells of lobsters and crabs, and is shed from time to time in the same way, to accommodate the animal's growth. If you poke over the rubbish in a female spider's back yard, among her cast-off corsets you will find the jackets of the males who have paid for their sociality with their lives—trophies of her barbarism as truly as scalps show the savage nature of the red man.

Water Ditches.

The ditches of California are the great arteries which bring life to the mines. Their even and constant flow secures a healthy and vigorous state of industry, while the dearth of water in the mines throws a pall over the business world of California, money becomes tight, and hard times are the consequence. The engineering skill displayed in the construction of ditches in this State is of the highest character, accomplishing the most daring feats, hanging flumes on steep, rocky bluffs, and crossing gorges of a thousand feet in depth, and it must seem almost a presumption to inquire whether any improvements can be suggested.

GIFFARD'S RAILWAY CAR.

M. Henri Giffard, inventor of the celebrated Giffard injector, has succeeded in constructing a railway car, the body of which is so supported on springs that all oscillation and jarring is entirely obviated, and the passengers within are enabled to read, write, and otherwise employ themselves with as much facility as if not in motion. Our engraving is prepared from a photograph of one of these vehicles, now in use on the railway between Paris and Lille, France. The platform is supported on heavy springs of its own, and carries at each extremity standards, which, in turn, are surmounted by ponderous leaf springs, to the ends of which the body of the car is suspended. It was found, on a first trial, that the peculiar horizontal oscillation which is so very fatiguing to the traveler was entirely suppressed, and that a light vertical elastic movement which remained was easily obviated by adjusting the suspending rods.



The weight of the car is somewhat more than that of those ordinarily employed on European railroads, and its cost is higher.—*Science Record for* 1875.

A NOVEL DESIGN FOR A BRITISH CHANNEL TUNNEL.

We illustrated, on page 306 of our volume XXXI., a new method of building submarine structures, the invention of Jerome Wenmaekers, a Belgian engineer; and we refer our readers to the description there given, which fully shows the adaptability of the system to works of any extent, and however difficult of execution. The inventor of the plan now publishes a detailed account of a tunnel under the British Channel, to be constructed on his plan, which shows many new features which are worthy of consideration.

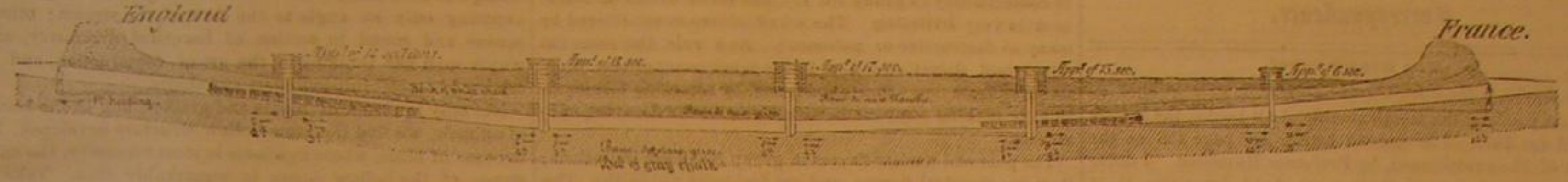


Fig. 1.—WENMAEKERS' BRITISH CHANNEL TUNNEL—LONGITUDINAL SECTION.

He proposes to sink five caissons (as shown in our longitudinal section, Fig. 1), the deepest of which, in the center, will require seventeen sections, the depth of water being about 40 meters (about 130 feet). The erection of these structures, if practicable at this depth, would enable the tunneling to be done in twelve headings at once, and would give an easy means of hauling away and disposing of the *débris*, an important consideration in a tunnel of this length. Moreover, a very large means of ventilating the tunnel would be afforded, and thus the great difficulty anticipated in working such a submarine railway would be obviated. M. Wenmaeker's idea is to insure solidity to the tunnel by perforating the white chalk which underlies the sand of the ocean bed, and to construct the work in the hard gray chalk still lower down. The magnitude of the proposed works may be seen by inspection of the plan, Fig. 3, which shows the diameter of the caisson to be 162·5 feet. This dimension would allow the work of hauling the loose earth to the surface of the water to be done on a very large scale and with great rapidity.

M. Wenmaekers prefers to construct the tunnel at the depth indicated in the engravings, on account of the increased solidity of the substratum of gray chalk, although he claims that his system is equally useful for building the work at a depth of 6 or 8 feet only below the bed of the sea. A tunnel made in the durable stratum, and lined, as he proposes, with masonry of *béton aggloméré*, or other well tried artificial stone, would doubtless be a work of great strength and permanent value.

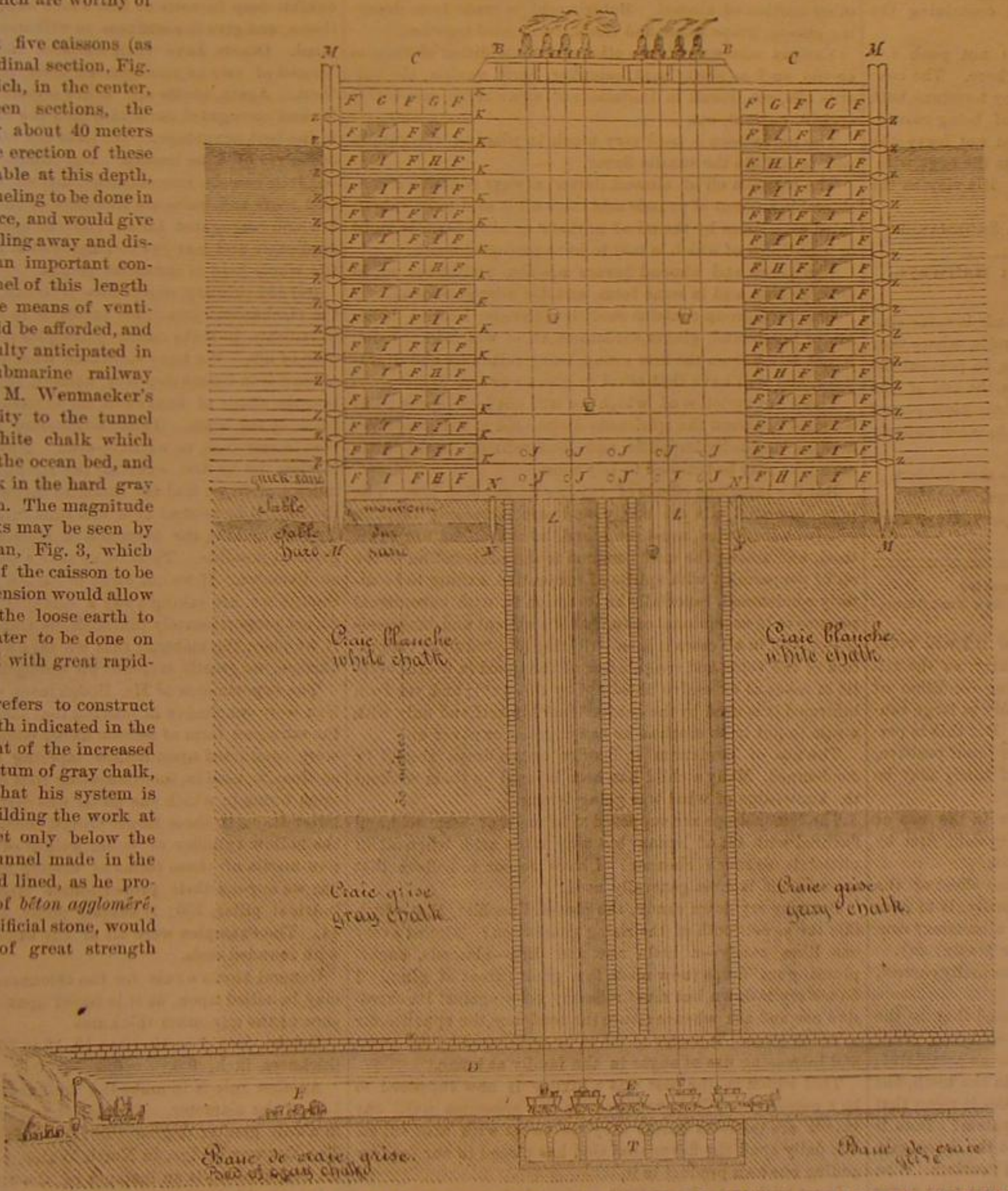


Fig. 2.—SECTION OF THE PROPOSED CAISSONS FOR THE BRITISH CHANNEL TUNNEL.

The distance between each two caissons would be about three miles and a half, and between those nearest the shores and the entrances to the tunnel, respectively, rather less. Tunnels of such lengths are trifling works compared to those of Mont Cenis and St. Gothard. It is proposed to take a route between the nearest points, namely, St. Margaret's, about three miles east of Dover, and a point about the same distance west of Calais, half way between that city and Cape Grisnez.

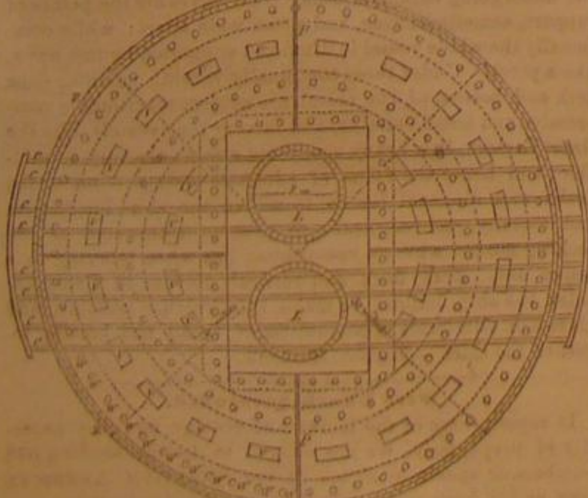


Fig. 3.—PLAN OF THE CAISSON.

M. Wenmaekers certainly deserves credit for the boldness of his scheme. His tunnel is to be for a double track railway, being 26 feet wide and 18 feet high; and he has carried out his design into detail, proposing to use perforating machines (Fig. 4) capable of excavating a bore 9 feet 9 inches in diameter. The use of a compressed air chamber, of the full diameter of the tunnel, is shown in Fig. 5. He is, moreover, sanguine as to the commercial success of the work, estimating its cost at $24,000,000, including the necessary junction railways on both shores. He anticipates a gross revenue of $6,000,000, and believes that the working expenses can be kept down to $1,000,000, leaving a profit of nearly 21 per cent on the expended capital.

There is reason to believe that the work of constructing a channel tunnel will be seriously taken in hand. The corporation most likely to be benefited by its construction is the Northern Railroad of France, a line which is largely owned by the Paris branch of the Rothschild family. A joint commission to investigate the whole subject has been appointed by the English and French governments and the capitalists interested, and M. Wenmaekers' plans have already been submitted for their consideration.

Fluorescence of Bodies in Castor Oil.

Charles Horner states that certain natural organic coloring matters, which exhibited no fluorescence when in aqueous or alcoholic solution, were observed to fluoresce brightly when dissolved in castor oil; while other substances, possessing naturally a faint fluorescence, were found to have this property considerably augmented.

In this solvent, cudbear exhibited a brilliant orange-colored light, and extracts of logwood and camwood a powerful apple-green fluorescence. The well known fluorescent light of turmeric solutions was increased in brilliancy at least threefold, and is described as a vivid emerald green fluorescence, comparable only with the appearance presented by the best uranium glass under similar circumstances. It is suggested, therefore, that, in studying the phenomena of fluorescence, advantage should be taken, when possible, of the solvent property of castor oil.

Compounding Marine Steam Engines.

A somewhat novel experiment in the way of applying the compound principle to existing oscillating paddle engines has been carried out in the case of the Royal Mail Company's steamship Eider, and the attempt, which it is believed has not previously been made, seems to have proved a great success. The Eider is a paddle steamer of 1,564 tuns, builder's measurement, and 310 horse power, built specially for the intercolonial service of the Royal Mail Company in the West Indies, and has been engaged in that capacity for several years. She was recently sent home to Southampton to be refitted and have her engines compounded; and this work having been completed, she will shortly sail again for her old station. The Eider's engines have oscillating cylinders, which were originally 66½ inches in diameter and 6 feet 6 inches stroke, working at 30 lbs. pressure, and consuming about 35 tuns of coal per day. In order to adapt the compound principle to these engines, and do so with as little alteration and expense as possible, Mr. J. Bowers (the company's superintending engineer at Southampton) decided to retain the whole of the existing engines, with the exception of the cylinders, pistons, and slide valves. As the new cylinders had to oscillate between the old columns supporting the entablature, it was found impossible to make the low pressure cylinder of a larger diameter than 72 inches, and the high pressure cylinder was therefore made 42 inches diameter, both, of course, having the old stroke of 6 feet 6 inches. The contract for the new compound cylinders, new high pressure boilers, steam pipes, etc., was given to Messrs. Day, Summers & Co., of the Northern Ironworks, at Southampton, who have carried out their engagement to the entire satisfaction of the company's superintendents. The Eider was taken to Stokes Bay a day or two since, and the results of two runs on the measured mile were as follows: First run, 4 minutes 30 seconds, equal to 13·333 knots per hour; second run, 4 minutes 46 seconds, equal to 12·587 knots, giving a mean speed of 12·96 knots per hour; revolutions of engines, 20½ per minute; steam, 65 lbs.; vacuum, 27½ inches; indicated horse power, 1,251. The space saved in the Eider by the diminished size of the boilers and coal bunkers enables her to carry between 200 and 300 tuns more cargo than heretofore, and the consumption of coal will be reduced from 35 to 22 tuns per day. The improvement in the general arrangements of the ship, in consequence of the decreased space required for the machinery, have added much to the comfort, and improved the appearance, of the Eider

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Female Voters.

The Supreme Court of the United States has lately decided, in the case of Miner *vs.* Hoppersatt, that women, although they are citizens, are not therefore voters. Women are citizens of the United States, and of the State where they reside. The court unanimously held that the Constitution of the United States does not confer the right of suffrage upon any one. The right of suffrage is not made, in terms, one of the privileges of a citizen. The elective officers of the United States are chosen directly or indirectly by the voters of the

Fig. 4.—PERFORATING MACHINE.

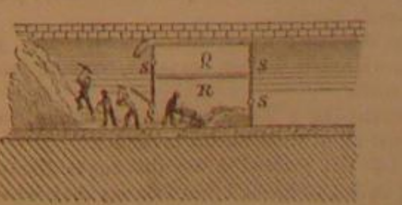


Fig. 5.—CONSTRUCTION UNDER COMPRESSED AIR.

States. The United States has no voters. No one can vote for Federal officers without being competent to vote for State officers. It follows from this decision that women cannot become voters until they are authorized by the States in which they live.

Correspondence.

The Grasshopper.

To the Editor of the Scientific American:

I have received the most valuable of all books, the *Science Record*, for 1875. I notice an article on page 456, on the habits of the grasshopper, by Professor Humiston. I differ from his description of their method of depositing their eggs. He says: "The tail of the female locust consists of a hard, bony, cone-shaped substance, capable of being thrust into ground from ¼ to 1 inch in depth. Just above this, on the body of the insect and attached to it, is the egg cell; the grasshopper is able to push its conical tail down into the ground and leave it there, with the cell containing the eggs."

I wish to state that the grasshopper does not push her tail into the ground, nor does she leave it there. The cone part, as he describes it, is a hard, forked, bony terminus, both above and below the anus. It is capable of being moved, and the female uses it as a drill. She does not leave the tail (as he calls it) with the eggs; but deposits the eggs, with draws the tail, and goes about her business. His view as the hatching in spring time are correct.

Leroy, Kan. J. G. SHOEMAKER.

An Improvement Wanted in Street Railways.

To the Editor of the Scientific American:

One of the greatest needs of street railroads is some simple and economical invention to keep the rails, where they meet, in a level condition; or in other words, to prevent the end of the forward rail from sinking below the end of the near rail. The device at present used is an iron plate placed under the junction of the two rails; but this does not entirely prevent the evil.

I invite the attention of inventive minds to this subject.

SAM. L. PHILLIPS, President.

Office of the Third Avenue Railroad Company, New York city.

Is Candy Injurious to the Teeth?

[From a paper by Dr. John T. Copman, read before the New York Odontological Society.]

Most certainly it is. For outward proof of it I will refer you to any candy-making village in our country, as the village of Neponset, Mass., where the shocking condition of the teeth, of the youth brought up in proximity to large candy manufactories, shows plainly the cause. But this is perhaps negative proof, and we should seek for proof positive, because other causes than those of the use of candy may be the reason, in this instance, of the disease.

But by far the most injurious consequence in the use of candy is in its indirect action through the system, first by its constituents, second by its disturbing action.

By long research I have discovered that the effect of the use of cane sugar, in small or in large quantity, is to produce a more or less constipated state of the alimentary canal, more particularly the refined sugar of the present day.

If, then, the balance of intestinal action is normally correct, the presence of sugar always disturbs it.

There is a point that may be stated here, and that is the action of sugar on an exposed nerve. We eat bread, meat, vegetables, and our "exposed nerve" makes no complaint; but the moment a little sugar is dissolved in the tooth, the tissue sets up a cry. What does it mean? Does it mean that it dislikes it—that it is discordant to the system? Does it mean that it is injurious to the fleshy or to the bony substances, or both? I have as yet not solved the problem. Who will do it? By an analogy we must conclude that cane sugar is injurious, and yet there may be other reasons and other causes for the pain produced in the tooth.

Besides the sugar contained in the candies of the present day and the coloring matters (mostly made of tincture of cochineal, which is harmless) are occasionally other material, such as pigments of green and yellow, which are poisonous.

We have a large number of essential oils, or medicaments, every one of which has a peculiar medical effect on the system, toning it up or down, binding up its parieties or loosening them, and to these medical effects much of the injury of the confectionery of the present time is due.

A small catalogue of these essential oils and flavors may be interesting:

Group No. 1.—Peppermint, checkerberry, sassafras, lemon, clove, anise, cassia or cinnamon, vanilla, rose, caraway, coriander, cayenne.

Group No. 2.—Jargonelle pear, strawberry, pineapple, banana, peach, almond.

Group No. 3.—Boneset, licorice, horehound, ginger, cardamom, chocolate, butter, cocoanut, cordial, brandy, gum arabic, acids.

In purchasing a pound of mixed candies, you may perchance get all of these flavors in one lot.

Now I do not pretend to say that one is likely to be poisoned by such a compound, but I do say that, when a mother gives a three year old child an ounce of peppermint drops to eat, she should know the effect of them when eaten—that she ought to know she is giving the child a medicament as well as an ounce of sugar; she ought to think and be taught that the effect of the oil of peppermint is definite, and that an ounce of peppermint drops will, if they are strong—and of course they are supposed to be good only as they are strong—contract the walls of the stomach and the small intestines, producing in a young child sometimes a spasm and inflammation, shown by a thirst for water, and a general disturbance of healthy action.

Such is, I believe, the general action of the essential oils of confectionery in group No. 1. The oil of cassia or cinnamon is very irritating. The oil of cloves is considered by many as destructive or poisonous. As a rule, the essential oils retard digestive action in the same manner that they preserve from decay meats and fruits, by retarding fermentation, or making compounds with digestible or decaying substances.

The pear and similar flavors in group No. 2 are imitations; they are chemical flavors, and are decidedly unhealthy. The composition of them I have found to be as follows:

The jargonelle pear flavor is made of the acetate of amylic ether, which is prepared by distilling a mixture of fusel oil, acetate of potash, and concentrated sulphuric acid.

The pineapple is made from butyric ether dissolved in another portion of alcohol. Butyric acid is made from decaying cheese, grape sugar and chalk, fermented together.

Various mixtures of the ethers, with addition of various agents, such as acetic acid, camphor, orris, vanilla, the volatile oils, etc., result in imitations of strawberry, raspberry, apricot, currant, etc.

The tonka bean is used very much in place of the vanilla pod, to imitate the vanilla flavor.

The common oil of almond (bitter) always contains a considerable amount of prussic acid; this oil is said to be substituted sometimes by the oil of mirbane or nitro-benzole, eight or nine drops of which is said to have produced death.

The peach and almond flavors are also imitations, made from prussic acid in some form, and are very poisonous.

The third group contains medicinal flavors: licorice, boneset, or horehound, ginger, cardamom, all of which have a different action from the first group, being relaxants and diuretives, and will have that effect in greater or less degree.

There are varieties of which we will not here speak; but we must condemn the spirituous drops sold at the street corners, as decidedly impolitic and demoralizing to the little ones who may be tempted to buy them.

But the injurious effects of candies do not stop here. The pure essential oils are costly and are increasing in price yearly; substitutes must be found, adulterations are practised, and among the most common is the adulteration of the oil of peppermint with spirits of turpentine, a thing to be utterly condemned, especially as its action is, with exceptional persons or in exceptional cases, that of a violent and dangerous poison, and in all cases it is an irritating oil, producing congestion of the veins and coagulation of the blood (a useful styptic in cases of excessive bleeding, by the way); and yet I am informed it is used by the confectioner himself, and only with a rule to put in as much as he can disguise or cover up.

The use of laudanum in licorice cough drops should be condemned. Many a child has been injured by them without the knowledge of what was going wrong.

The lemon drops are supposed to be made of citric acid, and flavored with oil of lemon; but why citric acid, when oil of vitriol is so much cheaper? I have reason to believe that tartaric acid is most generally used.

But why cry down candy, the pleasant pacifier, that which fills the sweet tooth of the rising generation? Almost every one likes candy—a little now and then—almonds, sugar-plums, gum drops (now made to a great extent of glue). I do not cry it down, but must raise my voice against its excessive use, and ask whence comes the tendency, the appetite, for so much sweet? It seems to me to be occasioned by the great and increasing use of sugar in the family at home.

That which in the past was a luxury is now supposed to be a necessity. We have toned up our appetites until our viands are tasteless unless they are sweet with cane sugar. We daily spoil the flavor that God has placed in our food, by adding our own product to it.

If we wish to eradicate from our youth the very strong tendency toward high seasoning or high sweetening, we must begin at home, and tone down instead of toning up, and teach ourselves and our children to love the inherent flavors of the grains, the fruits, and vegetables; and as we and our children cultivate a love for them, so will their tastes grow, until this excessive sweetness will bear disgust, and their appetites will turn away from what cloys and sickens, and disturbs the normal condition of the human body.

I should refer to an article used to adulterate sugar, called *terra alba*—a white earthy substance—quite harmless, being sulphate of gypsum (anhydrous calcic sulphate)—profitable to increase the weight without being suspected by the buyer. It is said to be used in large quantities. It can be easily found by dissolving the candy in water; if any sediment remains, it is likely to be *terra alba*, or perhaps chalk, which is also used.

Hollow Structures.

Nature teaches us one of the grandest lessons in her economization of structures and materials. The stems of water plants are hollow and of various sections, as cylindrical, angular, or furrowed. Many of them, as all know from the revealings of the microscope, are of cellular or tubular construction. Examining the stem of a young dicotyledon cut across, we find the inner portion full of radiating cells of fibro-vascular bundles, of wedge-shaped section, the pith occupying the center. If we minutely examine these vascular bundles we shall find a layer of cells traversing the bundles; on the inside of this, toward the center of stem, the cells form the proper wood of the fibro-vascular bundle, and on the outer side, toward the circumference, the cells are closer and more compact. The layer between these portions is called the *cambium* layer, and the stem of the oak and other *exogens* is strengthened by continual increase of woody fiber outside this layer, or the *liber* of the stem. We might go on illustrating, from a variety of plants, the remarkable adaptation of stems to their habitats and conditions of growing; some triangular in section, as in various water grasses, sedges, etc., exposing only an angle to the flow of the stream; others square and round in section, of beautiful symmetry, and which man has imitated in the art of construction, and in casting his metal into cylinders and shafts.

Not only in stems of plants and grasses, but in the bones of animals, we find the same hollow structure developed. In the case of birds, where lightness is most necessary, the substance of the hollow bones is remarkably thin. Take a feather. What a wonderful union of strength and lightness is there in it! We find this hollowness particularly evident in that end of the feather at which the muscles act, or at the short end of the lever.

Leaves show a similar adaptation of matter. Some leaves exhibit deep furrows or ribs which support the membrane or tissue, and give it a stiffness to withstand the pressure of the wind. Others have their surfaces indented or voluted, or formed of two or more convex lobes, thus giving rigidity to them. Again, shells and other organic forms possess cellular and corrugated parts in which the material is distributed to the best advantage. We have not been slow lately to avail ourselves of these lessons. Our tubular and cellular bridges, our iron vessels, our columns, and shafts of machinery, our iron roofs and walls, are instances of the employment of hollow and corrugated forms, and the extent to which they are applicable and may yet be employed is almost co-equal with the whole field of inventive genius.

But our primary object here is to call attention to some of the mechanical principles involved in these structures, and to indicate how the same principles may be applied to the uses of art. We have shown on what elements the strength of cast iron beams depends, namely, in putting all the metal into the shape of flanges on the extreme side of the neutral plane of the beam. Thus the inverted T shape answers this best in cast iron, as we have seen. Now, keeping this form in view, let us first examine the strength of a hollow cylinder. Here we find the material thrown at a distance from the central or neutral axis, and thus fulfilling the great principle of making the moments of resistance of the fibers the greatest possible. Thus let us take a solid cylinder of a given diameter. If we cut away or hollow it we shall find, although we are taking away a quantity of the material, we do not proportionately diminish its transverse strength; but if we place the material that we take out round its external surface, we greatly increase the strength.

The experiments of Mr. Hodgkinson upon columns of cast iron were conclusive in proving that the hollow cylinder was the strongest form of section under compressive force. These were conducted upon hollow tapering columns, upon cross sections, as used in the connecting rods of steam engines, and upon forms in which the metal was cast in the shape of the letter H. All these forms proved considerably weaker than the hollow cylinder of equal weight of metal. As the relative merits of these forms of casting metal are of constant use we append their proportionate strengths: Hollow cylindrical pillar, 100; H shaped pillar, 75; + shaped pillar, 44. The examples were all of the same weight and length, with rounded ends.

General Morin's rule for the thickness of cast iron pillars may be relied upon, as it is based upon the founder's experience of the minimum thickness.

Height, feet	7 to 10	10 to 18	18 to 20	20 to 27
minimum thickness, inch	0·5	0·6	0·8	1·0

Another rule is to make the thickness in no case less than 1-12 of the diameter. Cellular or tubular girders exemplify to a still greater degree the value of hollow construction. The Conway bridge, in North Wales, designed by Mr. Robert Stephenson, is an instance of the application. The two tubes of this bridge are each 25 feet high in center, and 14 feet wide externally, 420 feet long, and weigh 1,300 tons. The material is chiefly disposed in the top and bottom parts or flanges, and these are also composed of small tubes or cells to give additional stiffness. The sides are of plate iron riveted together, and each tube is really an immense beam, of slight diminution toward the ends. An iron ship is really a tubular or cellular beam, approaching a rectangle in section, and undergoing various strains. The waves are the points of support, sometimes near, and often wide apart; while occasionally the whole vessel is lifted and supported by one wave, like a pivot. Under these continually varying conditions, the deck and bottom of the vessel are subject to alternate compressive and tensile strains, and in very long vessels, like the Great Eastern, in a heavy sea, these strains are very formidable; and hence the value of adequate stringers under the decks, and diagonal braces, to stiffen the ship lengthwise and laterally, and bulkheads to prevent transverse or the rocking motion which a vessel often has when laboring in a heavy sea. Every deck and vertical division in a ship enables the ship builder to make his structure cellular, and gives him admirable opportunities of tieing and bracing together the sides.—*English Mechanic.*

Free Lunch Suspended.

In consequence of the increase of postage and the necessity of prepayment, we are obliged to decline sending odd numbers or specimen copies of the SCIENTIFIC AMERICAN free, as has been our custom for a quarter of a century.

Hereafter persons desiring specimens or any special numbers of the paper will please to remit, for each copy ordered, ten cents.

PRACTICAL MECHANISM.

NUMBER XXI.

BY JOSHUA ROSE.

HAND TURNING.

Turning work in the lathe with a tool held or guided by hand, or, as it is commonly termed, hand turning, is at once one of the most delicate and instructive branches of the machinist's art, imparting a knowledge of the nature and quantity of the resistance of metals to being cut, of the qualifications of various forms of cutting tools, and of the changes made in those qualifications consequent upon the relative position or angle of the cutting edge of the tool to the work; and this knowledge is to be obtained in no other way than by the practice of hand turning.

It is the work of an instant only to vary the relative hight and angle of a hand tool to the work, converting it from a roughing to a finishing tool or even to a scraper, which operations are difficult and sometimes impracticable, if not impossible, of accomplishment with a tool held in a slide rest.

The experience gained from the use of slide rest tools is imparted mainly through the medium of the eyesight, whereas in the case of a hand tool the sense of feeling becomes an active agent in imparting, at one and the same time, a knowledge of the nature of the work and the tool: so much so, indeed, that an excess in any of the requisite qualifications of a hand tool may be readily perceived from the sense of feeling, irrespective of any assistance from the eye; and in this fact lies the chief value of the experience gained by learning to turn by hand.

For instance, there is no method known to practice whereby to ascertain how much power it requires to force a slide rest tool into its cut, or to prevent its ripping in; so that a wide variation, in the tendency of such a tool to perform its allotted duty easily and without an unnecessary expenditure of power, may exist without becoming manifest to any save the experienced workman; whereas the amount of power required to keep the cutting edge of a hard tool to its work, to hold it steadily, or to prevent it from ripping, is communicated instantly to the understanding through the medium of the sense of feeling. Nor is this all, for even the sense of smell becomes a valuable assistant to the hand turner. Several metals, especially wrought iron, steel, and brass, emit (when cut at a high speed) a peculiar smell, which becomes stronger with the increase in the speed at which they are cut and the comparative dullness of the edge of the tool employed to cut them, more especially when the cutting edge of the tool is supplied with oil during the operation of cutting. The reason that this sense of smell becomes more appreciable during the operation of hand than during that of slide rest turning is because the face of the operator is nearer to the work, and because hand turning is performed at a higher rate of cutting speed.

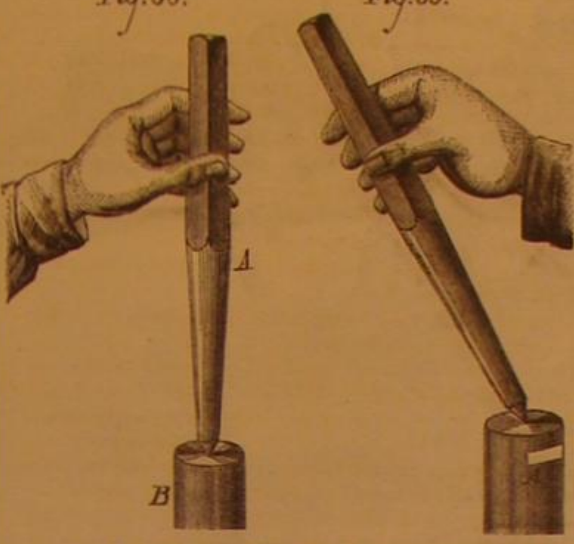
If a tool for use in a slide rest is too keen for its allotted duty, the only result under ordinary circumstances is that it will jar or chatter (that is, tremble, and cut numerous indentations in the work), or that it will lose its cutting edge unnecessarily quickly. But a hand tool possessing this defect will in many instances rip into the work, because the power, required to prevent the strain, placed by the cut upon the tool, from forcing the tool deeper into its cut than is intended, is too great to be sustained by the hand; and the tool, getting beyond the manipulator's control, rips into the work, cutting a gap or groove in it, and perhaps forcing it from between the centers of the lathe. If, on the other hand, a tool is of such a form that it requires a pressure to keep it to its duty, the amount of such pressure, when the tool is held at any relative hight and angle to the horizontal center line of the work, and the variation in that amount, due to the slightest alteration of the shape of the tool, are readily appreciated by sensitiveness of the hand; when they would be scarcely if at all perceived were the same tool, under like conditions, used in a slide rest.

These considerations, together with the great advantage in the relative rapidity with which the form and applied position of a hand tool may be varied, render hand turning far more instructive to a beginner than any other branch of the machinist's art. And since the subject is of equal importance to apprentices, to amateur turners, and to those who have learned their trade without having the opportunity to study this important branch of it, the subject will be treated in detail so as to be available to the merest tyro.

The first lesson will be to learn to turn a piece of plain iron, and the tools necessary for this operation are a bench vise, a file, a center punch, a hammer, a center drill, a graver, and of course a lathe, with the requisite hand rest and driver or dog. Having fastened the piece of iron to be turned in the vise, with the top face not more than an eighth of an inch higher than the jaws of the vise, so as to prevent the iron from jarring while it is being filed, file the end as nearly level and square with the body of the iron as possible. The next operation will be to centerpunch it by holding the pointed end of the centerpunch as near the center of the end face of the iron as the eye will direct; and while pressing the point of the punch sufficiently firm against the work to prevent the punch from slipping, strike the other end of the punch with a hammer, which will make a conical indentation in the end of the work, to receive the lathe center. This operation should be performed upon each end of the work so that it may be turned between the centers of the lathe. It is a common practice to center one end of the work only, and to fasten the other end in a chuck, thus making the chuck serve as a driver and obviating the necessity of centerpunching more than one end of the work. This method will, it is true, save a little time, but is objectionable for the following reasons: Chucks will run quite true while they are new, and indeed for some little time, but they do in time get out of true; and as a result, if the work requires to be reversed in the lathe so as to be turned from end to end, the part of the work turned during the second chucking will be eccentric to that part turned during the first chucking. If one end only of the work requires to be turned, and needs be true only of itself and irrespective of the part held in the chuck, the latter may be employed; this subject will, however, be treated hereafter.

The most desirable shape for the centerpunch, and the manner of holding it, are shown in Fig. 58, A being the

Fig. 58. Fig. 59.



punch, and B, the work. The work being provisionally centered, we must make those centers true, so that the work will true up without requiring to have too much metal cut off in the operation; to this end, we place the work between the centers of the lathe, and adjust the back center so that the work will revolve easily if the hand is drawn lightly across it, and yet it must not be so loose as to be able to shake at all. We then adjust the hand rest so that it will well clear the work; and using it to steady the right hand, we hold a piece of chalk near to the work, revolving the latter by brushing the fingers of the left hand quickly and lightly across it; by then slowly advancing the chalk towards the work until the two touch, the chalk will mark the eccentric side of the work if it does not run true, and a ring around the same if it is true. If it be so much out of true as to require alteration, it must be placed in the vise again and the center drawn by striking the centerpunch while it is at an inclination, the point being in the direction of the chalk mark, as shown in Fig. 59, A being the chalk mark, and therefore the direction in which the center requires to go.

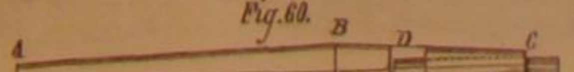
Having removed the center according to the judgment, the chalk mark should be effaced, and the work placed again in the lathe and tested as before, the whole operation being repeated until the work runs sufficiently true.

Our next performance must be to drill a small hole up the center of the work, using the centerpunch mark as the center wherein to insert the drill point. The object of this is to ease away the bottom of the center in the work, so that it will not press against and wear away the extreme point of the lathe centers, and to prevent the centers in the work from moving their position in consequence of the wear due to the friction caused by their revolving between the lathe centers, as they would do in the absence of the center drilling. For this purpose the universal chuck and a twist drill about a sixteenth of an inch in diameter are the most desirable tools, they being purchasable from any store keeping machinists' supplies. The chuck must be screwed on to the running spindle of the lathe; and the drill being fastened in the chuck, the work is placed so that the point of the drill is in one of the centers and the center of the back head of the lathe is in the other center. Then, by starting the lathe and holding the work still by the left hand while the right hand is gently screwing out the back lathe center, the work will be forced over the revolving drill, thus drilling the hole referred to. While the drilling is being performed, the drill should be freely supplied with oil to assist it in cutting and to prevent it from wearing away and becoming dull. It is very important, during this operation of center drilling, to relax, every few seconds, the hold upon the work sufficiently to permit it to make about a third of a revolution, which may be done while the other hand is supplying oil to the drill. The object and effect of this is to cause the center drilling to be true, which otherwise it would not be, especially if the work is comparatively heavy, or heavier on one side than on another.

In the absence of the possession of a drill chuck and twist drills, they may easily be made, the best forms being as follows:

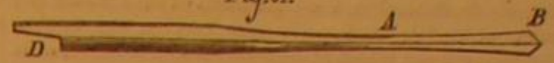
Fig. 60 represents the drill chuck with one end of the drill

Fig. 60.



in its place, while Fig. 61 represents the drill separate. The cone, from A to B in Fig. 60, is the part which fits into the socket or hole in the lathe spindle; from the end, C, to the nearest side of the slot, D, is drilled a hole, the slot, D, being cut down to half the diameter of the hole; and its bottom face is left taper as shown, so that the taper, D, of the drill

Fig. 61.



(Fig. 61) will, when forced into its place, serve to lock the drill and prevent it from turning in the chuck.

The drills may then be formed of steel wire (Stubs' is the best for the purpose) by simply filing the flat taper, D (Fig. 61), on one end of the wire, and forging out the other end to a drill of the required size, care being taken to forge the drill end (as shown in Fig. 61) smaller at A than at the drilling end, B, from B to A being a gradual curve: which is called the clearance, and which serves, in consequence of the decreased diameter of A, to permit the cuttings of the drill to pass out of the hole while the drilling is being done. If the drill is not given sufficient clearance, the cuttings will become jammed in the hole, and, binding fast to the drill, will arrest its revolving motion, and cause it to twist and break off, leaving the cutting end of the drill fast in the hole; in which case, unless one end of the broken piece happens to protrude so that it can be extracted by a pair of pliers or a hand vise, and unless it can be jarred loose (as is sometimes the case) by striking it against a block of iron or wood, the work must be heated to a low red and permitted to cool of itself, so as to soften the point of the drill to allow it to be, by another drill, cut or drilled out.

Important Researches on Explosive Substances.

Roux and Sarrau have previously shown that two different kinds of explosions can be produced by dynamite, according as the substance is made simply to deflagrate (explosion of the second order), or to detonate by the percussion of fulminate of mercury (explosion of the first order), and that the force of the explosion produced by the same quantity is very different in the two cases. They now find that the majority of explosive substances, gunpowder included, possess the same remarkable property.

The reciprocal of the weight (due corrections made) of each substance, which when exploded in one and the other manner sufficed to rend similar cast iron shells, gave the relative explosive forces. Some results of the experiments are given in the following table, the explosive force of gunpowder ignited in the ordinary manner being taken for unity:

Name of substance	Explosive force	
	2nd Order.	1st Order.
Mercury fulminate	—	9·28
Gunpowder	1·00	4·34
Nitroglycerin	4·80	10·13
Pyroxyl (gun cotton)	3·00	6·46
Picric acid	2·04	5·30
Potassium picrate	1·82	5·31
Barium picrate	1·71	5·50
Strontium picrate	1·35	4·51
Lead picrate	1·55	5·94

Of the highest practical importance is the discovery of the detonative explosion of gunpowder induced by the detonation of nitroglycerin (itself set off by the fulminate of mercury): for the force of the explosion is more than forefold greater than that obtained by igniting gunpowder in the ordinary manner. (The increased force of gunpowder and gun cotton, when exploded by the agency of detonation, was fully demonstrated by Abel six years ago). The authors observe that the mass of the substance employed for exciting detonation must usually bear a certain proportion to that of the substance to be exploded, but in some cases the action is propagated throughout the latter when once up at any given point.—*Comptes Rendus, Journal of the Chemical Society.*

Self-Watering Locomotives.

The self-supplying water apparatus for locomotives is coming into very extensive use in this country. It consists of a water trough from 800 to 1,200 feet long, laid between the tracks of the railway. As the engine passes along at a velocity of, say, 20 miles an hour over the trough, the fireman, by means of a lever, lowers one end of a pipe into the trough, and the water is carried up into the tender. The water is prevented from freezing in winter by means of steam pipes. The use of this device, by saving time in stoppages, permits a more moderate average of speed, and so results in economy.

Chromo-lithographic Process.

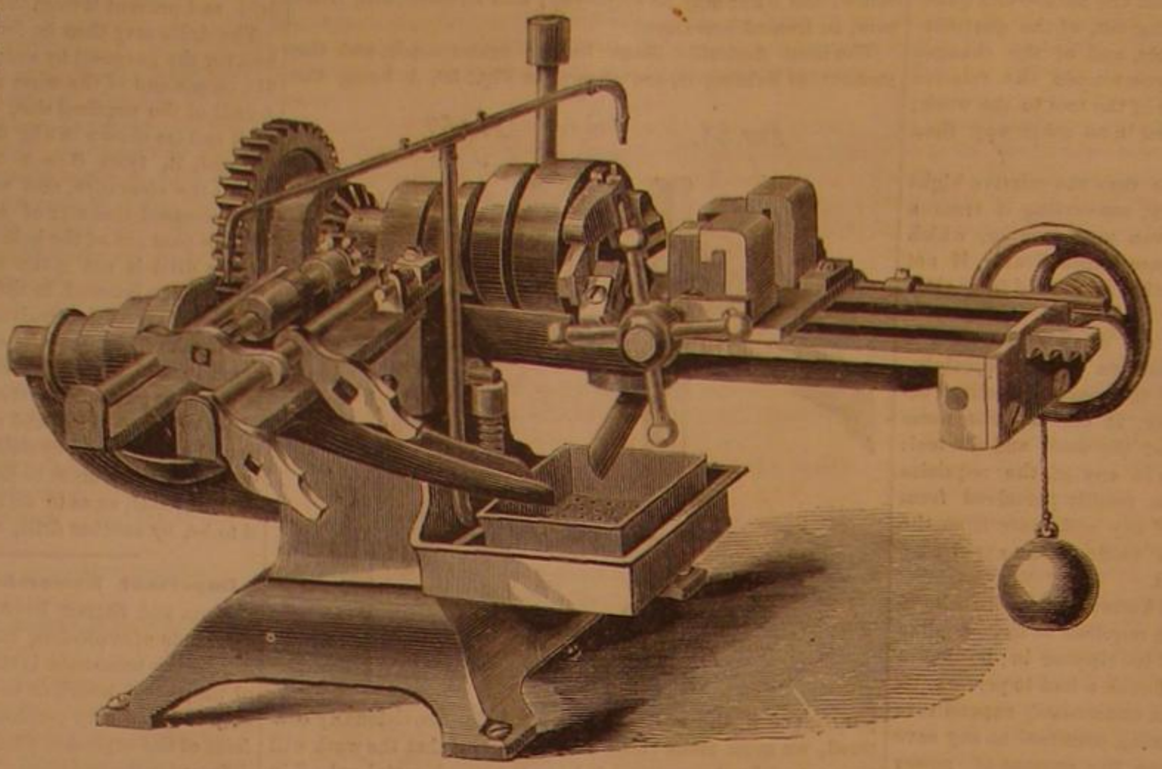
In place of using a special stone for each color, necessitating as many separate impressions as there are colors, the entire subject is drawn upon a single stone, and a proof is taken on a thin sheet of copper. This sheet is then cut out carefully according to the desired contour of the colors, and upon each of the portions is fixed a solid block of color, previously prepared. The whole is combined into one form, and is printed on an ordinary lithographic press, all the colors at once, the moisture of the sheet being sufficient to take off and hold the colors as the sheet goes through the press.

KANGAROO LEATHER.—In Australia kangaroo skins are becoming an important article of traffic, and experts declare that they make the toughest and most pliable leather in the world. Boot uppers of this material are said to be both comfortable and durable. It also makes the best of morocco whips, gloves, etc. Of these skins some are exported in their raw state, and others after being manufactured. The kangaroo is widely distributed throughout the colonies, and great numbers are slaughtered, yearly, for their skins.

IMPROVED BOLT CUTTER.

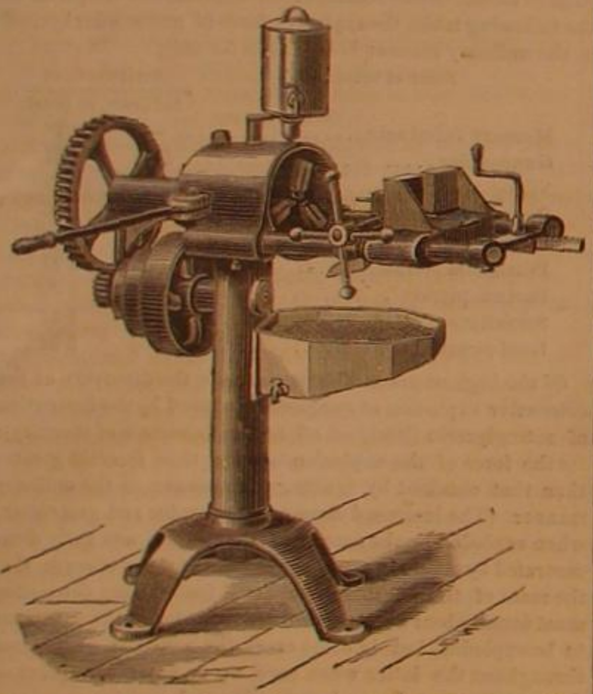
The annexed illustrations represent two sizes (Nos. 5 and 6) of a new automatic bolt-cutting machine, recently invented by Mr. E. Schlenker, Superintendent of the Howard Iron Works, of Buffalo, N. Y. The dies revolve, and may be easily removed and others of different sizes substituted, without taking out a screw. When inserted, they become instantly automatically locked. The dies open automatically to receive the bolt, upon which a perfect thread is cut by a single passage through the machine, when other automatic devices cause it to be discharged. The opening of the dies is effected by a gage rod which is set to correspond with the length of thread to be cut.

The smaller machine, illustrated in Fig. 2, may be operated by hand or belt power, and will cut from one quarter inch to one inch and a quarter inclusive. The next size, No. 5½, will cut from three eighths of an inch to two inches inclusive, and the No. 6 machine, which, in the larger engraving, is shown provided with a nut-tapping attachment, operates on from three eighths to three inches, also inclusive. Dies and master taps are furnished with the two machines first mentioned; with the third, the purchaser may order the nut-tapping attachment, and, in addition, as many dies and master taps as he requires. The apparatus is constructed entirely of strong and durable materials, and offers throughout, besides its special features of advantage, a simplicity of construction which will doubtless commend it favorably to mechanics.



SCHLENKER'S IMPROVED BOLT CUTTER.

Fig. 2.



For further particulars, prices, etc., address the manufacturers, R. L. Howard & Son, Buffalo, N. Y.

IMPROVED DINNER PAIL.

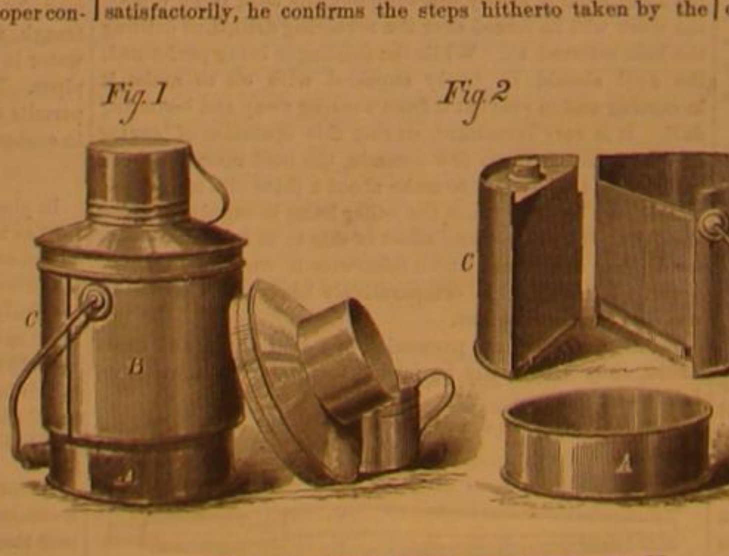
The construction of the dinner pails in daily use by the millions of working men throughout the country is, it is claimed, open to several objections, not the least of which is that the greater portion of the surface of the receptacle, into which the hot coffee is poured, is within the pail proper containing the meat and other edibles. The latter, by this arrangement, lose their flavor, and acquire an insipid, sodden taste. To remedy this and other disadvantages, the pail represented in the accompanying engraving has been invented by Mr. F. E. Heinig, of Louisville, Ky., who has obtained thereon two patents, one dated in 1873, and the other since the commencement of the present year.

Fig. 1 shows the pail complete as carried in the hand. In Fig. 2, A is a pan (to be used for meat, vegetables, or soup), the upper wired edge of which fits tightly within the lower wired edge of part B. The latter is in section a little over a half circle, and is intended for meat, bread, or pastry. C is the coffee bottle, which also fits over the wired edge of part A, and has a wired bottom describing a little less than a half circle. It has, besides, a simple tin hook on the lower edge of its flat surface, which, catching on the standing edge of the flat surface of part B, holds the bottle firmly in its place. The cover with the cup fits over parts, B and C, and holds them fast together. The size and weight of the pail can be reduced by dispensing with the pan, A, when desired.

Besides the evident lessening of the probability of spoiling the flavor of the edibles (owing to the greater portion of the surface of the coffee bottle being on the outside, and there being two sheets of tin and a thin layer of air between the hot fluid and the contents of part B), the inventor claims the following further advantages for his pail over those hitherto in use: Less chance of the introduction of dirt among the edibles, on account of all the edges fitting outside; greater economy of space; the convenience of separate apartments; simplicity of construction, and easy putting together; saving of material in construction, besides the permitting of much greater utilization of scraps.

For further information address the patentee, F. E. Heinig, 89 Floyd street, Louisville, Ky.

Fig 1 Fig 2



HEINIG'S IMPROVED DINNER PAIL.

Temperature of the Earth.

At the recent annual meeting of the Geological Society of Glasgow, the president, Sir William Thomson, gave a lecture on "The Conditions of Underground Temperature at Different Depths." The various classes of variations occurring, and the mathematical investigations which had been made by various eminent observers of the phenomena referred to, notably those of Fourier, who had done much on the subject of underground temperature, were considered. Such observations were difficult to make with correctness, on account of the changes of temperature caused by the opening of the ground for the placing of the thermometers. The best form of thermometer was that having a long-shaped bulb.

It was found that, generally speaking, the temperature of the earth increased by 1° Fah. for every 50 feet of depth. There were some considerable exceptions to this, the temperature increasing faster, which was apparently due to volcanic action.

By making use of the knowledge acquired by observations and supposing the earth at one time to have been in a molten state, this condition could not be placed further back than about 400,000,000 years.

The Lick Donations.

Some time ago Mr. James Lick, of San Francisco, deeded a large portion of his great estate, in trust for public purposes of an educational and philanthropic character, reserving a modest income for himself. For this good deed he was highly commended all the world round. Now he revokes the trust; and concluding that he has not done justice to his relatives, and that he can carry out his own purposes more satisfactorily, he confirms the steps hitherto taken by the trustees, and resumes possession of his property. The world will be obliged to revoke much of the praise heretofore bestowed on Mr. Lick, unless he shows that his change of mind in this instance does not involve the abandonment of his great scheme of good.

Among others of his bequests was the sum of $700,000 for an observatory on the summit of the Sierra Nevada, which all lovers of Science hoped would be accomplished. Alas! how uncertain are both man and riches!

TOMLINSON'S IMPROVED CHIMNEY COWL.

The construction of the new chimney cowl herewith illustrated is such as to prevent currents of air descending the chimney cap in stormy weather, this being effected by suitable provision for imparting an upward impetus to the incoming currents. The flue which constitutes the cowl is secured to the chimney by a flange, and carries above a suitable cap or hood. In the sides are a series of air openings, from the top edges of which, and exterior to the flue, project shields, A, which are adapted to shed water or wind, should the latter tend downwardly. From the lower edges of the air openings extend inwardly projecting deflectors, B, the length of which, as well as of the openings, is less than the diameter of the flue. By this means a space is created beside the ends of the deflectors, as well as between their inner edges, through which the products of combustion can pass and readily escape at the top of the flue. The air openings can be formed on all sides of the flue, or on but two, as in the present instance.

If a current of air strikes the cowl on either side, it will enter through the openings and be turned upward by the deflectors. A suction is thus created within the flue, and the eduction of smoke accelerated. If the current enters the flue from above, and tends downward, the deflectors will turn it sidewise and outward.

State and county rights for sale. Patented February 9, 1875, to Mr. Joseph Tomlinson, Mount Vernon, N. Y., who may be addressed for further information.

Magnetization.

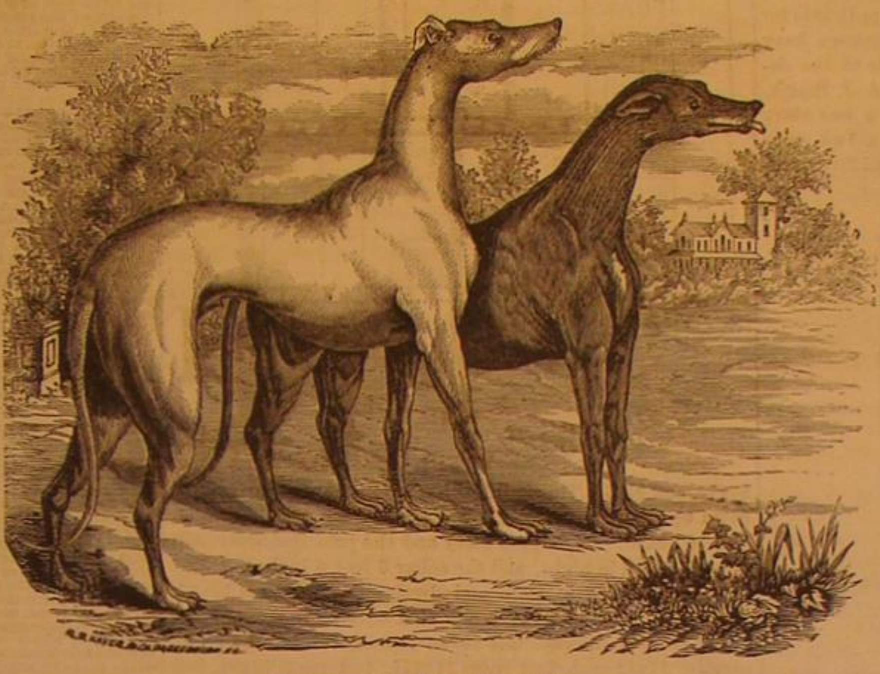
M. J. Jamin's researches point to an important modification in the construction of magnets. Suppose that a great number of plates, which, after being separately magnetized to saturation, are placed together. The magnetism of the combination will be seen to increase up to a limit which cannot be passed, and which is reached when the polar surfaces are filled. Suppose that ten plates are required. If now we re-commence the same experiment, applying the same plates against two iron armatures of a large surface, the intensities will increase much more slowly, because the sum of the magnetism is diffused over a more considerable extent, and the limit will not be reached till this extent is full. For this it may be needful to superpose twenty, thirty, or forty plates, and, generally speaking, a number so much the greater as the armatures are larger. The total power of the magnet will, therefore, increase with its armatures.

THE GRAYHOUND.

The grayhound is one of the tallest of the canine race, growing commonly to the hight of about thirty inches, but sometimes exceeds this by ten or twelve inches. The legs being long and muscular, the abdomen contracted, and the loins strong, the dog has advantages over any other kind for speed and endurance. His jaws are elongated so that he may seize his prey when at full speed; his neck is long so that he may lift his head high for sighting game, and he is as remarkable for his keenness of vision as the bloodhound for his scent.

Representations of the grayhound are to be found on the oldest Egyptian monuments, and the breed is supposed to have originated in Western Asia. The color and fur of the animal have been much varied by climatic influences. The English grayhounds, kept for centuries for the sport of coursing, are the fastest of the species, and their hair is moderately smooth, the colors being black, slaty gray, or fawn. The power of following game by scent is entirely absent in the English dog; while the Scotch grayhound (probably somewhat crossed with a deerhound) is remarkable for its keenness of nose. The Irish grayhound is very strong, muscular, and courageous, and will generally come off best in a combat with a wolf.

In coursing, it is usual to match two grayhounds against each other, and they are fastened by their collars to a leathern thong, with a snap hook operated by a string. Boys go into the field, and beat the grass or other crop with long sticks; a hare gets up and runs. The starter, when the hare has attained some distance, pulls the string of the leash, and away go the dogs, side by side and close together, with the speed of the wind. The hare would soon be run down were it not for its remarkable facility for suddenly doubling on its pursuers; and it will execute this maneuver so rapidly as to run right past the dogs and away in the contrary direction before they can turn to catch it. But the superiority in endurance of the grayhounds in time wears out the hare, and the fleeter of the two dogs will surely catch it at last, killing it instantly by one squeeze on the ribs with its long and powerful jaws.

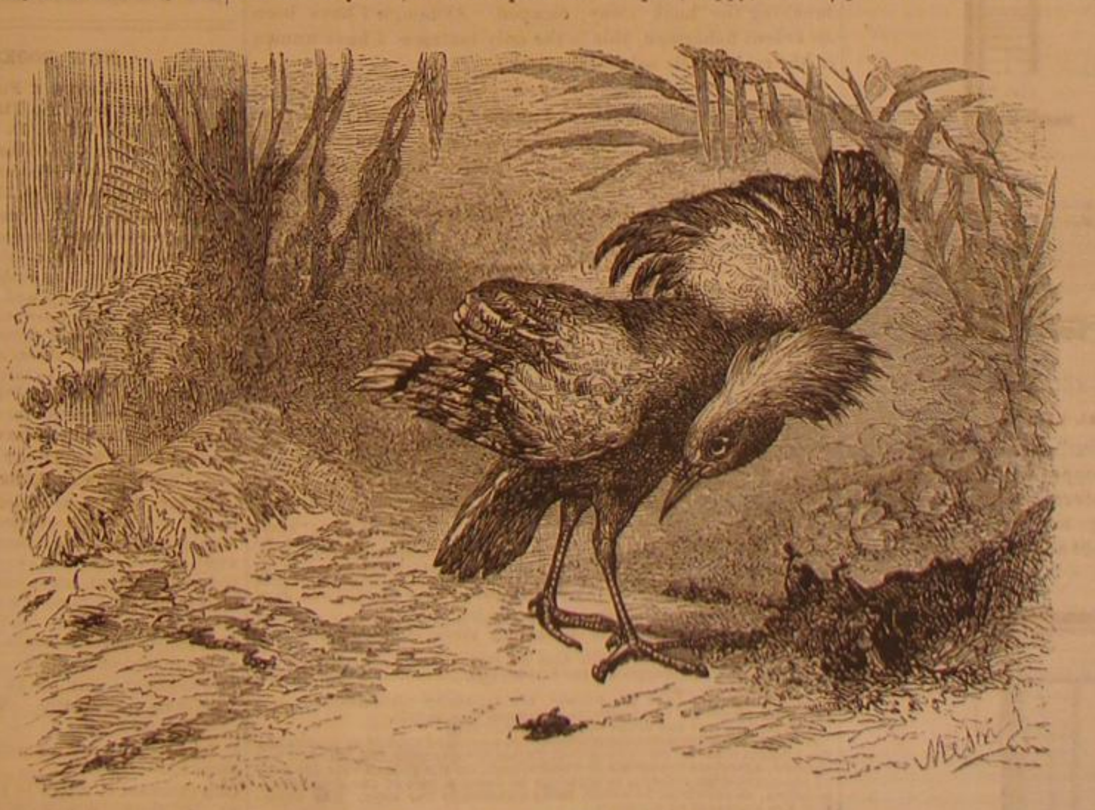


ENGLISH GRAYHOUNDS.

THE KAGU.

New Caledonia, in common with other countries lying in the South Pacific Ocean, contains a variety of ornithological species, peculiar to that region of the globe, and, besides, remarkable for the beauty of their colors and the singularity of their forms. A number of curious birds have, of late years, been transported from the colony above named, and confined in the various zöological gardens of Europe, where their habits have been carefully studied by naturalists. Among the specimens which quite recently have been added to the *Jardin des Plantes*, in Paris, is the kagu, or *rhinochetus jubatus*, a representation of which we have reproduced from the pages of *La Nature*. The bird presents the characteristics of the herons in general appearance, but careful study of its osteology has resulted in its proving to be a species of crane.

The plumage, during life, is of a soft grayish blue, but after death changes rapidly to a dirty yellow. The beak is long and curved, and, with the claws, is of a bright red. The plumes of the neck and breast are rather short; but as if to make up for this deficiency, those on the posterior portion of the head are long enough to form a hump, which the bird can raise or lower at will. The tail is poorly developed and the wings are ill formed and short. The pin feathers are streaked with white and covered with bands of black and brown. The size of the body is about that of a chicken, and its conformation shows very plainly that the bird cannot support itself in the air but for a very brief period.



THE AUSTRALIAN KAGU.

The kagu is easily tamed, and even in its native state will follow the plow to pick up grubs and earth worms, as readily as the crow. In its habits it resembles the rails, especially in approaching prey, when its serpentine and brusque movements of the neck and body closely resemble those of that class of birds. The hen lays two eggs, but conceals them with great care.

Measures are to be taken to acclimatize the kagu in France, as a protection to farmers against insects; while its present rapid rate of disappearance in New Caledonia will probably result in the careful guarding of the species in that colony.

BATTERY carbons can be readily cut with a handsaw moistened with water.

The Great Pen Maker.

At the recent ceremony of laying the foundation stone of the science college which he is about to give to Birmingham, Eng., Sir Josiah Mason said: "The trade of steel pen making, I have now followed for more than forty-seven years until I have developed the works into the largest pen factory in the world. This business and that of the split ring making were my sole occupations until 1840, when accident brought me into close relations with my late valued friend and partner, Mr. G. R. Elkington, who was then applying the great discovery of electro deposition; and through my association with him in this undertaking I may claim a share in the creation of a form of scientific industry which has so largely enriched the town of Birmingham, and increased its fame throughout the world. I mention these facts to show you how the means with which God has blessed me have been acquired, and to show, also, how natural it is that I should wish to devote some portion of those means to assist in promoting scientific teaching to advance the varied forms of scientific industry with which, throughout my Birmingham life, I have been so closely connected."

Paint for Shingle Roofs.

A correspondent of the *New England Farmer* says: "In regard to shingles, I have seen the highest cost shaved pine fail in ten years; and I expect the cheapest, sappy, sawed pine will last that length of time. Roofs are so expensive to keep in repair that it behoves every man who has had experience with them to contribute what he can for the general good on this all important subject.

In the future I intend to lay low priced shingles—say from \$2.75 to \$4 per thousand—and paint them with a coat of tar and asphaltum—say one barrel coal tar, costing \$3; ten pounds asphaltum at 3 cents, 30 cents; ten pounds ground slate at 1 cent, 10 cents; two gallons dead oil at 25 cents, 50 cents, which should be added after the other has been wetted and thoroughly mixed.

I consider the above mixture as good as anything that can be put on to shingles, as it will thoroughly keep the water out; and if dry they will not rot under the lap, nor will the nails rust, and I know of no reason why they will not last as long as I shall want shingles. The mixture should be put on hot, on a dry day, and upon a dry roof. Ground slate or asbestos is fireproof; so, also, is the tar, after it has dried thoroughly. The last shingles I had cost \$2.75 per thousand; laying, \$1.75 per thousand; nails, 25 cents per thousand; paint, 12 cents per thousand, and I now consider it as good as any roof I ever had or saw."

Street Pavements.

In a paper read before the Edinburgh and Leith Society, Mr. J. H. Cunningham describes very ably the relative merits of the various kinds of street paving used in the cities of Great Britain, namely, the Macadam, Telford, granite block, asphalt, and wood. He says:

On the whole, we may conclude that macadam and macadam concrete roadways, although they may answer well in secondary streets, should not be laid in main thoroughfares. We may also conclude that neither this system of road-making, nor any development of it, is likely to produce the street of the future.

Wood and asphalt pavements are in several respects superior to granite. Much less mud and dust is formed on them, and they are comparatively free from noise. They are also safer, except when thoroughly wet. I am not aware that granite is in any respect superior to either of them. Even if they should turn out to be more costly, owing to their requiring repair more frequently and having to be renewed sooner, I think the advantages already mentioned will more than compensate for the extra price. Only long and extensive experience can settle this point satisfactorily, because many indirect benefits are secured by their use, which it is not easy to estimate in money; and there are many expenses connected with all pavements which are not usually included under the head of maintenance. On the whole, it seems probable that either wood or asphalt is destined gradually to supersede granite as a paving material, at least in large and wealthy towns.

It therefore only remains for us to find out which of them makes the best, or, to quote the *Pall Mall Gazette*, the "least objectionable" road surface. Mr. Haywood has fully reported to the Commissioners of Sewers of the city of London as to the relative advantages, together with the probable expense and durability of these pavements. In 1873 he made a very extensive series of observations, in order to ascertain their relative safety. Allowing for all modifying influences, he found that wood is safer than asphalt, as not only fewer accidents occur on it, but those which do happen are of the kind least injurious to horses and obstructive to traffic.

Further, Mr. Haywood considers that wood is the most quiet, but also the dearest; that they both can be kept equally clean, and will probably be found equally durable. That they can be laid and repaired with about equal facility, but that the best repairs can be made in asphalt.

The general impression left in reading the report is that, except as regards safety, there is not much difference between them. Wood is, however, about twice as safe as asphalt.

Let us see which of these two pavements is likely to endure best, judging from theoretical considerations alone. Wood pavement is constructed according to Macadam's principles, asphalt according to Telford's. Wood is laid on a comparatively soft foundation, and the whole roadway forms a kind of elastic arch, which partly resists vertical pressure, by distributing the thrust horizontally through its entire substance. In asphalt roadways, on the other hand, the concrete foundation may be considered the real road, the asphalt being merely a sort of protection, which gives a smooth surface, and can be easily renewed as it is worn away. But this combination is, I fear, devoid of elasticity. Elasticity is without doubt essential to the permanence of a roadway. This quality certainly appears to be secured in improved wood pavements, though not in asphalt But it may be contended that the asphalt covering has in itself sufficient elasticity, and that it acts like a sheet of vulcanized india rubber. Possibly a concrete bed covered with a sheet of vulcanized india rubber might form a good road. I think a less yielding surface is desirable, and that elasticity of form is likely to give better results than mere elasticity of volume. For these reasons I venture to think that improved wood pavement will ultimately be found superior to Val de Travers asphalt, and that the introduction of the former has been a decided step in the right direction. I also think that we may look for further improvements in modifications of this system, and that a roadway having the requisite surface qualities, combined with elasticity of form, will always be superior to one whose chief recommendation is mere solidity.

The first cost of the improved wood pavement and the asphalte pavement in London is the same, namely, $4 to $4.50 per square yard. Cost of repairs per annum also about the same, namely, 50 cents per square yard.

A PRIZE PLAN FOR A FIREPROOF HOUSE.

On page 280 of our volume XXXI., we announced the offer, by the Merchants', Farmers', and Mechanics' Savings Bank, of Chicago, Ill., of a premium of $1,000 for the best set of plans and specifications for a fireproof dwelling house, of not less than five rooms, and a total capacity of at least 5,500 feet. Up to the end of last year, thirty applicants for the prize had put in an appearance, and a committee have since been occupied in investigating the merits of the designs. They recently awarded the prize to Mr. A. J. Smith, of Clark street, Chicago, whose plans were for a one story house, 20x43; a two story house, 18x26½; and a two story store and dwelling, 22x57. The cost of these buildings, respectively, is to be $1,200, $1,700, and $3,600.

Fig. 1.—FRONT ELEVATION.

The one story dwelling house is a building 43x20, of five rooms, consisting of parlor 13x10½, and two bed rooms 10x6½ each. The hight of each room will be 10 feet in the clear between floor and ceiling. An important feature in this plan is that, should a fire occur in the front part of the building, the rear portion may be preserved intact, and *vice versâ*. The outside walls are hollow from foundation to roof. The floor, beams, and rafters are wood, protected from fire by concrete, one and one half inches thick on the ceilings and underneath the floors; and the roof is covered with tin on the top of the concrete. Thorough ventilation is provided by flues adjoining the fire flues, and topped out in the chimney. There is a ventilated air space underneath the ground floor, preventing dampness from arising; and there is also a ventilated air space between the ceilings and roof, to prevent the heat of summer from affecting the rooms. The fire flues will be lined with flue pipes eight inches square. There will be a drain pipe, connected with sinks and closets and with main sewer, to carry off all surface water, slops, etc.

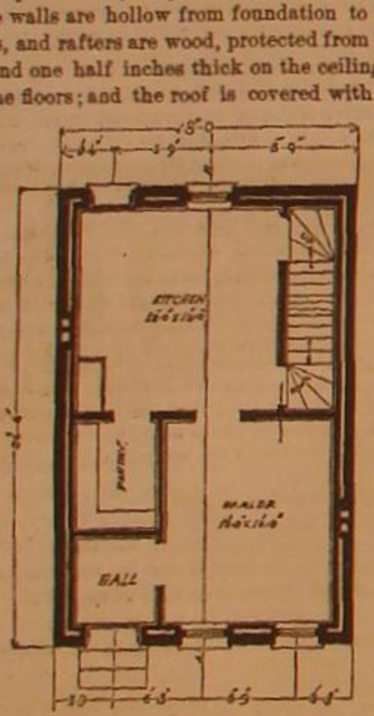


Fig. 2.—PRINCIPAL STORY.

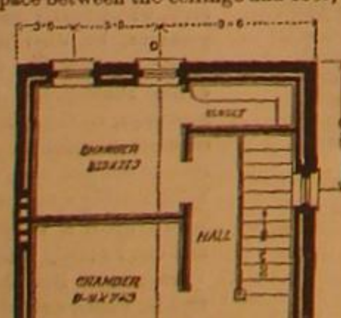


Fig. 3.—SECOND STORY.

The two story dwelling, of which we present a front elevation, Fig. 1, and the ground plans, Figs. 2 and 3, is a building 26½x18, with five rooms, two on the ground or principal floor, and three on the upper floor, the sizes of which are: Parlor 12x10, and kitchen 12x12. The three upper rooms are for bed rooms, the sizes of which are, respectively, 11x9, 8½x7½, and 8½x7½. This building has a cellar for coal and wood, fitted up with water closet. The size of cellar, within walls, will be 12x20. The upper story and the principal story will be each 9 feet in hight, and the cellar 6 feet 6 inches.

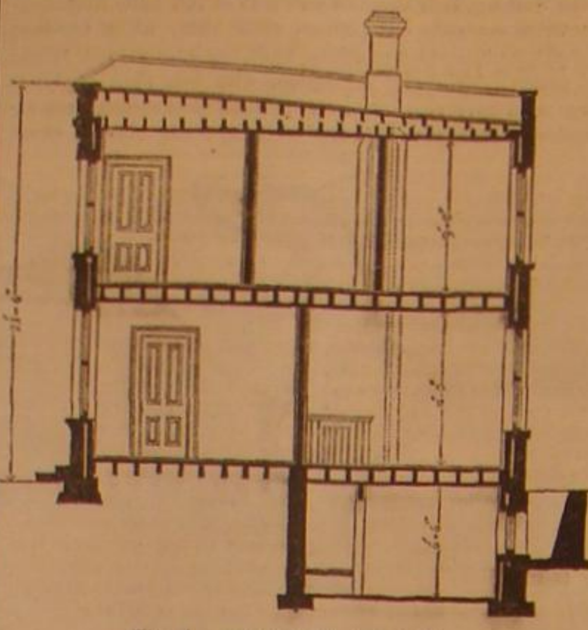


Fig. 4.—SECTION AT A, B, C, D.

The building with store and dwelling combined is 22x57. The entire principal story is occupied with store room. The upper story is divided into seven rooms, consisting of two parlors, 11x12 each, bed room 11x11½, bed room 13x9½, bed room 10½x9½, kitchen 13x11, dining room 13x11.

The three buildings are similar in construction. The cheapness of the structures is unquestionable, and we trust it will be long ere their fire-resisting qualities are put to the test.

A Water Rat taking an Artificial Fly.

A correspondent writes to *Land and Water* as follows: "In Mr. Buckland's chapter on 'The Rat,' he mentions the catching of a rat by one of the flies of a friend while fishing, hooked by chance; but I remember fishing with my father for trout in the May fly season, in one of the Derbyshire streams, when a water rat dashed out from his hole in the bank and took the fly in his mouth (the fly was the natural drake or May fly). After playing with him some time, he swam to the side, became entangled in some dead branches, and, breaking the hook away, escaped. Although I have been an ardent fisherman, this is the only instance I have known of the rat actually seizing the fly."

A SHAFT has been sunk at Lawton, England, for the purpose of pumping up brine, to be conveyed by pipes to the coke ovens in connection with a colliery, a distance of two or three miles, there to be converted into salt by means of the waste heat from the ovens. The cost of the undertaking will, it is said, exceed $200,000.

DECISIONS OF THE COURTS.

United States Circuit Court.—Southern District of Ohio.

PATENT LUBRICATOR.—WILLIAM W. PELTON AND HIRAM TAYLOR *vs.* GARDNER WATERS, JOSEPH J. STARR, AND CHARLES D. JOHNSON.

[*In equity.—Before* EMMONS *and* SWING, *JJ.—December*, 1874.]

STATEMENT OF FACTS.

[Gardner Waters filed an application for letters patent for an "Improvement in Lubricators," March 21, 1868. On the 21st of April, 1868, Hiram Taylor made an application for a patent for substantially the same improvement. Both applications were rejected by the examiner. Waters narrowed his claim, and thereupon received a patent of limited scope; but Taylor persisted in his claim, and upon appeal secured his patent, which was issued to him June 23, 1868.

When Waters learned that a patent had been issued to Taylor with a "broad claim," he filed a second application, asserting therein a claim for the invention substantially as covered by the Taylor patent, and demanded an interference. This was granted him; and upon the final appeal to one of the judges of the Supreme Court of the District of Columbia, he was adjudged the prior inventor; and accordingly letters patent were issued to him June 29, 1869.

The present suit under the Taylor patent had been begun in November, 1868, complainant's testimony being duly taken after the issue was joined.

In December, 1869, defendants filed an amended and supplemental answer, claiming that Waters was the first inventor, and setting up the interference decision.

Issue was joined upon this answer, and testimony for defendants, and rebutting proofs for complainants, taken and filed in 1870.

This hearing was had at the October term of 1874.

At the hearing the defendants objected to a certified copy of an application for a patent made by the complainant Taylor in September, 1867, which, it was claimed, described the device in controversy, on the ground that the copy of the application referred to drawings as being a part of the original application, no drawings, however, being attached to the copy. The objection was sustained by the court.]

EMMONS, Circuit Judge, delivered the opinion of the court.

The patent of the complainant, Taylor, antedates that of the defendant, Waters, and he is entitled to the presumption that his invention is novel.

This presumption is of importance only where the testimony is conflicting, and any considerable doubt is involved as to who is the first inventor. It is of but little consequence in this case. It has, however, been much argued.

The defendant insists that his application was made earlier than that of the complainant, and therefore his patent is to have relation to the date of its filing. As a general rule, this is undoubtedly true.

We do not intend to question, or even qualify, any of the cases on the subject, which we recently considered and applied in the case of the Dental Vulcanite Company *vs.* Willis. These judgments assert several exceptions to the application of the rule.

If, intermediate the first and second application, the patentee manifests an actual intention to abandon the first, his patent will have relation to the last one only. His actual intention severs the proceeding. The law deems the application terminated and as bearing no relation to the patent, which rests solely on the last one.

A withdrawal of a first application, and the reception of the fee paid back from the department, under the statute, is also a severance of the proceedings. The application so withdrawn is not deemed part of any proceeding, under a subsequent proceeding for a patent.

These are but illustrations of exceptions to the general principle, which deems the first in a series of applications for a patent as that upon which a patent depends.

We think the case before us comes within the reason of these exceptions.

Under the first application of the defendant he actually received a patent, after having amended his specifications so as to exclude the present device. We think the act wholly terminated the first proceeding. It was ended in the accomplishment of its object. The decision of the department was acquiesced in, and its final judgment obtained.

The subsequent application in such circumstances must be deemed the commencement of a new proceeding, and as that alone upon which the patent granted in pursuance of it depends.

This last application was subsequent to that of complainant's patent; and, as they are both for precisely the same device, the presumption is in favor of priority of invention on the part of complainant.

The complainant swears that in the fall of 1866 he cast an impervious joint upon the neck of a bottle. He proves his statement by a blacksmith, who came to present an account, and saw such a bottle in his shop; and the complainant's brother testifies that he also saw it at a subsequent period.

If his rights depended upon our adopting the theory that he completed his invention at that time, by such means, we should dismiss the bill. Positive as the testimony is, the fact of success at a period so early is too inconsistent with his subsequent conduct, manifestly evincing an entire ignorance of the thing we think he subsequently invented. Such singular stories are incident in nearly all these controversies in reference to priority of invention.

Parties frequently prove the making of some fixture which is destroyed; of some model which is lost; and some conversation which has never been acted upon sufficiently early to antedate his opponent. We could give many reasons why we fear the history of this castor bottle finds its origin in the fact that the defendant in his testimony places his discovery about a year earlier than we think it was invented by any one.

Far more satisfactory and convincing is the proof that the complainant, in the latter part of 1867 and subsequently, was making and vending, in large quantities, the patented device. The defendant's agent, Pelton, who was selling at that time a different article for the defendant, in the fore part of 1868, bought of the complainant a number of lubricators of the kind in question, to supply the place of an inferior article, manufactured by the defendant, which he had sold for him, and which, on account of their leaking, had to be supplied by a better.

It is needless to recapitulate the proofs; they are abundant and uncontradicted, to show that, from the latter part of 1867 forward, the complainant was in the full manufacture and sale of the patented device. There is no satisfactory evidence of its invention before that date. It is with this concession that we grant him a decree.

To overcome this case and prove the defendant to be a prior inventor, he himself swears that, in the latter part of 1866, he too made an impervious joint upon the neck of a glass globe, tested it with steam, and placed it upon the crosshead of an engine, where it worked successfully, as he proves by Henderson, the colored engineer, for three successive years. The witnesses, Reynolds and Phillips, with more or less confirmation, sustain Henderson.

We are absolved from the duty of contrasting this proof with other unquestioned facts in the case, for the purpose of ascertaining whether it was not 1867 instead of 1866 that this successful lubricator was made, because the defendant's own statement as a witness renders it wholly unnecessary. He says, most explicitly, that though he did succeed accidentally in making one close joint upon the neck of that single globe, he tried in vain, for five months thereafter, to make another. He says he broke many bottles in the attempt; that he did not even partially succeed but in a single instance during the five months; and that one leaked so badly it was unfit for use. It was not until 1868 that he learned how to produce a close joint, and at a time considerably after complainant was publicly manufacturing them. The accidental making of this one joint without any knowledge on the part of the producer of how to accomplish it, with utter inability on his part to produce another like it, is not invention. His ignorance was so complete concerning the mode of its production that he himself swears he not only did not attempt their manufacture, but laid aside a large stock of material during this period for the making of a wholly different article. These he did manufacture, and put upon the market through Starr & Pelton, his agents. He not only had not invented a close joint, but he had so little hope of success that he prepared extensively for the making of a different and inferior lubricator. In these circumstances a single fortuitous success is by no means invention, within the protection of the patent law. He not only did not and could not give it to the public, but he did not possess it himself. It might as well be claimed that he, that should be carrying three bottles in a basket, which being accidentally broken, their contents mixing in unknown quantities upon the earth makes some useful compound, and enters upon a series of experiments for the purpose of ascertaining, if possible, its relative proportions, but who does not succeed in doing so until after another has successfully completed the discovery, can antedate him by proof of the casualty by which he saw the same thing produced. When the defendant saw the first bottle on the crosshead of the engine, without any knowledge of the mode by which he could make another, he stood in no other relation to it, as far as the patent law is concerned, than if it had been placed there by somebody else.

It is not necessary to consider the many other facts in the case which tend to show that the defendant in fact obtained his knowledge of the device from the complainant. We refer to a few of them only, as illustrating the rightfulness of the principle we apply to the defendant's testimony. When Pelton, his agent for the sale of a different manufacture, as late as 1868, presented the defendant with one of the complainant's lubricators, he pronounced it impracticable. He said they could not be profitably made, and that Pelton did not know how many bottles must necessarily be broken by the complainant in making his lubricator.

Other analogous proofs exist. We refer to these single instances only to show the inconsistency of treating that man as an inventor who is so discouraged by his own failures, and the repeated breaking of his bottles, that he pronounces the attempt impracticable, and is himself at that time manufacturing a different and poorer article nearly a year and a half after the mysterious production of the close joint which the court is asked to believe was placed upon the crossheads in 1866.

We think the presumption of the law arising from the anterior patent of the complainant is consonant with the inference of the fact to be drawn from the testimony.

The complainant was the first inventor of the lubricator described in his patent. The accidental making of one in 1866 by the defendant, if everything occurred precisely as he swears it did, is not invention in any sense. There can hardly be said to be a conflict of testimony in reference to the fact that the complainant, for many months before the defendant did so, manufactured and put these articles on the market.

There may be a decree for the complainant in the usual form.

[*Reuben Syler*, for complainants.
E. W. Kittridge, for defendants.]

NEW BOOKS AND PUBLICATIONS.

TRANSITS OF VENUS, a Popular Account of the Past and Coming Transits, from the First, observed by Horrocks in A. D. 1639, to the Transit of A. D. 2012. By Richard Proctor, B.A., Author of "Other Worlds than Ours," etc. With Twenty Plates and Thirty-Seven Woodcuts. Price $3. New York city: R. Worthington & Co., 750 Broadway.

The subject of this volume and the renown of its author combine to render it most acceptable at the present time. The signal success of the recent observations has given a universal impetus to the public interest in the question, and there is no doubt that the transit of 1882, which will be visible in all parts of New England and the Middle and Southern States, will be watched by millions of our people, anxious to behold the strange spectacle on which the solution of so many mighty problems depends. Mr. Proctor's work is complete as a history of the phenomenon, and as a lucid and authoritative explanation of its phases, and its great import to scientific investigation; and the maps and illustrations, executed in a beautiful and very accurate manner, give additional value to a book which we unhesitatingly pronounce to be the best treatise which has yet appeared on the subject.

THE ORBITAL SYSTEM OF THE UNIVERSE. By Antony Welsch, Clinton, Iowa. Clinton: Allen & Bowers.

We have been led, by a brief perusal of this volume, to wonder upon the facility with which books get into print. Here is a work full of chaotic ideas, written in gross violation of the English language, on a subject of which the author gives us no reason to believe that he has the slightest comprehension himself, and on which he does not begin to attempt to enlighten his readers; yet 160 pages of it are printed in good style and well bound, and some hundreds of dollars must have been disbursed, which the author or his publisher will never see again, unless there comes a cataclysm of the intelligence of the human race,

THE INEXPEDIENCY OF AN IRREDEEMABLE PAPER CURRENCY. By John Stuart Mill. New York city: Henry L. Hinton, 744 Broadway.

A timely reprint of a convincing argument against unlimited and perpetual indebtedness.

OUR CURRENCY, WHAT IT IS, AND WHAT IT SHOULD BE. By John G. Drew. New York city: Henry L. Hinton, 744 Broadway.

A REVIEW OF SENATOR JONES' SPEECH ON THE BANKING AND CURRENCY BILL. By Henry S. Fitch. San Francisco, Cal.: Bosqui & Co., Clay and Leidesdorff streets.

These two pamphlets are earnest protests in favor of the policy of paying an old debt with a new one, and are not above the average of their class of literature.

TRANSACTIONS OF THE AMERICAN INSTITUTE OF MINING ENGINEERS. Volume II. Easton, Pa.: Published by the Institute, T. M. Drown, Secretary, Lafayette College.

The American Institution of Mining Engineers has a high reputation among our scientific bodies, and certainly none is doing or can do more valuable work. The future prosperity of this country depends in chief on the development of her enormous and varied mineral wealth; and the profession which is to pioneer this progressive movement fortunately contains many of our most illustrious scientists. We commend this volume to the perusal of all who are interested in the present industries and the future possibilities of the United States.

ON THE ALLEN GOVERNOR AND THROTTLE VALVE, a Paper read before the Institution of Mechanical Engineers, London, by F. W. Kitson, of Leeds, England.

Recent American and Foreign Patents.

Improved Method of Softening Umbrella Ribs.

John McAuliffe, New York city.—This improvement relates to the softening of the ends of umbrella ribs, to facilitate the boring or punching of the holes for the wire by which they are fastened to the collars. It consists in standing the ribs in a bath of hot lead, and letting them stand while the bath is cooled down gradually to atmospheric temperature.

Improved Apple Slicer and Corer.

Henry H. Siler and Thos. A. Brooks, St. Lawrence, N. C.—The invention consists in arranging a series of cutters so as to be adjustable to and from the center, to cut out a core of greater or less diameter; in a cutter bed made up of sections that slide upon each other and upon base blocks; also in a ring plate provided with slots and perforations arranged in a circle.

Improved Device for Soldering and Capping Cans.

Richard Henry Smith, Baltimore, Md.—This invention relates to certain improvements in machines for capping cans; and it consists in a soldering iron holder having a rear recess, and adjustable both vertically and horizontally by a sliding support and binding screws. The invention also consists in the combination with a revolving table of separate detachable and independently rotating plates, having clamping devices for holding different sized cans.

Improved Gang Plow.

Stephen S. Scheumack, Victoria, Tex.—The invention consists in combining a crossbar—placed above and having arms that straddle the axle—with another crossbar having a vertical adjustment, whereby the gangplow can be equally well employed for preparing, cultivating, and seeding land.

Improved Soldering Machine.

Wm. D. Brooks, Baltimore, Md.—This invention comprises a series of valuable improvements by which the caps and heads of fruit, oyster, and other cans may be soldered in a rapid, thorough, and economical manner, the cost of manufacture being thereby reduced from twenty to forty per cent, while the joints are close and reliable.

Method of Securing Pins to Artificial Teeth.

Orin S. Bixby, Syracuse, N. Y.—It is well known that in the manufacture of artificial teeth platinum is employed as the material of the pins that fasten the teeth to the plate, because it is the only commercial metal that will not fuse or oxidize in the heat and ventilation to which the teeth must be subjected in baking them. By this invention the pin cavities are made in the inner or back side of the teeth before the latter are baked, and the pins are not set in the cavities until after the teeth are baked, so that material other than platinum may be employed.

Improved Sugar Cane Cutting Machine.

Julius Robert, Gross Seelowitz, Austria, assignor to Dr. Otto Kratz and R. Sieg, New Orleans, La.—This invention relates to a patent granted to same inventor October 30, 1866. It consists essentially of detachable cutter-holding plates for connecting the cutters to the cutter-carrying wheel, contrived for the ready removal of the cutters for grinding, and the application of other plates with sharpened cutters, to be used while the dull cutters are ground and attached to their attaching plates, two sets of plates and cutters being used. These plates are also useful for adjusting the cutters for cutting thick or thin.

Improved Lever Press.

William O. Watson, Albany, Ga.—This improvement in lever presses consists of toggle levers to work the main lever, connected to the capstan by a rope passing over intermediate pulley blocks in a manner calculated to increase the leverage without the corresponding diminution of the speed consequent to the ordinary method.

Improved Butter Worker.

Frank B. Aldrich, Chicago, Ill.—In this butter worker the rollers are so formed as to take hold of the lumps of butter and draw them through the machine, and to prevent the butter from working out to the ends of the rollers, and there sticking. The rollers are grooved longitudinally in such a way that the projections between said grooves are concaved upon the forward side, and rounded upon the rear side, and concaved or beveled upon their end parts.

Improved Dental Reflector.

Francis M. Osborn, Port Chester, N. Y.—This reflector may be applied to a dental clamp to show the cavity of the tooth distinctly, so that the dentist can see just what is to be done, and also watch the progress of the work. The invention consists in a disk provided with a reflecting surface upon its front side, and a ball stem upon its rear side, and the arm provided with a spherical socket upon one end, and spring clamps upon its other end.

Improved Vegetable Slicer.

Aimé Vuillier, Newark, N. J.—This consists of an implement having a spiral cutting blade, with side-extending cutting rings at the upper end, for entering the vegetable and slicing out of the same a twist of two separated spiral pieces. The implement is very simple, and executes its work with remarkable celerity.

Improved Hoof Trimmer.

Andrew Shirran and William J. Givens, Pacheco, Cal.—In operating the knife a disk is given a revolving motion, thereby winding more or less of a band on its surface in cutting, and in releasing the band in every backward movement of the knife. In operating with the machine the shoulder of a slotted head is placed against the outside of the hoof. The bearing surface of this shoulder is faced with a concave piece of brass, which receives the rim of the hoof. This arrangement throws the knife toward the center of the hoof, and by working the lever back and forth the knife will be made to work from the center to the outer edge of the hoof. The knife is convex and attached to the lower end of the handle.

Improved Land Pulverizer.

Angeline Underwood, Carrollton, Ill.—Two strong wooden frames are placed side by side, and to the middle parts of the side bars are bolted bearings for shafts. Upon the shafts are placed a number of circular disks. The two frames incline freely in either direction to adjust themselves to any unevenness in the surface of the ground, and small friction rollers keep the frames from twisting when the machine is in use. The frames turn freely, and at the same time the ends of the tongue crossbar are prevented from dropping down. To the rear bar of the frame are attached scrapers of a width to scrape off any soil that may adhere to the cutters, and which might otherwise prevent the cutters from entering the ground to the required depth. The cutters are designed to enter the ground to the same depth as the plows, so as to cut in pieces all sods, clods, and lumps that may have been turned under by said plows.

Improved Washing Machine.

Gideon Huntington, Toronto, Canada.—In this washing machine a clothes-holding open work drum is arranged to rotate in a tub set over a furnace. The drum is reciprocated by a rocking standard, a horizontal bar pivoted thereto, and straps which are wound in reversed directions around a pulley of the drum shaft, and attached to said bar. By applying the foot to the rocker, the standard is vibrated and the desired motion imparted to the drum.

Improved Animal Hopple.

John D. Wilson, Round Grove, Kan.—The animal is placed within an enclosure formed by a fence made of a single wire, supported at a short distance above the ground. To its leg is attached a hopple on which are devices which catch on the wire fence when the animal attempts to pass over or crawl under the same.

Improved Flour and Middlings Purifier.

George Washington Brown, Metropolis, Ill.—A pressure chamber is arranged at the head of the reel to receive the air from a blast fan. A perforated tube surrounds the shaft, and is considerably larger, to form an air conductor extending along the reel about three quarters of its length, with one end opening into the pressure chamber to receive the air, conduct it along in the reel, and discharge it outward to the cloth, to aid in separating the bran and light matters from the middlings while falling about in the reel. The partition between the pressure chamber and the reel is perforated to allow the air to blow in the reel and along it. Below the reel is a long triangular air conductor over the conveyer, receiving air from the pressure chamber, and delivering into the space below the bolt. Along the top of the case is a wide conductor, and along each side is a narrow one; and under the wide conductors is another one, in triangular form, receiving and discharging air in the same manner, but discharging it more directly upon the cloth, mainly to keep it clear, while from the other conductors it is more particularly designed to fill the space with air to counterbalance that blown into the reel, and prevent the latter from unduly forcing the impurities through the reel. At the top of the fall boards there is a conductor for taking up the impurities from the flour and middlings as the air rises up through them while descending from the reel to the conveyer below.

Improved Saw Set.

Josiah B. Titus, New York city, assignor to himself and John McLean, of same place.—This consists in a sliding jaw piece in a slotted frame or plate having a bridge which supports an adjusting screw. The screw turns freely in the bridge and moves the slide, so that the jaw can be adjusted to suit the thickness of the saw.

Improved Candlestick.

Wells Kilburn, Napa City, Cal.—The invention consists of an improved candlestick, formed of spring jaws and a loose tube, provided with a cross wire in its lower part. In using the candlestick, the candle is placed in the tube, the wire is placed between the jaws, and the tube and candle are pressed down to the saucer. The inclined or rounded side edges of the jaws guide the wire, and enable the said wire to push back and pass said enlarged upper ends, both in passing down and in passing up. When the candle is burned down to the top of the tube, the tube is raised, which brings the wire against the lower end of the candle and raises it. When the candle has been raised sufficiently, the tube is again lowered, leaving the candle supported by the jaws.

Improved Clothes Line Support.

John N. Fuller, Cleveland, O.—The top piece consists of two circular prongs which branch off, with suitable interval between them, from the socket part of the head piece of a pole. The hooks are left open at opposite sides for admitting first the introduction of the rope or line into one hook, and then into the other, so as to be secured rigidly by the same. The pole or supporter is then raised with the clothes line and firmly planted into the ground by the pointed socket.

Improved Toy Arrow Shooter.

John H. Wales, Milford, Mass.—This invention consists of a toy formed of a tube, provided with an open ring upon one side of the arrow and the rubber band. In using the toy the tube is held in one hand, the arrow is passed through the tube from its forward end, and the rubber band is passed over the rear end of the arrow. The rear end of the arrow is then grasped with the thumb and finger of the other hand and drawn back to put the rubber band under any desired tension. The arrow is then released, and the elasticity of the rubber band will throw it from the tube with considerable force.

Improved Stove Grate.

William Walsh, Albany, N. Y.—This consists in a grate made in two parts, one of which parts is vibrated laterally similar to ordinary grates, while the other part is susceptible of a perpendicular movement to raise the fuel from the other part.

Improved Device for Holding Pipe Fittings.

Thomas P. Hardy, New York city.—This improved chuck for holding pipe fittings and other objects while being tapped is so constructed as to allow the fittings to center themselves upon the taps. The device opens its jaws to receive and discharge the fittings, and will move said jaws out of line with the taps to allow the fittings to be conveniently inserted.

Improved Top for Salt and Pepper Boxes.

George D. Paul, Brooklyn, E. D., N. Y., assignor to Paul Brothers & Co., New York city.—A gridiron-shaped stirring and crushing frame is arranged close under the top, to slide on a rod. It is provided with a thumb piece projecting out through one side of the cup, and also with a spring, the thumb piece and spring acting to push the crushing frame along beneath the top of the cup forward and backward, to crush the lumps that may fall upon it and stir the finer particles when packed against the cap, all so that the perforations will always be kept free.

Improved Butter Worker.

Jacob L. Englehart, New York city.—In using the device, the butter is placed upon a cloth, which rests on a bench, and is crushed and worked by a flexibly pendent corrugated block, as it is moved up and down by the revolutions of a crank shaft. The excess of liquid flows down the grooves of the bench. When the butter has been sufficiently worked upon the cloth and bench, it is transferred to the finishing table.

Improved Chimney Top.

Henry Becker, Blauveltville, N. Y.—This is a conical chimney top, whose base plate is provided with outwardly curved lugs, that bind after passing through the corners of the flue opening on the sides of the chimney coping.

Improved Molding Machine.

Aaron Miller, Ringtown, Pa.—This improved foot power molding machine, for working regular or irregular moldings upon the edge of lumber, may be adjusted to run the cutter head in either direction, as may be desired. Devices are provided which serve to drive the cutter head at a uniform velocity.

Improved Cotton Scraper and Chopper.

William H. McClaugherty, Seguin, Tex.—This is an improved machine for scraping cotton and chopping it to a stand, which is so constructed that it may be readily adjusted to leave the hills at any desired distance apart, and to scrape the ridge to any desired depth.

Improved Gun Carriage.

Nels E. Johnson, Chelsea Naval Hospital, near Boston, Mass.—This consists in the peculiar construction of a compressor or friction bar and compressing device for holding the carriage in position, and for lessening the recoil of the same when the gun is fired; also in a novel device for locking the carriage to the compressor bar, and in a windlass and rope mechanism for running the gun in and out.

Improved Breech-Loading Ordnance.

Nels E. Johnson, Chelsea Naval Hospital, near Boston, Mass.—The breech block is raised and closed down by a screw, and is hinged to the breech. The screw works through the extreme of breech as through a nut, and when it is turned back the breech block is raised by virtue of a joint bar. The piece to which the joint bar is hinged, and through which the screw works, is fastened by a small sleeve, and is carried back and forth with the screw. The breech piece is carried back and forth by the screw on guides. A piece on the end of the screw is connected with the breech piece by a fork, which allows the screw to turn and move the breech piece back and forth on its ways, and a lip on the end of the breech block closes down into the groove in the screw piece. A spring plunger in the breech block is drawn back by a lever when the breech block is closing, and prevents the block from being blown upward when the piece is discharged. This gun may be loaded at the muzzle, if preferred; but ordinarily the breech block will be elevated to a perpendicular position, and the charge inserted, the screw being drawn back.

Improved Animal Trap.

Isaac V. Newsom, Eatonton, Ga.—The animal enters a dark bait chamber, and, on attacking the bait, pulls down a treadle and shuts the door of the trap behind him. At the same time, he opens an orifice into a light chamber, into which he escapes, and in so doing moves mechanism which sets the trap back to its original condition, ready for another visitor.

Improved Shoe Brush.

Israel Joseph and J. Albert Joseph, New York city.—This is a box made with rounded side edges, and open at the top and one end. The cover is made with rounded sides and open at one end, and the whole is combined with the back of a shoe-blacking brush. Two small brushes have their backs and handles formed to fit upon each other and the blacking box, and into the cavity of the box attached to the back of the blacking brush.

Improved Neck-Tie Shield.

Reginald R. Parker, Indianapolis, Ind.—This invention consists in providing the shield with a strap loop for receiving a neck-tie and and button loop.

Improved Screw Plate.

George R. Stetson, New Bedford, Mass.—The ways are each fixed on a pivot, at the side of the opening next to the adjusting screw, so that they can swing out of the opening freely at the other end to facilitate the changing of the dies. At the opposite side of said opening is a stud, which enters a socket in the back of the die to fasten the dies and the ways in working position.

Improved Watch Case Spring.

Constant W. Wadsworth, Peekskill, N. Y.—The spring is made in two parts, which may be readily adjusted upon each other to bring the screw holes of one part into line with the screw holes of the watch case, so that it may not be necessary to mar said case by forming a number of screw holes. With this construction, also, the spring will not be liable to break when in use.

Improved Peat Molding Machine.

Jean François Bocquet and Victor Alexis Bénard, of Paris, France.—This invention relates to an improved machine for molding peat that has been crushed and mixed or reduced to a homogeneous condition in a grinding or other mill. The peat thus prepared is received into a hopper or box, above a set of traveling molds, formed chiefly of a series of suitably articulated plates, said molds being revolved by and around polygonal drums, and the peat being thus formed into blocks, and deposited on the ground or other surface. The molding machine travels along a rack or toothed rail, whereby the peat blocks are laid regularly and close together in a row.

Improved Smoke and Cinder Conductor.

Daniel Brancher, of Lincoln, and Jacob L. Ring, of Mount Pulaski, Ill.—The conductor is made of separate pieces of pipe slipped together, having flanges and telescopic slides between the cars to allow the cars to move back and forth. Slots in the outside pieces and pins limit the longitudinal motion of the parts. This joint section and flange, made of rubber, gives additional flexibility to the conductor. Spring hooks, placed on the outer slotted pieces in reversed position, hook over the flanges and hold the parts together. This forms the coupling of the conductor, and enables the conductor to be pushed back over the projecting roof of the car when not in use.

Improved Combined Clothes and Quilting Frame.

Melvin Churchill, Helvetia, Wis.—This is a quilting frame combined with a clothes rack, the two being connected so as to be used for either purpose when required, so that they may be folded into a small space for storage, transportation, or when not in use.

Improved Ice Former.

Stephan Krauss, Clifton, N. Y.—A small stream of water is allowed to flow upon the apex of an upper tier of spouts. As the concavities of the spouts of the upper tier fill with ice, the water will drip from their edges upon the spouts of the tiers below. The water will also fall upon pins, and will thus be further subdivided. In this way the water will be exposed to the air in films, drops, and very small streams, and will be very rapidly frozen. When a sufficient quantity of ice has been formed, the apparatus may be covered with a shed, so as to serve as an ice house for storing the ice.

Improved Grain and Straw Lifter.

Donald Crane, Knight's Landing, Cal.—This is composed of ropes interlaced, and forming a kind of net, made in two parts and attached to timbers or bars, and divided in the middle. When the load has been transported to the desired place for unloading, a derrick is provided, on the hook of which rings attached to the ropes are placed, and the entire load is lifted from the wagon and swung round over the place where it is to be discharged. Suitable mechanism then allows the parts of the lifter to separate and discharge the load.

Improved Stencil Cutter.

Patrick L. O'Brien, New York city.—This invention consists of a stencil-cutting device, which is guided longitudinally and laterally on suitable supporting and sliding frames, and adjustable to produce single and double, straight, circular, or curved lines, being readily operated by one hand, while the stencil plate or sheet is fed to the cutting knife with the other hand.

Improved Bag Fastener.

Charles W. Harvey, Waterloo, Iowa.—This bag fastener is formed by the combination with each other of a rubber block, a screw, and two metallic washers. The mouth of the bag is gathered in the usual way, the string is passed one or more times around it, and is then passed once or twice around the outer washer, and is drawn in between the said washer and the body of the bag, where the elasticity of the rubber will hold it securely in place.

Improved Watch Case Spring.

Jules Menegay, Brooklyn, N. Y.—This consists of a watch case spring, made of uniform thickness throughout its length, and fitted in a dovetail groove in the inner face of a section of the rim of the case. The latter is split for a short distance from one end, and is provided with a clamp screw for pinching the split parts upon the edges of the spring, so as to hold it at any point. The spring can thus be shifted to any needed extent for adjusting it to the case after the spring holder has been fixed in the rim of the case, and can thereby be adjusted more accurately.

Notes & Queries

S. A. T. will find a description of making plaster molds on p. 59, vol. 24.—E. L. will find directions for making colored paper for manifold writing on p. 363, vol. 31.—E. L. will find a correct rule for ascertaining the curvature of the earth on p. 395, vol. 31.—S. H. M. will find directions for preparing bones for manure on p. 75, vol. 31.—J. W. R. will find a recipe for a gold wash on p. 43, vol. 30.—C. R. B. will find a recipe for fine blacking on p. 283, vol. 31.—W. S. R. will find directions for making a pot for melting metals on p. 235, vol. 32. Plaster of Paris is the best material for making molds for small castings.—J. E. M. can repair the silvering on looking glasses by following the directions on p. 203, vol. 31.—J. S. H. will find full directions for mounting chromos on p. 91, vol. 31.—C. E. will find a good recipe for axle grease for heavy bearings on p. 90, vol. 31.—W. H. T. will find a recipe for waterproof cement for aquariums on p. 202, vol. 28.—A. A. will find a recipe for bronze for use on brass on p. 283, vol. 31.—E. F. can make his tent waterproof by using the varnish described on p. 347, vol. 31.—L. K. Y. will find a description of water glass on p. 154, vol. 32. Furniture polish is described on p. 315, vol. 30. Muriate of ammonia can be bought for a small fraction of what it would cost an amateur to make it.—L. J. B. will find a description of the manufacture of rubber stamps on p. 156, vol. 31.—J. P. A. will find a formula for the proportions of a safety valve on p. 197, vol. 31.—W. W. H. will find a description of sailing faster than the wind on p. 176, vol. 28.—E. W. will find directions for waterproofing muslin on p. 347, vol. 31.—C. M. B. will find that etching on glass is described on p. 409, vol. 31.—J. R. M. will find directions for calculating the diameter of the driven pulley on pp. 26, 73, vol. 25.—C. D. will find directions for making colored lights on pp. 58, 154, vol. 30, and pp. 90, 219, vol. 31.—S. F. S. will find an answer to his queries as to lime light in our reply to J. H. S., p. 218, vol. 32.—C. C. will find directions for casehardening plow mold boards on p. 202, vol. 31.—C. L. and W. B. A. will find directions for imitating bronze on gun barrels on p. 171, vol. 32.—W. B. A. will find that iron can be softened by following the directions on p. 123, vol. 31, for steel.—C. L. D. will find directions for laying out a sun dial on p. 409, vol. 29.—H. D. E. will find a recipe for waterproof blacking on p. 155, vol. 26.

(1) F. D. D. asks: Why is it that oscillating engines are not used on steamboats or by manufacturers? A. They are, to some extent.

(2) H. C. asks: What degree of angularity can be given to a wedge of cast iron, finished smooth and thoroughly lubricated, without its being forced back by the compression of wood into which it is driven? A. It must not exceed twice the angle of friction between the wedge and the surface. An average value of the angle of friction is 5¾°, so that, for such a case, the angle of the wedge should not be greater than 11½°.

(3) T. J. A. & Co. ask: What is the process of cupellation? A. The principle depends upon the property which lead possesses of absorbing oxygen at a high temperature, and of forming with it an easily fusible oxide, which imparts oxygen with facility to all those metals which yield oxides which are not reducible by heat alone. Most of the oxides thus formed unite with the oxide of lead, and produce a fusible glass, which is easily absorbed by a porous crucible made of burnt bone, termed a cupel; while any silver that the mixture contains is left behind in a bright globule, which admits of being accurately weighed. The cupels are prepared from bone ash (burnt to whiteness, and ground to a fine powder), by moistening it with water; a suitable quantity of the mixture is placed in a mold, and the required form and coherence is given to it by the blow of a mallet or of a press; the cupels are allowed to dry thoroughly before they are used. The method of cupellation you can find described in any good book on chemistry.

(4) J. & D. N. say: You mention a large magnet, weighing half a tun, that can raise twenty times its weight. At what distance would a magnet of that strength, being stationary, draw another magnet of the same strength not stationary? A. We can give you no general rule for determining magnetic attraction of this description. Much depends upon the quantity of current flowing through the helices.

(5) G. W. S. says: I am running an engine, 12x24 inches stroke, with a common slide valve set to cut off ⅝ stroke, making, with throttle wide open, about 63 revolutions. If I shut my throttle to reduce the speed to about 55 or 56 revolutions, with no load on, I have no back lash, neither have I back lash when load is on; but as soon as load comes off, I have back lash, and in consequence I must slow down my engine. Why have I back lash without load, and none with? A. It appears probable, from your statement, that the governor does not control the engine properly; so that when the work is removed, the speed of the engine is changed. It would be impossible, however, for us to give a definite opinion without further knowledge of the situation.

(6) S. H. M. says: I have a small steam chest which is cracked near one of the bolt holes. What will make a perfect steam joint? The chest is of cast iron. A. If it cannot be brazed, you might apply a patch with tap bolts, either driving a rust joint or using a piece of sheet rubber for packing.

(7) H. F. R. asks: 1. What should be the thickness of shell for boiler of one horse power, to bear 135 lbs. with perfect safety? A. We have no idea of the size of a one horse power boiler. 2. What power would each of two engines give, the one 1¼x4 and the other 2x6 inches, with 100 lbs. boiler pressure? A. The power would depend upon the piston speed, which you have not stated: but you will find numerous rules in back numbers by which you can make the necessary calculations. 3. What are the addresses of the Cooper Institute and Cornell University? A. Cooper Institute, New York city; Cornell University, Ithaca, N. Y. The tuition is free at the Cooper Institute. By addressing the presidents of the institutions named, you can doubtless obtain full information in regard to their relative advantages. 4. Has there been any contrivance patented to light the gas in any part of a residence by electricity, each jet to light independently of all others, but all getting the spark from one battery? A. We think that something of this kind has been introduced. 5. Is there a portable forge made of boiler iron, arranged to use all the extra or lost heat to generate steam to run a small blower, or the steam from several such forges to drive a light steam hammer? A. We have never seen anything of the kind.

(8) B. asks: Will pine wood ignite by coming in contact with a pipe through which live steam is passing? A. Not unless the steam is greatly superheated.

(9) M. E. C. says: 1. I have a small boat with upright boiler two feet in diameter. I have 4 or 5 feet of common one inch iron dipe in the firebox, connected to the crown sheet and side of firebox, and of course there is a good circulation. A friend says that these pipes will burn out very quickly if I use the boat in salt water. Is this so? A. The pipes would soon burn out if scale were formed in them, which would be very likely to occur by the use of salt water. 2. If I wish to take this boat to Florida by inland navigation, would the boat have to be inspected? A. Yes. Apply to the inspector in your district.

(10) W. R. J. asks: Are there any Barker's centrifugal mills now in use? A. We believe there are some turbines constructed in such a manner that they are virtually Barker mills. They do not meet with much favor, however, since the Barker mill is by no means an efficient machine.

(11) A. H. C. asks: 1. At what power would you rate an engine that is 8 inches bore by 15 inches stroke, running at 120 revolutions a minute and using steam at 80 lbs.? A. About 12 horse power. 2. Do you think steam-riveted boilers are as good as hand-riveted? A. Yes, if a good machine is used. 3. Do you think double rivets along the side seams of a boiler make it any stronger? A. Yes.

(12) O'B. & D. asks: 1. What size of wire rope will be strong enough to draw 7,000 lbs. up an inclined plane of one foot rise in three? A. From ⅝ to ¾ of an inch in diameter. 2. Will the wire rope work satisfactorily on a wooden drum 15 inches in diameter? A. No. It would be better to make the diameter of the drum from 24 to 30 inches.

(13) C. D. says: On p. 36 of your current volume, it is stated, that five minutes before a certain explosion occurred, the water stood at 3 inches above the flues. By a long experience with steam boilers, I have become convinced that the water at such times is converted into foam, and entirely fills the boiler. Upon pressing the gage the water has the appearance of being flush, while in reality the boiler was nearly dry. A. We would be glad to receive some facts in corroboration of your statement.

(14) W. S. S. asks: How is burnishing done, with the use of a burnisher? A. By rubbing the tool rapidly over the work.

What kind of briar roots are pipes made of? A. They are made of knotty roots of the common heath, which is found abundantly in Europe, and to some extent in this country.

The cone pulley on my lathe has 3 sizes for change of speed, 2¾, 4¼, and 7¾ inches. I want to make a treadle wheel so that one band will suit the three sizes. What rule can I work by? A. We hope soon to publish a simple explanation of the method.

I wish to make some stamps for marking clothing. I have the printer's types, and I wish to make the impression of the types in something that I can run the old types in after being melted. What will answer? A. Plaster of Paris.

(15) W. L. asks: 1. Which will stand the greater pressure, a pipe one inch in diameter or a pipe six inches in diameter, provided both pipes are of the same material and of the same thickness? A. The former. 2. In a boiler with steam up, is the pressure greater or less below the water level than above? A. Greater.

(16) S. says: A train of cars is going round a curve. The outside wheel must go a greater distance than the inside one, yet they are geared together. Please explain it. A. If the wheels are not coned, one must slide. If the wheels are coned, the one on the outer rail will be larger than the other, so that it is possible there may be no slipping. Of course this can only occur when everything is rightly proportioned; and in general there is some slip even with coned wheels, though it is usually reduced by coning.

(17) G. G. C. says: I have a foot lathe on which the belt does not run true, but runs ¼ inch off of both large wheel and pulley wheel. Is this because the shaft and lathe bed are not parallel? A. It is either on that account or because the pulleys are not round or are not centered properly. You can make the adjustments, if required, by measurements.

(18) C. asks: Who first invented the dial steam gage, Eastman, Bourdon, or a German engineer? A. We believe that the Magdeburg gage was the first. Perhaps some of our readers have definite information on the subject.

(19) C. A. C. asks: 1. What can I use to fill up blow holes in some small steam cylinders, subjected to 100 lbs. pressure? A. Braze plugs in the holes. 2. Will a steel boiler be better than an iron one for a two horse engine? A. The steel boiler can be made lighter than an iron one of the same strength. We do not know that it would have any other advantage.

(20) D. E. B. asks: Can a common slide or rock valve be set to work expansively? A. Yes.

What were the seven wonders of the world? A. The pyramids of Egypt, the tomb of Mausolus, the temple of Diana, the walls and hanging gardens of Babylon, the Colossus of Rhodes, the statue of Jupiter, the watch tower built by Ptolemy.

(21) W. H. B. says: L. O. S. says that the same power will do the same work with a 60 inch as with a 30 inch saw. I do not see how it is possible for an equal power to move (through a log) a 60 inch saw. Of course the 60 inch has double the leverage from center to verge, consequently the power to drive such a saw successfully would do twice the work of the smaller saw. But I cannot see how he gets away with the short lever in favor of the small saw. Admitting the verge of each to travel at same speed, of course there must be an increase of speed only at the expense of power. A. In the case of the large saw, the pressure on the engine piston must be doubled, but the piston only moves half as fast.

(22) L. C. W. says: My water pipe, leading from main in street to house, is frozen. Some two or three hundred fellow townsmen are in the same fix. Some few have dug up the street and sidewalk and thawed the pipes out, but this is very expensive and difficult, owing to the frozen condition of the earth. Is there any plan by which they could be thawed out from the inside of the house? A. It can often be done by forcing steam into a pipe from a small boiler.

(23) G. A. McL. asks: What is agate, used for making buttons, etc.? A. It is a variegated chalcedony. It is supposed to have been formed by a deposit of silica from solutions intermittently supplied, and deriving their concentric waving courses from the irregularity in the rocky walls of the cavity in which they were formed. The colors are due to traces of organic matter, or of oxides of iron, manganese, or titanium.

(24) J. C. K. asks: What kind of a locomotive is the Fairlie narrow gage engine, with smoke stack at each end? Is the boiler solid throughout? A. Yes; it is all one boiler, and the two trucks, with the engines, are each pivoted so that they can swing.

(25) W. S. C. says: Can steam power be used in place of horse power in threshing wheat with the same machine? A. Yes.

If two boilers are supplying a third one with steam, will the third one have double the amount of pressure of the other two, or will steam be of equal pressure in all? A. The pressure will be equal in the three boilers.

How should a whiffletree be made so as to hitch 2 horses against one, giving equal advantage to all? My notion is that the middle hitch should be made so as to give the single horse ⅔ of the lever, and the 2 horses just ⅓ of it. Am I right? A. Yes.

Will pewter or lead do to make a cylinder head for a small steam engine 1x2 inches? A. Yes, but it will not be very serviceable.

(26) J. E. R. says: I have an 18 inch circular saw for sawing stove wood. I have it set to double the thickness of saw, and it is perfectly straight. I have run it at different speeds; yet when it is a few inches in the wood it blackens the wood on both sides, though I can see through all the time on either side. A. The bends in the teeth are probably too far from the point. Have the bend in the teeth on a true curve to the extreme cutting point, so that no part of the tooth can touch against the timber except the extreme cutting point, and you will obviate the trouble. The teeth of your saw probably wedge and bind in the kerf, about one third the length of the tooth from the point.—J. E. E., of Pa.

(27) E. F. F. asks: 1. What will be the effect of inserting teeth two gages thicker than the saw? Will not the teeth be likely to expand the saw more than the light teeth? A. If properly fitted, the thick teeth would have no more tendency to expand the saw than those of the same thickness as the saw plate. 2. Would such a saw stand to saw frozen beech, if the blade is properly hammered, using such teeth on ¾ or 1¼ feed? A. Such a saw, if properly made and kept in order, will stand to saw any kind of frozen timber. But in a saw for ordinary use, there is no advantage in having the teeth thicker than the plate of the saw at the rim.—J. E. E., of Pa.

(28) S. A. H. asks: With a column of water of a given hight, and a tube leading out from its base, turning up and opening at a level with the base, and all the proper conditions of free passage secured, to what hight, proportional to the columns, will the jet of water spurt? A. From 50 to 75 per cent.

(29) D. A. R. says: I want to make a magic lantern. I have two lenses 2¼ inches in diameter and of 8 inches focus. Will these do? A. Place a reflector and a light in the focus of the fixed condensing lens, then the slide in the focus of the objective, the latter in a sliding tube, both with plane side to light.

(30) T. M. says: I have seen a small battery consisting of two cells, with zincs 2x2 inches and ⅛ inch thick. The exciting fluid was sulphate of mercury. The cells were black. Are they made of rubber or carbon? A. They are probably carbon. Such cells and also positive plates are made of carbon deposited in gas retorts by the splitting-up of too highly heated hydrocarbons. In default of this, mix coke or charcoal powder with molasses to a stiff paste, mold, bake, and heat red hot.

Who sells second hand scientific books? A. Scientific books out of date are of but little value.

How can I grind and polish small lenses? I cannot get rid of the scratches in lenses of about 1 inch diameter. A. Repeat the fine grinding with emery that has been suspended in water one hour, then poured off and settled; repolish with rouge or putty powder treated in like manner.

Is there a practical way to transform motion into heat? A. Two flat iron disks rotating in opposite directions were found exceedingly wasteful of power.

(31) E. J. S. asks: What is the distance of Jupiter from the sun? A. Mean distance 475,692,000 miles.

(32) H. C. C. asks: What is the difference in bulk between 1 lb. gold and 1 lb. silver? What is the difference in value? A. These metals in our coinage contain $\frac{9}{10}$ of pure metal, alloyed with copper. It may be profitable for you to work out the answers yourself, from the following data: Value of 1 lb. of pure metal: Gold $301·45, silver $18·85. Weight of a cubic inch in lbs.: Gold 0·697, silver 0·381.

(33) W. B. C. says: On p. 36, vol. 32, you describe a new light invented by MM. Delachanal and Mermet, of Paris. The description is hardly full enough. You say: "The flask is filled with spongy fragments, which imbibe the carbon sulphide." Is the carbon sulphide the liquid bisulphide? 2. Do you understand that only a sufficient quantity of this liquid is applied to saturate the porous substance, or would a surplus in the bottom of the vessel be desirable? 3. Can you give a brief description of the St. Claire Deville apparatus and the Bunsen burner, as you understand them to be adapted in this case? A. In answer to these questions, we cannot do better than refer you to *Science Record* for 1875, p. 208.

1. Can you tell me how to stop the hissing noise made by the oxyhydrogen calcium light, when under heavy pressure? A. Slightly enlarge the opening at the orifice in the jet. 2. Would enlarging the orifice in either of the gas jets be equivalent (in effect of producing greater light) to putting heavier pressure upon the bags? A. It would simply tend to render incandescent a larger surface of the lime, with a corresponding decrease in the intensity of the light from each point of the heated surface.

(34) G. R. asks: How many times is an object increased in size when viewed through a magnifying glass of a power that increases the diameter 1,500 times? I contend that it is increased 2,250,000 times; my adversary says that it is only 1,761,150. A. You are right.

(35) N. R. H. asks: What preparation is used to stick gold leaf or powder to paper or cardboard, for book marks or illumination? A. Use the slightest possible touch of oil on the surface, and apply gold leaf. The powder is best applied by mixing it with size.

(36) C. M. says: I wish to make microscopic objectives of the following foci: 2, 1, ⅝, ¼, ⅛ inch. What should be their respective dimensions? A. Try the following formula for a 1½ inches, and let us know the result: Single front: Plano convex; radius of curvature 0·6 inch, thickness 0·2 inch, diameter 0·3 inch. Triplet: Diameter $\frac{3}{10}$ inch; composed of a plano convex front lens 0·9 inch radius, a double concave flint, radii 0·9 and 1·5 inches, and a double convex, radii 1·5 and 1·7 inches. Back lens: ⅝ inch diameter, plano convex, 2·7 inches radius. Convex lenses to be of a crown glass slide; the double concave to be flint (Chance's heavy glass).

(37) E. A. W. asks: Can a perspective drawing be reduced to a mechanical drawing? A. Not unless the object is represented in all its parts, and the proportion of all the parts given.

(38) E. L. asks: How can I remove the glaze from a cup, to make it porous for battery use? A. Porous cups can be bought for a few cents each from any dealer in telegraph supplies, and it will not be worth your while to make them by such a process as the one you enquire about.

(39) C. C. asks: How is zinc used as a substitute for lithographic stone? A. It is used exactly as the stone is. It is convenient to attach the zinc plate to a slab of stone or slate.

1. How is the wax removed from an electrotype after it is taken out of the battery? My object is to overcome the warping or twisting. A. Lift it off. The plumbago prevents adhesion. 2. What is used for filling or backing, lead or type metal? A. Either will do.

(40) L. W. F. says: I have made three good-looking violins, that sound harshly. I used soft pine for the top. Is this right? A. No. The purity of tone of a violin depends on the hardness and immutability of the wood of which it is made. Hence old violins are the most highly esteemed. Look about for some very old hard wood; it may sometimes be found when an old house is pulled down.

(41) J. W. asks: How can I prevent chickens from eating their own eggs? A. Fill an egg shell with pepper, and give it to them to practise on.

(42) J. C. R. asks: What is the best method of keeping chickens clean and free from vermin? A. Give them plenty of gravel and dry sand to rub themselves in.

(43) J. F. W. asks: How can I make shaving soap? A. Take genuine Naples soap 4 ozs., powdered Castile soap 2 ozs., honey 1 oz., essence of ambergris, oil of cassia, and oil of nutmegs, 5 or 6 drops each. Melt and mix. Smear the slightest portion of this soap on the chin, then use the shaving brush wet with cold water. Do not put water or the brush in the soap dish.

(44) J. B. S. asks: What can I use to polish ivory with? A. Ivory turned in a lathe is readily polished by applying its own dust to it.

(45) R. J. S. asks: What is the correct rule for ascertaining the size of a fly wheel for any given horse power of engine? A. Boulton and Watt give the following: Multiply 44,000 times the length of the stroke in feet by the square of the diameter of the cylinder in inches, and divide the product by the square of the number of revolutions per minute multiplied by the cube of the diameter of the fly wheel in feet. The quotient will be the sectional area of the rim in square inches.

(46) M. M. asks: How is the case-hardening compound mentioned on p. 150, vol. 32, applied? A. Mix the ingredients thoroughly and put the iron articles, red hot, in the powder, and leave till cold.

(47) R. & W. ask: How can we find the number of lbs. pressure obtainable from a wheel weighing 1,000 lbs., diameter 4 feet, velocity 100 revolutions per minute, geared 4 to 1, 5 to 1, 6 to 1, or 7 to 1? A. It would be difficult to obtain an accurate result in any other way than by making a few experiments, to get the necessary data.

(48) G. A. B. asks: From a post a gate is hung which extends horizontally 20 feet. In the center of the gate, or ten feet from the post, the gate has hinges, which allow one half of it to be opened without disturbing the half next to the post. Is the strain as great on the hinges of the post when one half of the gate is folded back so as to lie against the other half as when the whole gate is opened, that is, when the second half is in line with the first? A. The strain is the same in both cases, but the moment of the couple which is acting, and which represents the tendency to break the hinges, is twice as great when the gate is extended.

Can I get a film of copper on a piece of steel without a battery? A. Yes. Clean the steel and immerse it in a solution of sulphate of copper.

(49) J. S. M. asks: If a stick of timber is 20 feet long, 12 inches square at one end and 18 inches square at the other, and of a uniform taper throughout, what are the cubic contents of the stick? A. 31·66+cubic feet.

(50) E. D. F. says: Given the area and radius of a circular segment to find the hight of the segment. Is there any formula for finding this exactly? A. No.

If two iron balls, one 1 inch in diameter and the other 10 inches, are at the same instant dropped from an elevation of 100 feet above the earth, will both touch the ground at the same instant? A. The difference would not be essential; but the resistance of the air would affect the balls differently because the cross sections of the two balls are as the squares, while the weights are as the cubes, of the diameters.

(51) B. P. G. asks: Which is the best for a water pipe, lead or galvanized iron? A. We can recommend iron pipes, prepared with a coating of pitch.

(52) F. R. M. asks: How many degrees compose the angle $f\ h\ k$, making $f\ h\ k=a$, so that $\cot. a = \cot. 110° + \frac{1}{\sin. 20°}$? This formula is from Fairbairn's "Mills and Mill Work," part 1, p. 160. Are there any numbers, from 100° to 110°, and from 15° to 20°, that will produce, according to formula, 30° or nearly so for the angle $f\ h\ k$? If there be such numbers within these limits, please state them. A. You can readily work it out with a table of natural sines and tangents, by substituting proper values in the equation and solving it. It will be a good problem for some of our readers who are beginning the study of trigonometry.

(53) M. B. L. asks: How can steam be superheated in an ordinary flue boiler? A. You must attach a superheater. 2. What is the piston speed per minute in the fastest passenger locomotives? A. From 700 to 800 feet.

(54) F. M. A. asks: How can I prepare mucilage for office use? A. Make a concentrated solution of gum arabic in hot water, and add to it a little Blitter sulphate of quinine, which will effectually prevent it from molding. Only a very small quantity of the last named substance is necessary.

(55) P. McL. asks: How can I make molds with plaster of Paris? I have tried to do it, but they come out full of airholes. A. Use your plaster thinner when constructing the molds; and when ready to cast the metal, heat them nearly to the melting point of the metal; or thoroughly dry the mold and coat it with a solution of shellac in alcohol.

(56) H. & C. ask: 1. How can we make a strong thick paste for pasting sheets of brown paper together in large quantities? A. Melt together in an iron pot equal parts of common pitch and gutta percha. It is kept liquid under water, or solid, to be melted when wanted. 2. Which makes the strongest paste, starch or flour? A. Probably flour. 3. Is alum of any use in paste? A. Yes, to prevent its molding.

(57) H. J. M. says: 1. I find that if fully hydrated oxalic acid be suddenly heated to about 300°, it is resolved into carbonic dioxide, carbonic oxide, and formic acid. How can I separate the formic acid from the other two substances? A. Formic acid ($C_2H_2O_4$) is not known in the free state. Its hydrate, or what is generally known as formic acid, was originally obtained from red ants, and was named from that source. This may be obtained by immersing a glass retort or flask about one third filled with concentrated glycerin, in boiling water, and adding to the glycerin as much dry oxalic acid as it will cover. The mouth of the retort or flask should be connected with a receiver in such a manner that the formic acid distils over into the receiver, while the carbonic acid escapes. When it ceases to come over some fresh oxalic acid is put into the retort, and the process is repeated with the same portion of glycerin until enough acid has been collected. 2. How can I render the oxalic acid fully hydrated? A. What is commonly called oxalic acid is the hydrate required. The anhydrous acid is not known in a free state.

(58) D. C. asks: How can I bore an oblong hole 1x1⅝ inches and 1 inch deep in a block of malleable cast iron (having sides and bottom perfectly smooth) in an ordinary turning lathe? A. The conditions, as stated, are incompatible.

(59) C. W. asks: I have a steam boiler, hight 2 feet, diameter 1 foot, with a 2 inch flue through it. The head is made of cast iron ½ inch thick, the shell being of ¼ iron. What pressure will it stand with safety? A. About 80 lbs. per square inch.

(60) L. A. D. says: A. contends that a man born in 1800, and living now, would have lived in both the eighteenth and nineteenth centuries. B. contends that he would not. They will abide by your decision. A. B. is right.

(61) V. H. N. says: A turbine of about 3 inches diameter proper, purchased by us, behaved strangely. It was first located in the second story of a printing house, and water was conducted to it by a 3 inch pipe connected at a right angle to main in the street, then led 20 feet to cellar, thence at right angle to floor of second story (say 18 feet), thence at right angle to wheel (1 foot). A 3 inch pipe, connected to bottom of wheel, discharged water near point of entrance in cellar, having a siphon end to make it an exhaust tube. Under a few turns of valve (15 or more being required to open it entirely) it drove a ¼ medium and a ½ medium job presses, with power to spare. Now presuming the exhaust pipe to compensate for elevation to second story, the fall was 102 feet. It was removed up street, difference in elevation being 10 feet. A 3 inch supply pipe is connected with main in street at right angle, thence runs 130 feet to wheel in cellar, attachments being made to the pipe on the floor above. It gave scarcely any power, after repeated examination, until 13 out of 16 apertures in wheel were closed with wood; and with valve entirely open, it seems to give less power than the difference in elevation would justify. The water discharges right from the wheel into an open ditch. What is the cause? A. We judge, from your description, that increasing the length of pipe, and diminishing the elevation, cut down the head to a serious extent.

(62) M. U. asks: I have a steam engine 1⅜ inches bore x 3 inches stroke. What size should the feed pump be? A. You can make a plunger pump with same stroke as the engine, and diameter from $\frac{3}{16}$ to ¼ inch.

(63) W. B. says: 1. I have a small boiler 10 inches long with 5 two inch tubes half around a five inch flue. The tubes are connected with it by small pieces of pipe. The water is placed in the tubes and fire passes up between them and out at top. The tubes are ⅛ inch thick, and the ends are secured by a bolt. What would be a safe pressure? A. One of 150 or 175 lbs. per square inch, if the boiler is well constructed. 2. What size of engine ought it to run? A. One developing from ⅛ to ¼ a horse power.

(64) S. G. asks: 1. Will an engine of 2 inches bore and 4 inches stroke be powerful enough to run a foot lathe with 10 inch swing? A. Yes. 2. What size of boiler should I use? A. Give it from 8 to 10 square feet of efficient heating surface.

(65) M. E. C. says: Our engine is 16x30 inches, and makes 80 revolutions per minute. It is impossible to keep the journals cool. We have ample power. It would do the work with 20 or 30 lbs. of steam. A. The piston speed is not excessive, if the engine has large bearings and is in good adjustment, with the valves properly set and the parts in line. You may possibly find that the trouble occurs from a neglect of some of these details.

(66) E. R. C. asks: Can you give me some information as to using lead pipe for carrying steam underground? Will the expansion and contraction weaken the pipe? A. We have had no practical experience with the lead pipe for this purpose, but are inclined to think that it will answer very well. We would be glad to hear from any of our readers who have used it.

(67) E. W. P. asks: In an artesian well, 1,200 feet deep with 3½ inch bore, what flow of water per minute might be expected at a depth of 20 feet below the highest point to which water will rise in the pipe, conceding that the supply at the head is inexhaustible? A. We do not know of any method but experiment, applicable to such a case.

(68) J. W. says: I wish to build a small steamboat 35 feet long and 20 feet wide, without any upper work, save a frame and awning. Would a five horse engine do to drive it? A. The engine will answer very well. Use an upright tubular boiler. You will require a license. We could not answer your other question without more data.

(69) J. W. H. asks: What is the effect on air, as regards volume, of increasing the heat from say −20° to 80° Fah.? Does not the heat greatly increase the volume of air? A. If the volume is maintained constant, the pressure increases. If the pressure is maintained constant, the volume increases.

(70) C. S. asks: 1. Will it be safe to use condensed steam to feed the boiler with, and convert it into steam again? A. Yes. 2. Will the condensed steam be soft water? A. Yes.

(71) E. G. P. says: I have seen the bottom of small creeks coated over with ice, in shape corresponding with the shape of the gravel and small rocks on the bottom. I found it much more difficult to walk across the creek, from the unevenness of the bottom, than on clear ice on the surface. During this time there was no ice running on the surface. How is this? A. Very likely the water was frozen solid during the winter.

It is well known that heat and cold are antagonistic. Which of the two predominates? If all heat were annihilated, can the amount of cold be estimated? A. Heat and cold are only relative terms, so that a body could not be cold unless it had some heat. Were heat annihilated, we should reach the absolute zero of our temperature scale, and could take no more account of heat and cold.

(72) L. F. M. and others.—The square of the diameter (expressed in inches) is the number of square inches in a square which has the diameter for a side. It is also the number of circular inches in the circle (a circular inch being the area of a circle whose diameter is one inch). Hence, as a circular inch is about 0·7854 of a square inch, the square of the diameter multiplied by 0·7854 gives the number of square inches in the circle.

(73) W. S. C. asks: What is meant by a steam boiler priming? A. The boiler is said to prime when water is mingled with the steam.

An artesian well is said to be one bored to a stratum of water that will force itself up out of the well, and that the water will rise as high as the source of supply. How then can an artesian well deliver water higher than its source? A. It cannot, but the source of the water may be very distant. There are some artesian wells which are estimated to be more than 200 miles from the source of supply.

There is a kind of powder claimed to keep coal oil from exploding. Can that be done? A. No. The thing is a fraud.

Where does the supply of oxygen come from that we breathe? A. Animals exhale carbonic acid, which the plants require. The plants take the carbon and set free the oxygen.

(74) R. M. asks: I am building a small steam engine with a square cylinder, of $\frac{3}{16}$ wrought iron, to be bolted together. The bolts are to be 2 inches apart; the cylinder is 4 inches in the clear by 8 inches long. Would such a cylinder be as good as a round one? A. You will have difficulty in keeping the piston tight without excessive friction. You do not send enough data for the determination of the other points.

What will cut off the attraction of a lodestone from steel? A. It can sometimes be done by striking the bar, or bringing it under the influence of a more powerful magnet, and reversing the poles.

Is there a rule for telling how much lumber there is in a log? A. We do not know of any that is applicable in all cases.

(75) R. L. asks: What sized boiler, engine, and propeller would it take to run a boat 20 feet, long by 4 feet beam, and 3 feet depth of hold at 15 miles an hour, with steam at 60 lbs. pressure? A. The boat is too small to carry the machinery required for such a speed.

(76) J. V. asks: How can the area of a circle be equalized to that of an equilateral triangle? A. A side of the triangle is equal to 2·6942 times the radius of the circle.

Would a locomotive be able to run through a drift of wet snow 6 feet high and about 25 feet wide? A. Some engines are powerful enough.

What is an easy process of testing gold and silver? A. They can be treated in solution by various substances, when they will give characteristic precipitates. Consult a good work on chemistry.

(77) H. A. J. asks: What will remove a kerosene stain from a carpet without injuring the colors? A. Try benzine.

(78) G. W. H. says: 1. I am making a small oscillating engine, cylinder of 3 inches diameter and 6 inches stroke. Would it do to run an ordinary rowboat? A. Yes. 2. What kind of propeller wheel should I use? A. One of 2 feet diameter and 3 feet pitch. 3. Would a boiler 2 feet in diameter by 3 feet high be large enough to run it at 7 miles an hour? A. No.

(79) D. H. asks: 1. In testing a boiler with cold water through a rubber hose, does the hose sustain the same pressure per square inch as the boiler? A. Yes. 2. If the entrance to the boiler is smaller than the hose, will the hose have to stand the same pressure as the boiler? A. Yes.

(80) D. H. M. asks: What is the process of oil tempering tools for cutting wood, such as planer knives, chisels, etc.? A. Heat them red hot, and quench them right out in oil.

(81) J. H. F. asks: 1. What kind of clay do artists use for modeling? A. The material used in modeling is common potter's clay of the best quality, made so wet that a mass of it will not stand an inch higher than its own width without support. 2. Is modeling done by the hand or trowel? A. Modeling tools are either loops of wire of different sizes fixed in wooden handles, or various shaped pieces of ebony or boxwood. Both are to be considered merely as occasional aids to the fingers, or to be used in portions of the work which cannot be reached by the fingers.

(82) J. M. asks: 1. How can I give paraffin a fine red color? A. By the application of magenta and stearic acid, to the purified paraffin, a most beautiful rose color is obtained. 2. How can I perfume paraffin? A. We can give you no recipe for the purpose.

(83) J. G. asks: How are red and green lights made for use in tableaux? A. Red fire is made by using 61 per cent chlorate of potash, 16 of sulphur, and 23 of carbonate of strontia. Green fire, 61 per cent nitrate of baryta, 22 sulphur, and 18 chlorate of potassa.

(84) M. M. & Co. say: There is a person here who proposes to sell a recipe for causing 50 gallons of water to mix with 50 gallons of lard oil, thereby doubling the quantity and not deteriorating the value of the oil for lubricating purposes. Is this a fraud? A. Yes. We know of no chemical which will impart such properties to water.

(85) H. J. asks: 1. Are green paper hangings, that have been on the wall four or five years poisonous? A. Very probably. 2. Is the gas arising from coals taken from a stove as poisonous as that arising from burning charcoal in a room? A. Yes, if the gas given off is of equal amount. 3. In a recent article in your paper, you stated that kerosene oil barrels were poisonous. Is refined kerosene poisonous? A. It is injurious if taken in large quantities.

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

M. A. P.—The brilliant metallic particles are copper pyrites; they are imbedded in an impure quartzose rock.—T. A. H.—It is a rock, composed of quartz and mica.—E. W. S.—The sand is made up mostly of pure white quartz sand, and the bright shining appearance is due to little scales of mica. It can be employed where a fine white sand is needed.—O. H. P.—It is sulphuret of iron.—A box, directed to Rev. L. S. Bacon, contained red argillaceous (clay) shale, containing sufficient red oxide of iron to make it appear like an iron ore, but not enough to make it fit for working. When shale of this character gives a good color on grinding, it is sometimes used as a coarse paint.

A. B. asks: What is the material used in the manufacture of corduroy, which gives that fabric so disagreeable an odor whenever it is wet? —H. S. asks: Is there a good and speedy dryer for lithographic ink?—C. H. U. asks: How is the black stain and finish, similar to that used on lead pencils, made?—W. asks: How can I make rice paper?—L. K. Y. asks: In what way can I plug up screw holes in finished work, so the plugs will not show? —J. E. M. asks: What will keep sumac or bark liquor from souring in warm weather?—J. W. B. asks: How can I bleach yellow paraffin?—E. L. asks: How can I make a preparation for coloring eggs blue, red, and yellow?—J. W. asks: Is there a cheap mode of soldering or otherwise making a tight joint on black sheet iron pails?—J. N. P. says: I have some books that got very badly smoked from being in a burning house; the insides are not burnt, but the backs and edges of the leaves are very black. What can I do to take it off?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a Ride on a Locomotive. By G. M. G.
On the Patrons of Husbandry. By W. R. S.
On Chemical Telegraphy. By G. L.
On Rubber Ligatures. By R. B. M.
On Telegraph Alphabets. By J. M.
On Boiler Explosions. By T. F. T.
On Squaring Numbers. By F. C.
On Cleansing Dirt from the Hands. By B. F. R.
On Steam Climbers. By W. E. S.
On Frozen Water Mains. By A. C., by W. T. F., and by F. T.
On Polarity of Water. By J. T.
On Flies. By C. T.
On Kaolin. By G. B.
On Talking Ants. By R. A. H.
On Flying Moths. By J. S.
On Finding the Meridian. By J. A. M., and by C.

Also enquiries and answers from the following:

E. E.—F. F. A.—J. T.—J. M. S.—A. G.—R.—T. L.—A. A. P.—J. D. M.—W. L. S.—D. L. B.—W. P.—A. S.—T. A. B.—O. G. S.—W. H.—W. W. H.—S. N. M.—J. H. P.—A. S. G.—S. B.—E. R. H.—J. L. B.—A. G.—R.—H. C. W.—H. O. T.—E. J. E.—T. H. N.—J. C. G.—A. R. L.—G.—J. C. B.—H. T. B.—A. Y.—R. E. M.—S. & S.—J. M.—L. D.—A. F.—S. A. T.—W. M.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who makes firemen's respirators, invented and described by Professor Tyndall? Who makes the best ten horse engine for a sawmill? Who makes a lathe for turning wooden bowls? What is the price of galvanized iron water pipe? Who sells machines for sandpapering wooden rollers? Who sells sash holders that are efficient substitutes for sash weights? Who makes the best dynamometers? Who sells dentist's diamond drills? Whose is the best mode of drying lumber? Who sells an icebox constructed on scientific principles? Where can seeds of *arundo arenaria* be obtained? Who sells machines for turning croquet balls? Is there a glass bead factory in the United States? Who sells diamond drills? Who sells the most economical steam boiler? How small are hydraulic motors made? Who can give particulars as to drying lumber by steam? Who makes a spiral spring that will sustain 500 lbs.?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week ending March 16, 1875, AND EACH BEARING THAT DATE.

(Those marked (r) are reissued patents.)

Acid, obtaining boracic, F. Formhals	160,761
Advertising medium, C. H. and H. F. Torsch	160,971
Air compressor, relief, G. H. Reynolds	160,956
Alarm, burglar, M. E. Lasher	160,918
Alloy, bronze, S. Doubleday	160,885
Anatomical specimens, jar for, J. M. Maris	160,926
Anvils, casting steel-faced, J. Donovan	160,816
Atomizer, C. Weed	160,802
Awning, C. J. Trumper	160,978
Bag, rubber coated, W. D. Grimshaw	160,897
Barrel barrow, J. H. Brown	160,810
Barrel crozing machine, Steel and Munson	160,966
Bed bottom, P. C. Ingersoll	160,913
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Vegetable washer, J. Brooks	160,870
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Wash benches, F. and M. Way	160,977, 160,978
Washing goods in the piece, C. J. Barker	160,743
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Wood, apparatus for preserving, G. B. Smith	160,846
Wrench, J. L. Whipple	160,981
Wrench, pipe, H. Otto	160,946

DESIGNS PATENTED.

8,206.—AQUARIUMS.—J. W. Fiske, New York city.
8,207.—MUSTARD BOTTLE.—J. Gulden, New York city.
8,208.—CARPET.—A. Heald, Philadelphia, Pa.
8,209.—GAUNTLET.—B. G. Shults, Johnstown, N. Y.
8,210.—PERFUME BOTTLE.—G. Storm, Philadelphia, Pa.

TRADE MARKS REGISTERED.

2,287.—PERFUMERY.—W. B. Dorman, Georgetown, Mass.
2,288.—COOK STOVE.—M. L. Filley, Lansingburg N. Y.
2,289.—MEDICINE.—B. Gorrell, Hopewell, Md.
2,290.—CIGARS.—Harned & Co., Brooklyn, N. Y.
2,291.—MEDICINE.—Henry & Co., New York city.
2,292.—FLOUR.—T. C. Jenkins, Pittsburgh, Pa.
2,293.—PRONG HOES.—Reisig *et al.*, New Castle, N. Y.
2,294.—CIGARS.—A. Schuneman & Co., Detroit, Mich.
2,295.—OILS.—W. C. Stiles, Jr., Volcano, W. Va.
2,296.—SOAP.—Kendall M'f'g Co., Providence, R. I.
2,297.—EXTREMETS.—Underwood & Co., Boston, Mass.
2,298.—BURNING FLUID.—B. A. Rose, Urbana, Ohio.
2,299.—LINIMENT.—E. Mastman, St. Louis, Mo.
2,300.—FERTILIZERS.—Patapsco Guano Co., Baltimore, Md.
2,301.—DYEING CHEMICAL.—Weeks *et al.*, Boston, Mass.

APPLICATION FOR EXTENSION.

11,385.—WATER WHEEL.—J. Haseltine, Boston, Mass.

SCHEDULE OF PATENT FEES.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,
MARCH 12 to 19, 1875.

4,487.—P. Mayrand, Gentilly, P. Q. Wood splitting machine. March 12, 1875.
4,488.—G. R. Edwards, Galena, Ill., U. S., *et al.* Safety whiffletree. March 12, 1875.
4,489.—J. B. Havs, New Orleans, La., U. S. Treatment of cod liver oil. March 12, 1875.
4,490.—J. S. Garner, Galena, Ill., U. S. Wash boards. March 12, 1875.
4,491.—J. A. Lakin, Westfield, Mass., U. S. Overdraw bar check. March 12, 1875.
4,492.—H. B. and E. W. Rathbun, Mill Point, Ont., *et al.* Barrel heading cutter. March 12, 1875.
4,493.—C. C. Roe, Hamilton, Ont. Machine belt buckle. March 15, 1875.
4,494.—C. I. Corbin, East Oxford, Ont. Extension of 287. Rake. March 15, 1875.
4,495.—M. Pettingill, Minneapolis, Minn., U. S. Car coupling. March 15, 1875.
4,496.—E. L. Howard, Boston, Mass., U. S. Fagotting attachment to sewing machines. March 15, 1875.
4,497.—C. F. Ritchel, Corry, Pa., U. S. Brush block boring machine. March 15, 1875.
4,498.—L. Coté, St. Hyacinthe, P. Q. Forming stiffeners for boots. March 15, 1875.
4,499.—J. S. Anderson, Flintville, Wis., U. S. Wash boiler. March 15, 1875.
4,500.—R. Paradis, St. Hyacinthe, P. Q. Shingle machine. March 15, 1875.
4,501.—T. Richardson *et al.*, Fergus, Ont. Gang plow. March 15, 1875.
4,502.—J. K. Feick, Berlin, Ont. Felt boot tree. March 16, 1875.
4,503.—G. Houlton, St. Andrews, N. B., *et al.* Car axle boxes. March 16, 1875.
4,504.—W. R. Close, Bangor, Me., U. S. Friction catch wheel. March 16, 1875.
4,505.—J. Collins, Montreal, P. Q. Bag tie and fastener. March 16, 1875.
4,506.—J. C. Peacock, Finsbury, London, England. Non-conductor of heat. March 16, 1875.
4,507.—J. F. Williams, Niagara, Ont. Extension of 289. Lever buckle. March 17, 1875.
4,508.—L. J. House *et al.*, Stanstead, P. Q. Stump extractor and stone puller. March 18, 1875.
4,509.—C. C. Jones, Fredericton, N. B. Combination barrel pump. March 18, 1875.
4,510.—S. E. Foster, Minneapolis, Minn., U. S. Vehicle spring. March 18, 1875.
4,511.—F. G. White, Ottawa, Ont. Artificial honey. March 19, 1875.
4,512.—J. M. Mehag, Montreal, P. Q. Wedge valve. March 19, 1875.

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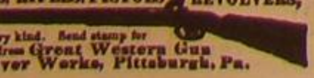

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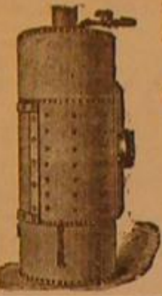

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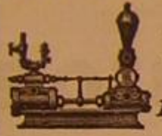

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