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THE GILBERT ELEVATED RAILWAY.

In continuation of our promised series of articles on the means of rapid transit adopted in New York City (the first of which, on the New York Elevated Railway, appeared in our issue of January 12), we this week place before our readers engravings and a detailed description of the manner of construction of the new aërial line, known as the Gilbert Elevated Railway. Viewed simply as an engineering work, this structure does not present features of special originality or ingenuity. It is little more than an iron bridge as lightly built as is compatible with due strength, and entirely devoid of anything which would lead it to be regarded as ornamental. On the contrary, the reverse object, of making it as unobtrusive as possible, seems to have been sought—a questionable measure, under the circumstances, we think, for the obscuring of the lower stories of property in the narrow streets was inevitable, according to the essentials of the plan, and in the form of a light, gracefully arched structure along wide thoroughfares, it would have been much more pleasing to the eye. As it is now, the aspect strikes one indifferently, either as that of an interminable bridge, or as an immensely long tunnel, according to the position from which the observer takes his view.

Neither do we present this railway in detail to our readers from any conviction that it is a work of major public benefit. On the contrary, while almost any system of rapid transit is likely to supply public wants in some good measure, yet we have always regarded the elevated railway conducted through streets as one of the least advantageous modes of meeting the need. Aërial lines led through the blocks are for many reasons—the chief of which is the imperative necessity which we believe exists in a great growing city like the metropolis of keeping the thoroughfares, the arteries of business traffic, unimpeded—greatly to be preferred, and the advantages of subterranean routes have been fully demonstrated to exceed those of all other projects. But the elevated system, having found public favor, is now an accomplished fact. It exists; it is a new undertaking, an interesting subject for examination and comment, and hence we present it. The engravings on our initial page exhibit it in Sixth avenue, where it is least objectionable as directly affecting property; and in two of the smaller streets, where, as can plainly be seen, it acts as a screen to light and air, and in consequence has reacted disastrously on the value of the real estate in its vicinity. As regards the circumstances attending its inception, it will suffice to say that the plan came into competition with many other ones—several of which were better—which were proposed with the same object; that the Act incorporating the Gilbert Elevated Railway Company (so named after the projector of the system, Dr. Rufus H. Gilbert) was passed by the New York Legislature on June 17, 1872. Work was begun in March, 1876, but the injured property-owners and others stopped it by appeals to the courts until last October, when the final decisions, which we noted at the time, were rendered, injunctions were dissolved, and active operations were resumed.

The distinctive features of the project are that the railway tracks are supported by two rows of columns above the middle of the street, thus carrying the tracks as far as possible from the buildings on either side. The sustaining columns are connected by lattice girders, which will interfere little with vision, and will admit also of the ties being removed for repairs. At certain times of the day the travel will be mainly one way, so that if a car should break down, the obstruction may be moved upon the least used track and taken to a siding without interfering long with travel.

The stations will be built of corrugated iron, and at intervals of half a mile, and usually at the intersections of cross streets. The platform will be covered, and long enough to load and unload four or five cars at a time, because the exchange of passengers must be made in half a minute. The locomotive engines will be of special design, weighing not less than fifteen tons. The speed will be

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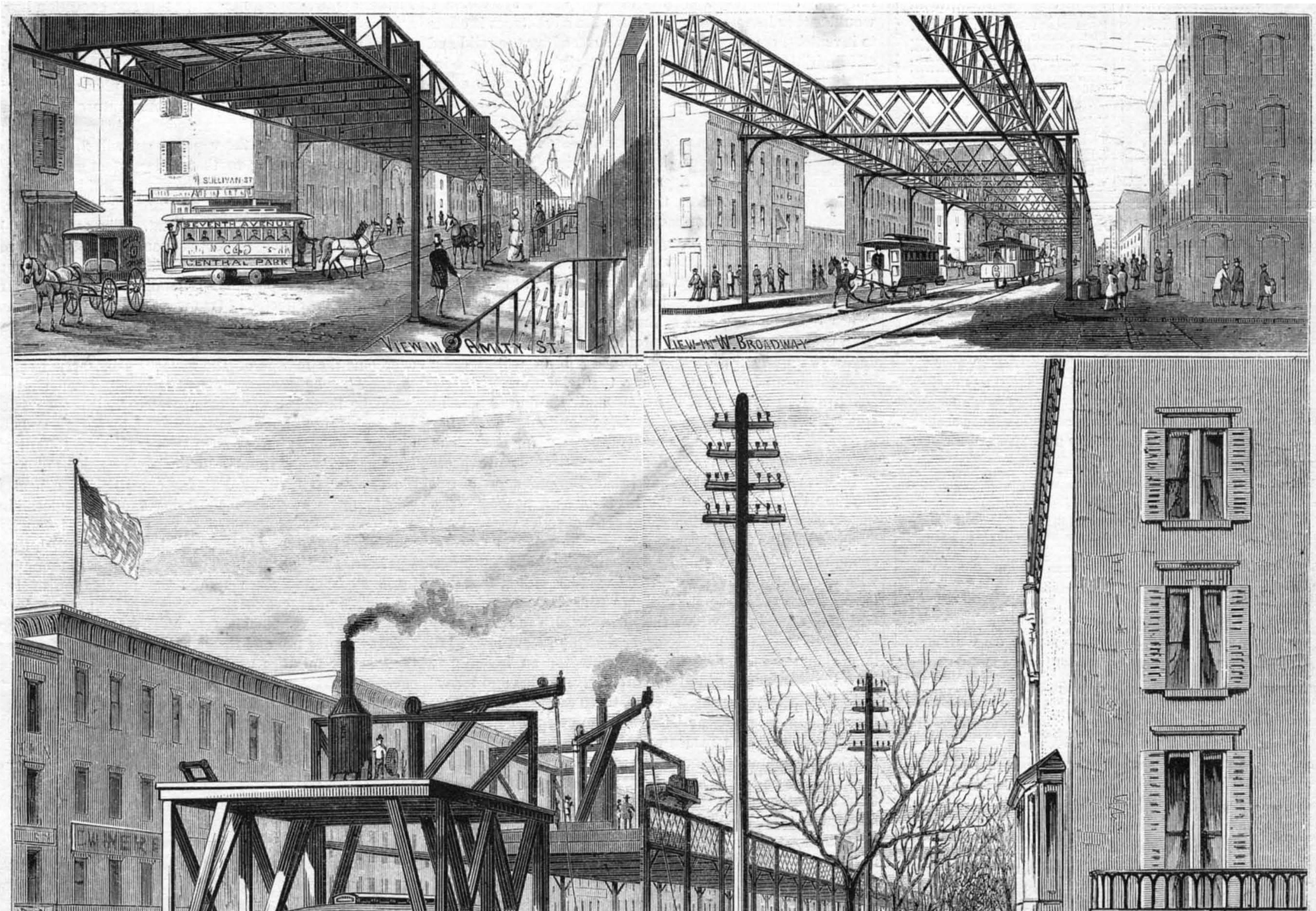

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A THREE SIDED QUESTION.

Since there are three measurably distinct, and in some respects opposing, interests involved in the question of patent rights, there are naturally not less than three independent ways of regarding them. And it is equally natural that these opposing interests should now and then meet in open conflict.

There is first to be considered the interest of the community at large. Next in influence, though not in right, must be ranked the manufacturers and special users of inventions, such as railway companies and other great commercial or industrial corporations. Last in power, though first in beneficence, are the men of fertile brains and skillful hands to whom the world owes so much of its wealth, comfort, and civilization—the inventors.

The practical wisdom of the Fathers of our Republic was in no way more strikingly manifested than in their appreciation of the value of inventions. A new land gave rise to new necessities, and the prosperity of the country largely hinged upon the promptness and skill with which those necessities should be met. Accordingly they set a premium upon invention, and took pains to secure to inventors, at little cost, a property-right in the fruits of their creative genius.

The history of industrial and social progress in this country amply demonstrates the wisdom of the course adopted. Under a hundred years of encouragement, the inventors of the United States have added more to the power and prosperity of mankind than all the rest of the world during unnumbered antecedent ages. And that no peculiarity of race, or situation, or needs is to be credited with this rapid advancement in wealth and power is evident from the single circumstance that the same race, and other races of like development, have been colonizing new lands and creating new nationalities ever since history began. Other nations have been free; other nations have conquered wildernesses; other nations have built up great empires under new conditions. But no other nation ever offered such encouragement to invention, and in no other has invention progressed with such marvelous rapidity. Very naturally therefore the sound common sense of our people, notwithstanding the specious special pleading of doctrinaires and corporation lawyers, thoroughly approves of our patent system, and would rather increase than diminish the advantages it offers to inventors, confident that the evils attending the mild and self-limiting monopolies which patent rights create are insignificant compared with the enormous benefits the country has reaped and daily reaps from the privileges so conferred. Inasmuch as the normal and practical tendency of invention is to benefit the community—by improving and cheapening manufactures, by multiplying and bringing within easy reach of all a greater number and variety of articles of use and comfort, thus widening the scope and enjoyment of life—the community is necessarily bound to favor inventors and encourage their activity.

Not so the second class we have named. To them new inventions are not altogether beneficial. They have an enormous property interest in old inventions. Their profit comes from making and selling articles already in use, or from using processes already profitably applied. Every new device or improved process, particularly if of a high order of merit, is an immediate injury to them, unless they are free to appropriate it. It is a new and winning rival. To compete with it in open market is to invite defeat. They must either better the improvement, or pay for the use of it; and either alternative subjects them to trouble or expense or both together. What wonder, then, that not a few of this class are disposed to treat the inventor as a poacher upon their preserves; an interloper, not content to let well enough alone; a restless, troublesome fellow, who might be useful enough provided he would be controlled by them, but otherwise a very costly nuisance. What wonder, either, that they have a horror of *new* patent rights (they have less fault to find with those upon which their own wealth and prosperity have been founded), and are eager that the patent laws shall be so changed as to make it impossible for an inventor to keep them from enjoying the fruits of his genius and labor!

As for the last mentioned class, there can be no question that their interests lie, not less than those of the community at large, with those measures which secure to them the utmost freedom and encouragement consistent with the common rights of all: this as a right, not as a gratuity. More than any other class the inventors are the mainspring of modern material civilization. Unlike other producers, their contributions to the public wealth are actual creations. But in its first and essential condition the creation of the inventor is intangible. Not until it is translated into material form, and so brought to bear upon the physical and commercial realities of life, can it bring wealth to him; and then only in case he has the right to control it. To insure this translation and the consequent benefit to the community, the theory of our patent system has been that it is necessary to offer the inventor some assurance of property-right in the fruits of his invention: and the practical working of the system has amply demonstrated the correctness of the theory. The temporary monopoly which the patent right grants to the inventor has unquestionably secured the practical application of myriads of useful ideas which would otherwise have died with the minds which harbored them, or still more speedily have passed into the oblivion of forgetfulness; while the temporary restraints which such monopolies have imposed upon others, and the public disadvantages incident thereto, have been infinitely outweighed by the preponderance of the system's good effects.

The recent history of the civilized world has shown the greatest progress to be coincident with the greatest encouragement of invention. To withdraw the direct results of such encouragement, in the past, would be to take away four fifths of our power as a people, four fifths of all that we specially prize and delight in, four fifths of all that goes to make modern civilization higher, more enjoyable, more secure, and more promising for future good, than any that has gone before it: and what has proved so beneficial in the past is not likely to prove less so in the future.

It is a serious question, therefore, whether our legislators shall be allowed to withdraw, at the instance of the short-sighted selfishness of special classes, any portion of the protection and encouragement which our inventors have hitherto enjoyed. To recur to a figure already used, the country cannot afford to break, or even weaken, the mainspring of its material progress.

THE LIQUEFACTION OF AIR AND ALL THE PERMANENT GASES.

Matter exists in the three forms, solid, liquid, and gaseous, and is in all these states supposed to consist of molecules which are never at rest but which always possess a movement or vibration of their own. In the solid state the molecules vibrate about fixed positions from which they are prevented by the force of cohesion from departing, and which movement does not interfere with the shape of the body. In liquids the fixed positions are absent, and the molecules while still affected by the force of cohesion are free to move and rotate about themselves. In gases the molecules are altogether freed from their mutual attraction and follow the ordinary laws of motion. When they meet they repel each other, and thus a gas will expand indefinitely unless inclosed in an envelope.

Under certain conditions of heat all substances in nature are capable of assuming these states. When heat is imparted to a solid the motion of the molecules is accelerated until the limit of such motion is reached, which allows the body to remain in solid form. Further elevation of temperature determines the passage of the substance to the liquid form, and ultimately to the gaseous state. Still further application of heat after this last condition has been assumed increases the velocity of molecular motion, and causes the molecules, if in a closed vessel, to resist greater pressure, or under the same pressure to resist that pressure over a greater area; hence follows the phenomenon of the expansion of gases. Now, if the temperature be indefinitely raised or the volume of space indefinitely increased under a constant temperature, the vapor or gas will finally approach a state corresponding to that of a perfect gas, that is, one which possesses the condition of perfect fluid elasticity and presenting under a constant pressure a uniform rate of expansion for equal increments of heat. The conditions, however, of an absolutely perfect gas cannot be attained, because all gases change their physical state when the molecular movement of their particles is modified. And this modification may be effected in two ways. First we may reverse the operation above detailed and abstract heat, producing just the reverse result to that noted, or, second, we may overcome the motion of the molecules by actual compression. That by these means presumably permanent gases could be liquefied was demonstrated by Faraday in 1823, but he is said to have been anticipated by Monge and Clouet in the condensation of sulphurous acid in 1800, and by Northmore, who liquefied chlorine in 1805. The simple apparatus used by Faraday consisted of a bent glass tube having a long and a short leg at right angles. In the open end of the longer portion was placed a substance from which gas could be obtained by heat, after which the tube was hermetically sealed. The shorter leg was then plunged into a freezing mixture and by the application of heat to the long leg large quantities of gas were produced which through being confined in very small compass was subjected to its own pressure and to the reduction of temperature by the freezing mixture until finally the liquid form was assumed. Faraday in this manner liquefied chlorine and several other gases supposed to be permanent, and demonstrated the truth that between vapor and gas, the one being transformable into liquid, the other not, no difference exists, or, more broadly, that the three states of matter, liquid, solid, and gaseous, are not specific to any form of matter, but solely depend upon the mode of motion of the molecules of the substance.

A few weeks ago, to have stated this law thus broadly would have been to neglect an apparently very important exception, namely, that six gases had persistently refused to be governed by it; and although, theoretically, it was impossible to except them, still, practically, the ingenuity of chemists and physicists had failed in all attempts to reduce them to actual conformity to the law. Six gases—hydrogen, oxygen, nitrogen, nitric oxide, marsh gas, and carbonic oxide—had resisted all efforts to liquefy them. Records of tests of this kind are not wanting; and among the most elaborate experiments are those made by Dr. Andrews, and described by him before the British Association in 1861. He used the elastic force of the gases evolved in the electrolysis of water as the compressing agent, and subsequently mechanical means. The gases were compressed in capillary tubes and then subjected to the cold produced by the carbonic acid and ether bath. Atmospheric air was compressed by pressure alone to $\frac{1}{371}$ of its original volume, and by the united action of pressure and a temperature of —106° Fah. to $\frac{1}{675}$, in which state its density was little inferior to that of water. Oxygen was reduced to $\frac{1}{324}$ of its volume by pressure, and by pressure and cold to $\frac{1}{554}$; hydrogen by cold and pressure to $\frac{1}{278}$; carbonic oxide by same to $\frac{1}{278}$; and nitric oxide to $\frac{1}{680}$. Yet it is stated that none of these gases exhibited any appearance of liquefaction. Berthelot also made experiments in the same direction in 1850, and, by means of the expansion of mercury, subjected oxygen, nitric oxide, and carbonic oxide to immense pressures. He concludes "that pressure alone is not capable of effecting the liquefaction of gases under certain conditions of temperature," but suggests that better results may possibly be obtained by the aid of powerful refrigeration. Natterer of Vienna has also made valuable experiments in the same line.

Within the last few weeks the problem which for more than half a century has defied all experimenters has been solved. Almost simultaneously, yet by different methods, the liquefaction of the supposed permanent gases has been accomplished by Raoul Pictet, of German Switzerland, and M. Cailletet, in Paris. M. Cailletet's apparatus consists of a massive steel cylinder with two openings, through one of which hydraulic pressure is communicated. A very strong small tube passes through the other and is inclosed in a freezing mixture. It opens within the cylinder into a second smaller cylinder serving as a reservoir for the gas to be compressed. The remaining space in the large cylinder is occupied by mercury. The gas is compressed into the small tube and then suddenly placed in communication with the atmosphere, when its expansion causes its intense refrigeration.

The original announcement of M. Pictet's discovery is given in another column. The following details are given in *Nature:*

M. Pictet uses four vacuum and force pumps, similar to those used for making ice in his ice machine (which we recently illustrated), driven by an engine of 15 horse power. Two of these are employed in procuring a reduction of temperature in a tube about four feet long containing sulphurous acid. With the pumps at full work there is a nearly perfect vacuum over the liquid and the temperature falls to —85° or —94° Fah. M. Pictet uses this sulphurous acid to cool the carbonic acid after compression, as water is used to cool the sulphurous acid after compression. This is managed as follows: In the tube thus filled with liquid sulphurous acid at a temperature of —76° Fah. there is another central one of the same length but naturally of smaller diameter. This central tube M. Pictet fills with liquid carbonic acid at a pressure of four or six atmospheres. This is then let into another tube 12·8 feet long and 1·2 inch in diameter. When thus filled the liquid is next reduced to the solid form and a temperature of —220° Fah., the extraction of heat being effected as before by the pump.

Now it is the turn of the oxygen. Just as the tube containing carbonic acid was placed in the tube containing sulphurous acid, so is a tube containing oxygen inserted in the long glass tube containing the now solidified carbonic acid. One end of this tube is connected with a strong shell containing chlorate of potash; the other end is furnished with a stop-cock.

When the tube was as cold as its surroundings, heat was applied to the chlorate, and a pressure of 500 atmospheres was registered; this descended to 320. The stop-cock was then opened, and a liquid shot out with violence. Pieces of lighted wood held in this stream spontaneously inflamed with tremendous violence.

M. Cailletet first introduced pure nitrogen gas into the apparatus. Under a pressure of 200 atmospheres the tube was opened, and a number of drops of liquid nitrogen were formed. Hydrogen was next experimented with, and this, the lightest and most difficult of all gases, was reduced to the form of a mist at 280 atmospheres. The degree of cold attained by the sudden release of these compressed gases is scarcely conceivable. The physicists present at the experiment estimated it at —508° Fah.

Although oxygen and nitrogen had both been liquefied, it was deemed of interest to carry out the process with air, and the apparatus was filled with the latter, carefully dried and freed from carbonic acid. The experiment yielded the same result. On opening the tube a stream of *liquid air* issued from it resembling the fine jets forced from our modern perfume bottles.

M. Cailletet reports the liquefaction of nitric oxide at 146 atmospheres, and at +12° Fah.; the details relative to the other gases are not yet at hand.

The discoveries of MM. Pictet and Cailletet are of the highest importance, both as adding still further confirmation to the dynamic theory of heat, and as opening the way to new studies into the nature of our atmosphere. They will also tend to induce further examination into Professor Graham's inference of the existence of hydrogen in solid form—a substance which he named hydrogenium—believed to exist in an alloy with palladium, and the density of which he calculates to be 0·733. As it appears clearly from the records of the experiments now at hand that refrigeration—as Berthelot predicted—has more to do with liquefaction than compression, it would seem possible to find a limit for our atmosphere, which could not exist in gaseous form if suddenly dispersed in planetary space. The idea is suggested that a boundary may exist at which, through the intense cold, air is always liquefying, falling, revaporizing, and thus a circulation is constantly taking place.

WHILE this winter may yet be very cold, Professor Smyth's predictions to that effect thus far are hardly verified.

MYSTERIOUS EXPLOSIONS.

A singular explosion occurred in a candy manufactory in this city about a month ago. We adverted to this last week, giving a correspondent's theory, and pointing out that fire officials and other authorities had reached no definite conclusion as to its cause. Investigation as to the inflammable or explosive material in the manufactory has shown that there was chlorate of potash, a small amount of fulminate, used for the making of snap crackers, and a large quantity of starch, from which material moulds are made for candy. These moulds, it appears, after being charged with syrup, are put in a drying room, which is highly heated. And it is stated that in previous fires in candy manufactories, when the flames have reached this room, explosions have occurred. Starch also was probably present in several of the work rooms in the form of fine dust, owing to its being used in this condition in some of the manufacturing processes,

It seems to us that here are quite sufficient data to base a reasonable theory as to the cause of the catastrophe. It may be assumed that accidental conditions were such as to ignite the chlorate of potash or the fulminate, which last would explode with terrific violence, and that thereby the powdered starch in the rooms became fired and also exploded; or the circumstances may be reversed, as it is quite as reasonable to suppose that the starch, being highly explosive in its comminuted state, blew up first, constituting the major explosion, which subsequently involved the chemicals. The examination of the details of many other mysterious explosions fortifies us in the belief that the finely pulverized starch lies at the bottom of this one.

Two years ago just such a casualty occurred in the Pullman Car Works at Detroit. There all the sawdust and shavings from the wood-working machines were taken by exhaust blast into a pipe and forced to the furnaces, where they were consumed. When it was not desired to direct the material into the furnace, communication therewith was closed and a grating prevented the escape of the dust, etc. from the cupola in the roof, to which it was conducted. While cleaning this receptacle the workmen discovered its contents to be on fire, sparks having been drawn in from the furnace. A stream of water was thrown in, but the instant this was done a tremendous explosion ensued, killing 13 men and destroying the adjacent portions of the building. Two months prior to this casualty a similar one occurred at the works of the Milburn Wagon Company at Toledo, where the fine wood dust in a shaft exploded, causing extensive destruction.

Much further evidence can be adduced to show that just as ordinary illuminating gas is liable to explode when mixed with air in the right proportion, so will the dust of any inflammable material. A sawdust explosion occurred four years ago in the town hall of Friedele, Germany. At the Ofen-Pesth (Austria) steam mill a terrific explosion was caused by a cloud of dust of some very fine varieties of flour being ignited by a candle. In 1872, at Glasgow, a flour explosion was caused by sparks from the millstones. Professors Rankine and MacAdam investigated the subject, and found that the rapid combustion of the finely divided flour, as well as the ignition of a mixture of air with the gases furnished by the decomposition of flour and of wood, may produce explosions. Flour and bran mixed gave off at 450° Fah. a gas which, mingled with nine times its volume of air, ignites; and such a temperature may be obtained by friction in the grinding process, or, as might have been the case in the Barclay street disaster, by actual contact of the dust-laden air with a light.

Flour, bran, starch, sawdust, all belong to the same category in this respect. The correspondent whose letter we published last week states that finely pulverized cork in air is also explosive, and that it caused a similar disaster at the Linoleum Company's factory on Staten Island, where it is used in the manufacture of floor covering. In the Grahamite mines of West Virginia an explosion was caused by a dry, resinous, brittle material filling the mining shaft in the form of impalpable dust, which it was afterward found could not be entered with impunity without safety lamps.

We do not doubt but that conditions for explosions of this kind, as well as those tending toward slow spontaneous combustion, often exist over long periods of time in manufactories without the immediate cause of disaster happening to come into action. Probably the rooms in this factory had been filled with starch dust day after day for years, just as rooms in other candy factories now are; but the combining proportions might not have been exactly right, or the misopportune spark might not have been applied. So also in wood-working shops. Under the flooring of many we dare say there are abundant accumulations of sawdust and shavings—perhaps steam pipes are imbedded in this refuse. Inspection may reveal no immediate apprehension of danger, but a few drops of oil may trickle in upon the mass, rapid oxidation may be caused, and a disastrous fire or explosion may ensue. The ounce of prevention in such cases would be worth many pounds of cure.

NOTES OF PATENT LAW DECISIONS.

OF THE COURTS.

In Reissner *vs.* Auness, the suit was brought against the defendant for infringement of certain letters patent, No. 7,751, reissued to John A. Fray, June 19, 1877, for "improvements in coal oil stoves," to which the defendant put in a plea embracing three distinct defenses, namely: 1. That the reissue to Fray was unlawful, because he had previously obtained a patent in Canada for the same invention, granted May 15, 1873, for the term of five years, and the reissue in question was not limited to expire at the same time with the foreign patent. 2. That new matter was introduced into the reissue which was not shown and described in the original patent. 3. That for the purpose of deceiving the public the description in the reissued letters patent was made to contain less than the whole truth relative to the alleged invention. The plea or pleas were set down for argument, and the first question raised was whether the same were not bad for duplicity. The counsel for the defendant insisted that they were not, because, although three distinct matters were alleged against the right of the complainant to recover, they all related to a single defense—to wit, the invalidity of the complainant's patent. The court held that the plea was bad for duplicity, as the several matters, although relating in a general way to but a single defense, namely, the invalidity of the complainant's patent, were essentially independent of one another, and by their retention destroyed the very office of the plea, which was to secure singleness in the issue. The court therefore ordered that the pleas as filed might be set down as an answer at the option of the defendant, or that the defendant might elect within a specified time which of the several grounds of defense he would stand on, and that the other grounds be overruled.

The case of the Gould's Manufacturing Company *vs.* Cowing came up on exceptions taken by the defendant to the report of the master under the interlocutory decree directing an accounting upon the infringement of the plaintiff's patent.

The invention was one only of an improvement in a pump, and not of the entire pump. Numerous parts of the pump were in general use prior to the grant of the complainant's letters patent, and were not claimed therein, and were free to be used by the defendant. The patented invention claimed was a special construction of a side chamber, whereby the same was adapted to use with valve casings bolted on the outside. Held: That the damages could not exceed the profits upon such improvement, and that upon the failure of the complainant to show the profits or damages arising from the use of the improvement, the master should decide that nominal damages only could be recovered; and that it was not sufficient for the complainant to show that wherever the particular patented improvement was introduced other kindred devices could not be sold.

OF THE PATENT OFFICE.

The interlocutory appeal in the matter of the application of Henry Law for letters patent for "improved window blind actuator" has been decided adversely to the applicant.

The claim was for two independent results produced by two independent mechanisms, namely, a device for opening and closing window blinds and a device for locking and unlocking the blinds.

Rule 15 of Office Practice authorizes the claiming of two distinct devices in one application where they are "dependent upon each other and mutually contribute to produce the new result." The question to be determined in the case, therefore, was: Had the applicant combined the two devices so that the operation of each contributed, either simultaneously or successively, to a unitary result?

It appeared that not a single part of the mechanism for opening and closing the blinds was described as affecting the operation of any part of the locking mechanism, nor was the latter dependent on the former in any respect whatever. Both mechanisms performed precisely no other function, when used together on one window, than when used separately a thousand miles apart. The Commissioner held that there was not such an intercommunication of parts or mutual dependence of the distinct devices to entitle them to be incorporated in the same application.

In the interlocutory appeal of Howland, lately decided, the practice of the office in regard to the admissibility of several specific devices embodying the same general features of construction in a single application is laid down as follows: Whenever a generic claim can be predicated which is good in view of the state of the art, and which will include the modifications or specific devices described or exhibited in the drawings, then these may all be retained in a single application; for it is manifest, from the fact that the claim applies with equal aptitude to each, that there are generic features of identity which indicate the same basis of invention. On the other hand, where no claim of the character indicated can be maintained, it is equally true that there is such diversity as will require a division of the application, this restriction being pursued until the matter retained in a single case can be safely said to relate to but one invention, or, in other words, can be contained in the broadest patentable claim that is capable of being drawn to it.

A New and Easily Cleansed Filter.

Filters are liable to become choked with the material which they collect, especially where water is filtered before use in a steam boiler, and the result is that the supply through the stoppage of its conduit is materially diminished. Messrs. Ralph S. Jennings and Norman G. Kellogg have recently patented, both in this country and abroad, an ingenious device which they claim entirely obviates the above mentioned trouble. The filter is provided with a valve and a series of pipes by means of which hot water may at any time be conveyed through the filter. The water enters at the discharge end and passes through to the supply end, where it escapes to a pipe leading to the sewer. The hot water dissolves the various salts hitherto held in solution by the cold water, and mechanically removes all solid matter from the charcoal filling.

[*Continued from first page.*]

from thirty to forty miles per hour. It is computed that 100,000 persons can be carried in eighteen hours. The length of the road will be 22 miles, including both sides of the city.

The engravings on the front page represent the mode of construction and the different structures on Sixth avenue, West 3d street, and West Broadway. The structure on West Broadway is termed a deck structure, and is lighter in appearance than the others. On Sixth avenue the columns are in line with the longitudinal truss, and the transverse girders are latticed in the center, but on West 3d street the longitudinal trusses set inside about four feet from the columns, and the transverse girders are plate. For the construction of the Gilbert Elevated Railway there are three different contracts with three manufacturing iron companies, namely, the Keystone Bridge Company, of Pittsburgh, Pa., the Edgemoor Iron Company, of Wilmington, Del., and Messrs. Clarke, Reeves & Co., of Phœnixville, Pa.

The mode of constructing the permanent way by using portable derricks, as shown in the engraving on the front page, was devised by Dr. Gilbert. The forward or leading derrick, that moves on the street in advance of the work, has strong wooden frames, well trussed, and a platform between the frames, placed at a height that allows the horse cars to pass under, and thus does not stop or even obstruct travel. On the platform are a portable steam engine and boiler which give power for operating the crane used for hoisting material. As the permanent way is advanced, another derrick follows, and thus by means of these two portable derricks, the one leading on the street and the other following on the railroad, the heavy girders and truss work are lifted and easily adjusted to their places.

Fig. 1 represents a section of the railway as it will be built on Sixth avenue. P P are the vertical wrought iron columns or foundations; A is the upper chord and B the lower chord. Between these are the panel posts and truss work, the whole forming a longitudinal truss between the two columns. The distance from center to center of the numerous columns necessarily varies, but it may be stated at about 43 feet. The foundation and bed plate for each column are massive and durable, and are put down in the following manner: An excavation between five and six feet in depth and six feet square is first made, and at the bottom of this is laid hydraulic mortar 4 inches in thickness. On this are placed two flat blue stones not less than 5 inches in thickness and having not less than a superficial area of six feet.

Four holes in these stones are cut for the reception of holding-down bolts. Brick masonry is built up near the level of the sidewalk. This brick work is 4 feet square at the top, and is all laid in hydraulic cement. The cast iron bed plate weighing about 1,200 pounds is then put down and secured by bolts 2 inches diameter and about 3 feet 7½ inches long. The washers for the heads of the bolts, which are upset 2½ inches diameter and 1¼ inch thick, are 7 inches square. Height of bed plate is 15 inches by 3 feet 2 inches square at bottom. The bottom of the wrought iron column is bolted to the upper surface, 21 inches square, of this cast iron bed plate by eight bolts 1¼ inch diameter. The whole is filled in with cement and brick. The vertical columns consist of two 12-inch wrought-iron channel bars and two 12 inch plates riveted to the channel plates. Four pieces of angle iron bars and a plate are fastened to the foot of the column joint and made water tight. The upper part or top of the column is fitted with such plates, angle irons and brackets as are necessary to secure the girders to them and to each other.

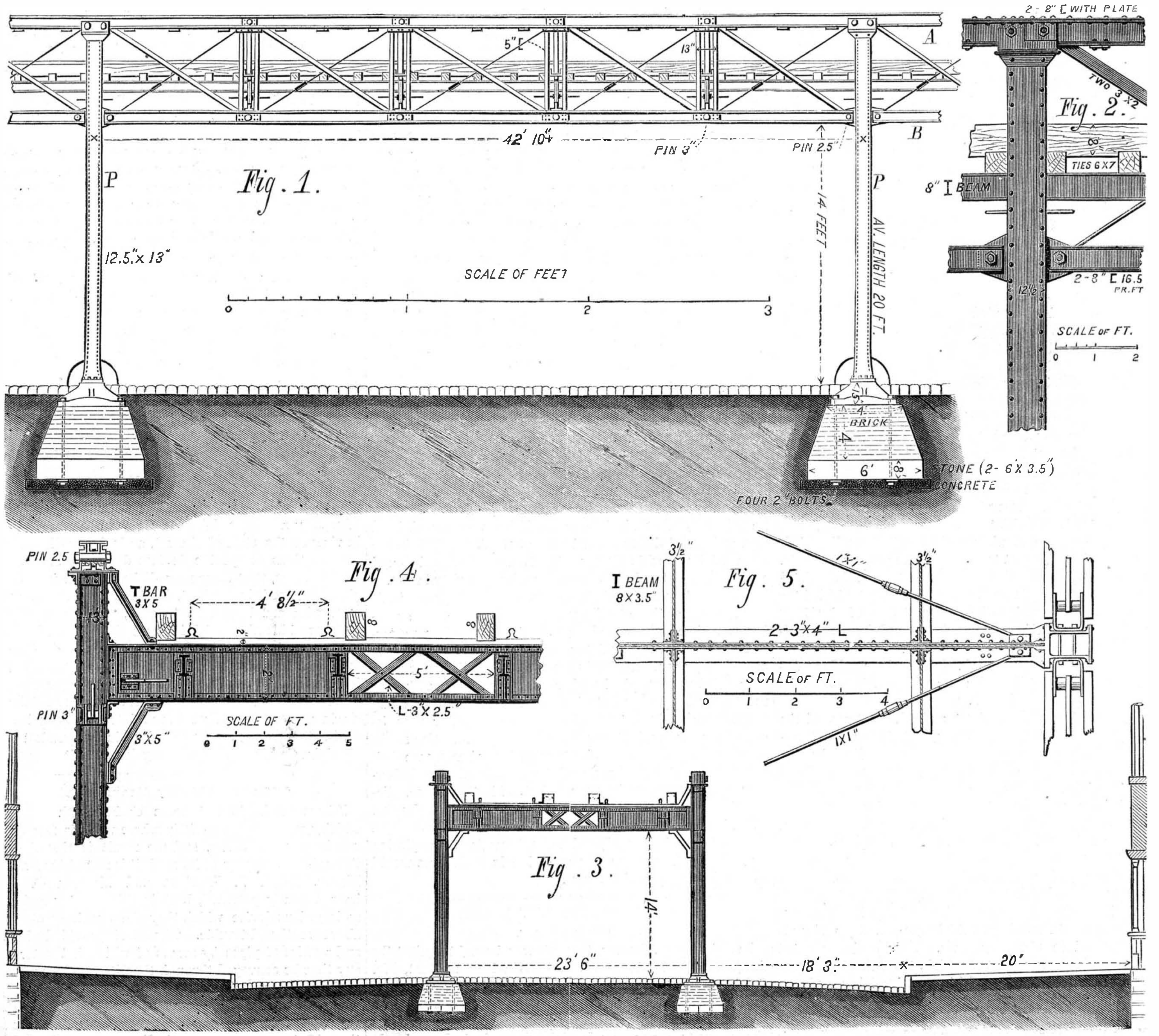
Reference being again made to Figs. 1 and 2, showing a longitudinal girder and an enlarged view of column, the following details will be intelligible:

The longitudinal girders are pin-connected trusses 6 feet 2 inches deep and about 5¼ feet vertically from center to center of pins. The upper chord is made up of two channel bars 8 inches deep united by a plate 12 inches wide firmly riveted thereto. The lower chord consists of two channel bars 8 inches deep. Panel posts are of two channel bars 5 inches by $2\frac{1}{16}$ inches by $\frac{5}{16}$ inch. Pins 3 inches diameter, and nuts at each end. Main ties are of two bars 3 inches by 2 inches. Counter ties 1 inch square. There are four sets of track stringers of rolled I beams, 8 inches by 4 inches, weighing 66 pounds to the yard, and fastened to the cross girders and floor beams by angle irons at each end. Placed on these are the wooden cross ties of yellow pine, 6 by 7 inches by 8½ feet long. From center to center of ties is 24 inches. The steel rails weigh 56 lbs. per yard; guard rails, 7″ by 8″ of Georgia pine, are securely fastened to the cross ties outside of each rail for safety in case of derailment. The whole structure is stiffened permanently by diagonal braces in each panel. Fig. 3 represents a transverse view of a section on Sixth avenue, by which with Figs. 4 and 5 the arrangement and form of the transverse lattice girders forming the floor beams will be understood. These are 24 inches deep and $\frac{5}{16}$ inch thick. The top chord is of two bars of angle iron 3 inches by 4 inches. The bottom chord is of two angle irons 3 inches by 4 inches. The distance between from center to center of columns transversely is 23 feet 6 inches.

The route of the Gilbert Elevated Railway will be as follows:—

Commencing on the south shore of Harlem River at Kingsbridge, thence along River street to Eighth avenue; thence along Eighth avenue to One hundred and tenth street; thence along One hundred and tenth street to Ninth avenue; thence along Ninth avenue to Fifty-third street; thence along Fifty-third street to Sixth avenue; thence along Sixth avenue to W. 3d street; thence along W. 3d street to South Fifth avenue; thence along South Fifth avenue to Canal street; thence crossing Canal street into West Broadway; thence along West Broadway to Chambers street; thence across Chambers street into College Place; thence along College Place to Murray street; thence along Murray street to Church street; thence along Church street to New Church street; thence along New Church street to and across Morris street; thence through private property to Bowling Green; thence around Bowling Green into Beaver street; thence along Beaver street to Pearl street; thence along Pearl street and New Bowery to Division street; thence along Division street to Allen street; thence along Allen street and First avenue to Twenty-third street; thence along Twenty-third street to Second avenue; thence along Second avenue to Harlem river; thence along River street to Eighth avenue. Also a connecting line through and along Chambers street from West Broadway to Chatham street; thence through Chatham street to Division street.

Also an extension from the junction at Fifty-third street through and along Sixth avenue to Fifty-ninth street.



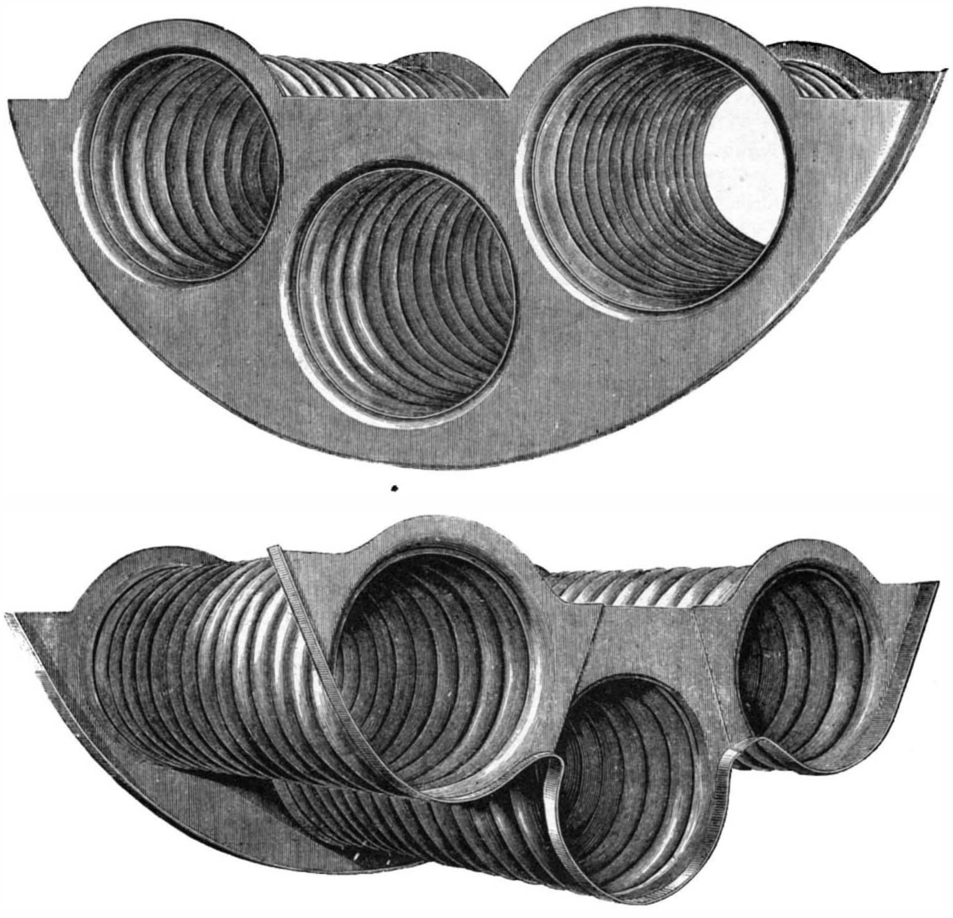
THE GILBERT ELEVATED RAILWAY IN NEW YORK CITY.

CORRUGATED BOILER FLUES.

Various modifications of construction have from time to time been applied to boiler flues in order to protect them against collapsing strain. Flanged flues have been employed and also flues with U-joints at every length of plate, or with chambers of alternately large and small diameters. Mr. Samson Fox has lately proposed still another construction, which consists in corrugating the flues in the direction of circumferential rings.

Fig. 1 represents some of Mr. Fox's corrugated flues, and Fig. 2 the special machine used for making the same, our engravings being taken from *Iron*. The flue is of 4 feet diameter, about 8 feet long, and of half-inch plate, and is claimed to be nearly ten times as strong as a plain flue of similar section. The machine shown in Fig. 2 is constructed as follows: Two chilled rolls, alternately grooved and recessed to give the required corrugations, are arranged one over the other. The plates are first rolled plain, welded up, and then placed in the corrugating machine. To do this, one end bearing of the top roller divides so that it may be lifted and the flue inserted between the rollers. The bearing is then screwed home again by the right and left hand screw, and the rollers are revolved by the usual universal breaking clutch by any steam motor. The lower roller is capable of rising vertically and is pressed upward by a lever arrangement driven by a special steam piston attached to the piston rod seen in front of the illustration. The pressure is thus gradually put on the grooving rollers and the plate is squeezed or swaged into the corrugated shape. After the operation the length of the flue is not found to be materially altered, thereby showing that the material is swaged out slightly thinner to cover the larger surface required for the corrugations. The plate, when corrugated, will be thus slightly thinner than when plain, and the plain ends will be the thickest parts. This is an advantage, as thin plate is undoubtedly the best for heating surface, and the stoutest material is required at the ends for riveting through. It is only the very best class of homogeneous plate that would stand this drawing; and, in fact, we understand that many of the best brands will not stand it, but show lamination. The corrugating is, therefore, in itself as severe a test as can be applied, not only to the welded joint of the flue, but also to the plate itself, and is therefore a valuable guarantee, when successfully accomplished, of the thorough good quality of plate and workmanship.

Iron quotes the following tests of the strength of this flue: Two flues, each 7 feet long and of ⅜-inch plate, with 3 feet 2 inches mean diameter, the one plain and the other corrugated, have been subjected to water test. The plain flue showed signs of distress at 150 lbs. per square inch, and totally collapsed at 225 lbs. In the case of the corrugated flue, the pressure was brought up at once to 1,000 lbs. per square inch, and it was only at 1,020 lbs. that the flue began to collapse. After partial collapse of 6 inches, the pressure was taken off, and once more gradually accumulated. It was then found that 450 lbs. was reached before the collapse continued. At this pressure the flue ultimately collapsed—without crack or flaw—simply by the straightening out of the corrugations. The comparisons, then, are, in this case, as about 7 to 1 for initial signs of distress; and after collapse has actually taken place, the strength of the corrugated flue is still as about 2 to 1 compared with the plain flue. The plain flue also cracked from the tension produced upon the plate by bulging in, while the corrugated flue allowed for the bulging action by flattening out its corrugations, and thus saving the plate from fracture.



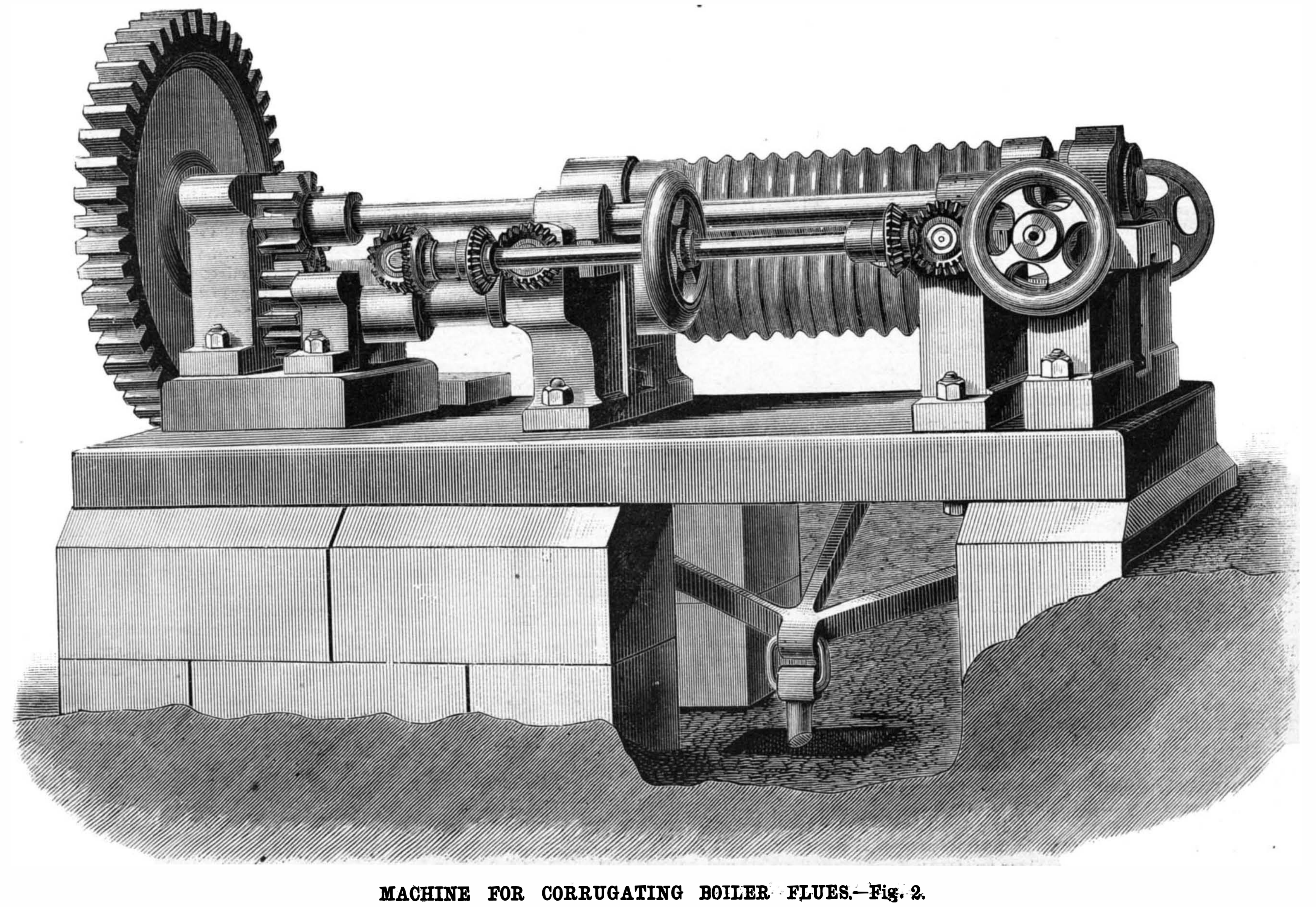
CORRUGATED BOILER FLUES.—Fig. 1.

Friction and Singeing Lights in Factories.

A fire broke out in the mule spinning room (fifth story) of a large Philadelphia cotton and worsted mill, 5:15 P.M., December 5, and but for the prompt action of the employés the fire would probably have caused the destruction of the establishment. Cause named as "friction," but the source of the friction is not stated; and how such cause could be discovered in the sudden commotion always occasioned by an alarm of fire in a factory is not very clear.

The spinning room in any cotton, woolen, or worsted mill is, or should be, a comparatively safe portion of the working parts of such establishment. In a cotton mill there is naturally more danger, especially from the illuminating lights—as we have before noticed—through fine flyings in the air, which accumulate on the machinery and floors, together with roving scattered on the latter; but in a woolen or worsted spinning room the danger of fire should be slight, on account of less flyings and the inferior inflammability of the material.

The spindles of mules, and flyer and throstle spindles of spinning frames, though revolving very rapidly, are so often, carefully, and regularly oiled, to prevent undue wearing, that their heating to a dangerous degree is extremely rare. It should never occur at all, and probably would not unless the lubricant were inferior or adulterated with a dangerous admixture. Petroleum, as a lubricant, which is now, in combination with sperm or lard oil, largely used on machinery in every part of factories, instead of being calculated to cause fires, rather tends to repress them, or, as the employés say, has a cooling tendency. Notwithstanding this, it does, in time, cause considerably more wear to spindles and shafts than sperm or lard oil, though the latter often has sufficient sulphuric acid left in it from its refinement to be very hurt-



MACHINE FOR CORRUGATING BOILER FLUES.—Fig. 2.

ful to general machinery and the cylinders of steam engines.

The careful general attention we have noticed, also, as a rule, extends to the oiling of all parts of the operating "heads" of spinning mules, both for hand and self-operating, so that only the heating of main or counter shafting for want of oil, and the slipping of loose belts on pulleys, remain as agents of fire in the spinning room. Neither of these is very likely to cause such accident, because most factories now use self-oiling hangers, which, though they need not be replenished with oil for months, are, or ought to be, felt daily, to discover if, by warmth, they show any defect in their working. Belts when slipping almost always "squeal" with the friction, so that their want of being "taken up" is soon attended to. Even were it unnoticed, the slipping could hardly generate sufficient heat to be dangerous, though electricity would be excited, which in a cotton mill might, if long continued, cause ignition of light flyings.

These remarks apply to the spinning department, but other parts of cotton, woolen, and worsted mills are much more likely to have fires arising from friction, as, for instance, the picker, carding, and preparing rooms, where every prudent manufacturer takes extra precautions.

There is one part of the worsted process where an imminent danger from fire seems to exist, but we have never heard of any serious loss occurring therefrom. In the worsted combing machine the long woolen fibres, as they are drawn out by the iron fingers, pass very closely but rapidly over a series of gaslights burning with a low flame. This high degree of heat, directly applied, is required in this process for reasons which it is not necessary to explain here; and, of course, if the machine were suddenly to stop working, the wool remaining over the flame would ignite. It is a special duty of the attendant to watch that this does not occur, and we believe that each drawing frame is now furnished with a self-acting safety apparatus, extinguishing the lights if the machine stops working. At any rate, great care is needed, because the open light in that position is known to be a source of danger, and such care, as already intimated, has largely prevented fires from occurring in these machines.

In many cotton and linen spinning mills (more especially in thread mills), singeing machines are used in which a number of single or twisted threads are all at the same time drawn rapidly through a gas flame, to rid the surface from projecting filaments. Should this machine cease running, and the flame be continued, a fire would result; but this is generally well guarded against, both by the attention of employés and a safety apparatus for extinguishing such flame.

This "fire protector" has now, we believe, an attachment to each thread, consisting mainly of an eye through which the thread runs, the eye being connected with delicate levers, which turn off the gas, so that if the thread break and the eye drop, the flame is instantly extinguished. The sudden stopping of a machine of this kind is never allowed when at work, without the lights being put out, except when it is accidentally caused by the breaking or flying off of a driving belt. In such case, the first act of the attendant is to extinguish all the flames before the motion of the wheels is perceptibly checked.

More care is required in these singeing frames than in the worsted combing frames, because of the higher inflammability of the material, and also because should a thread break and the protector not instantly work, the thread at the back of the eye may pile forward and ignite itself and all other threads on each side of it. All recent singeing machines have, we believe, the separate attachments mentioned to each thread, though in former years it was not so. The improvement renders the machines much more costly, but greatly diminishes their fire risk.

In some factories certain kinds of fine cotton and linen fabrics are singed after the weaving, by being drawn rapidly over a low, continuous gas flame. In such machines, stop-motions for the gas, and great care and precaution in management, are necessary for the safety of the cloth and the mill.—*American Exchange and Review.*

Caventou.

Caventou, the distinguished French chemist, died in Paris in May last at the age of 82. Medicine is indebted to him for some of its most valuable remedies. In conjunction with Pelletier, Robiquet, and others, he discovered strychnia in 1818, brucia and veratria in 1819, quinia and cinchona in 1820, and caffeina and theina in 1821. The discovery of quinia should of itself immortalize his name. Though laden with the highest honors which a gratified country could bestow, he was one of the most modest of men. Just before his death he requested to be buried without military honors, and that no discourse should be pronounced over his tomb. His request was complied with, though all the members of the Academy of Medicine and of the School of Pharmacy attended his obsequies.

What the Telephone Might have been Called.

We prophesied even better than we knew the other day when we said that the adoption of so short a name as "Fernsprecher" for the telephone by the Germans was a matter of congratulation, because they would otherwise soon find a way of smothering it under some frightfully polysyllabic title. To show how closely the fortunate instrument has escaped this fate, a correspondent in Heidelberg writes us that no less than fifty-four names were proposed in German, all of varying degrees of length and atrocity. Some (we will not inflict the reader with the original titles) signified "mile tongue," "kilometer tongue," "speaking post," "word lightning," "world trumpet," and finally one inventor, collecting all his energies for a grand effort, triumphantly produced "doppelstahlblechzungensprecher." The jaw can be replaced by pressing on the lower molars with the fingers, and guiding the muscles with the thumbs.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, January 16, 1878.

PLANETS.

	H.M.		H.M.
Mercury rises	5 59 mo.	Saturn sets	7 20 eve.
Venus sets	6 23 eve.	Uranus rises	5 25 eve.
Mars sets	11 42 eve.	Uranus in meridian	0 15 mo.
Jupiter rises	5 19 mo.	Neptune sets	11 7 eve.

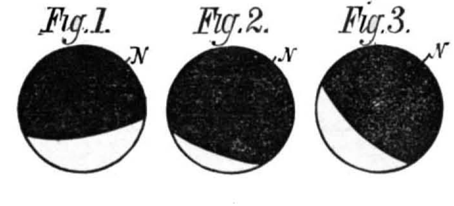
FIRST MAGNITUDE STARS.

	H.M.		H.M.
Antares rises	2 17 mo.	Sirius in meridian	8 52 eve.
Regulus rises	5 31 eve.	Procyon in meridian	9 45 eve.
Spica rises	10 08 eve.	Aldebaran in meridian	6 42 eve.
Arcturus rises	9 10 eve.	Algol (2dmg.var.) in merid.	5 13 eve.
Altair rises	3 31 mo.	Capella in meridian	7 20 eve.
Vega sets	5 40 eve.	7 stars (cluster) in meridian	5 53 eve.
Alpheratz sets	10 05 eve.	Betelguese in meridian	8 01 eve.
Fomalhaut sets	5 03 eve.	Rigel in meridian	7 21 eve.

REMARKS.

The most remarkable event of the week is a partial eclipse of the moon February 17, in the morning. The beginning and middle only are visible, the setting eclipsed. The last contact of the moon with the shadow occurs 51 m. after sunrise and 49 m. after the setting of the moon, and is invisible east of the Mississippi river. The eclipse begins at 4 h. 47 m. morning; middle, 6 h. 15 m. morning; end, 7 h. 43 m. morning. For the time of beginning, middle, and end at any other place, add the difference of time longitude if east, subtract the same if west of New York city. Examples: Boston, 12 m. east, begins at 4 h. 59 m. morning; Philadelphia, 4 m. west, begins at 4 h. 43 m. morning. The following figures represent the phases of the illuminated

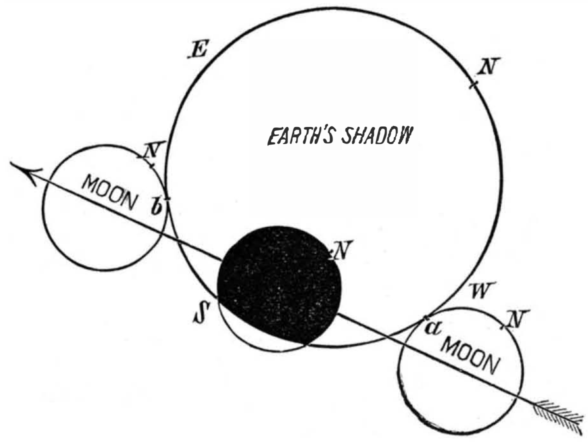
Fig. 1. Fig. 2. Fig. 3.



crescent as they appear with respect to the horizon, at three intervals, as stated below, N being the north point. Fig. 1 represents the phase at 5 h. 45 m. morning, one half hour before the middle, and 58 m. after beginning, the moon being about one hour high. Fig. 2 shows the phase when at the middle, or when the eclipse is largest, 1 h. 28 m. after first contact, the moon being 39 m. high. At this time ·84 of the moon's diameter will be in the earth's shadow. This multiplied by 12 gives the size of the eclipse in digits, which is 10·08 digits. Fig. 3 shows the phase at 6 h. 42 m. morning, 10 m. before the moon sets, and one half hour after greatest obscuration.

Fig. 4 shows the middle of the eclipse and the points of

Fig. 4.



first and last contact of the moon with the earth's shadow, and the moon's path through the shadow with reference to the western horizon. The point of first contact is at *a*, 82° from the north point (N) toward the east. The point of last contact, *b*, is 31° from the north point toward the west. Hold the engravings so that N will point toward the north star.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations of the following notes, which are merely approximate, have been made by students in the Astronomical Department of Vassar College.

Position of Planets for February, 1878.

Mercury.

On February 1 Mercury rises at 5h. 49m. A.M., and sets at 3h. 6m. P.M. On February 28 Mercury rises at 6h. 11m. and sets at 4h. 15m. P.M.

Mercury is at its greatest elongation west from the sun on February 2, and should be looked for before sunrise, south of the point of sunrise.

Venus.

On February 1 Venus rises at 8h. 2m. A.M., and sets at 7h. 43m. P.M. On February 28 Venus rises at 5h. 30m. A.M., and sets at 5h. 1m. P.M.

Mars.

Mars rises on February 1 at 10h. 21m. A.M., and sets at 11h. 53m. P.M. On February 28 Mars rises at 7h. 19m. A.M., and sets at 11h. 35m. P.M.

Mars is becoming more distant, and therefore smaller, but is easily recognized, and by February 8 will be known by its approach to the moon, then nearly at first quarter. The recent report of Professor Pickering, of the Observatory of Harvard College, gives the diameters of the two satellites of Mars as determined by the 15-inch telescope. The outer satellite is six miles in diameter, and the inner seven miles. Only a few of the very largest telescopes can render such minute bodies visible.

Jupiter.

Jupiter has passed to the western side of the sun, and must be looked for before sunrise.

On February 1 Jupiter rises at 6h. 10m. A.M., and sets at 3h. 22m. P.M. On February 28 Jupiter rises at 4h. 44m. A.M., and sets at 2h. 4m. P.M.

Saturn.

The ring of Saturn is at this time (January 15) exceedingly narrow, looking like a bright line projecting on each side of the planet. It will become more and more threadlike, and, according to the *Nautical Almanac*, will disappear on February 6. As Saturn shines by reflecting the light of the sun, when the sun is in the plane of the ring only its edge is illuminated, and this edge being supposed to be less than a hundred miles in width, cannot be seen at so great a distance. Astronomers will watch this disappearance of the ring with great interest, although Saturn ranges so nearly with the sun in February that only a few early evening hours can be used.

On February 1 Saturn sets at 8h. 8m. A.M.; on the 28th at 6h. 39m. P.M.

Uranus.

Uranus is in its best position in February, coming to the meridian on the 18th very near midnight, at an altitude of about 61°. It will at that time be west of the star Regulus by 41', and above that star by half a degree, or the diameter of the moon.

On February 1 Uranus rises 6h. 25m. P.M., and sets at 7h. 59m. of the next morning. On the 28th Uranus rises at 4h. 33m. P.M., and sets at 6h. 11m. of the next day.

Neptune.

On February 1 Neptune rises at 10h. 43m. A.M., and sets just after midnight. On the 28th Neptune rises at 8h. 58m. A.M., and sets at 10h. 23m. P.M.

Another Railway Bridge Disaster.

The Ashtabula bridge disaster seems to have been repeated on a smaller scale in the recent breaking down of a bridge near Tariffville, on the line of the Connecticut Western Railroad, during the crossing of a passenger train. The structure was a Howe truss of two spans, each 163 feet in length, supported in the middle by a pier of solid masonry. The height over the stream was 10 feet. The train consisted of two 60 ton locomotives and appendages, six heavily laden passenger coaches, one baggage and two freight cars. The first span was crossed in safety, but when the locomotives reached the middle of the second span, the right side suddenly settled, a break followed, and the cars crashed through. Thirteen persons are known to have been killed, and many others are injured.

The bridge is said to have been in good condition, and the timbers where broken off and splintered exhibit no signs of deterioration. The calamity seems simply to have been owing to the weakness of the structure, the iron tie rods of which appear to have given way first, under the unusual weight of the two locomotives and loaded train. That any railroad bridge should have fallen under such a load is incomprehensible if the construction had been correct in the beginning. The commonest test of such a structure is to run as many locomotives or cars loaded with iron upon it as can be accommodated on both tracks; but even this proceeding is little more than a matter of show for the benefit of the general public, because the engineer knows if he has designed the members of the structure to withstand any load to which they are likely to be subjected, and adopted a factor of safety of 6 besides, that even a double line of locomotives should produce no material deflection. If this bridge simply fell because it could not stand the strain, it was extraordinarily weak, and that fact must have been patent from the outset. It might be well for those charged with the investigation of this disaster to examine into the safety of other railway bridges on the road; and indeed, the matter of overhauling the plans of all their bridges with a view to observing whether their ultimate breaking strength reaches proper limits, or has deteriorated therefrom, might be commended to railway engineers and managers as a good winter's work.

Mechanical Theory of Forgetfulness.

To the Editor of the Scientific American:

Your number for January 12 contains some speculations on a new theory of a Mr. Verdon under the above heading. Permit me to say that this theory, or rather conjecture, will not stand the least examination. Were it true, people who are entirely illiterate ought to have immense potential capacity, and ought to attack any given study with immense advantages. Every one knows that the contrary is the case.

The more the memory is cultivated the more active it be comes. A second foreign language is learned more easily than the first, and so on.

This is the age of bald and barren speculation. Alongside of those who earnestly and patiently labor for the truth are those who tie a few stray facts together and deduce a string of paragraphs. As for Mr. Verdon's theory, it corresponds with his own name. ALIQUIS.

Coal Dust Fuel.

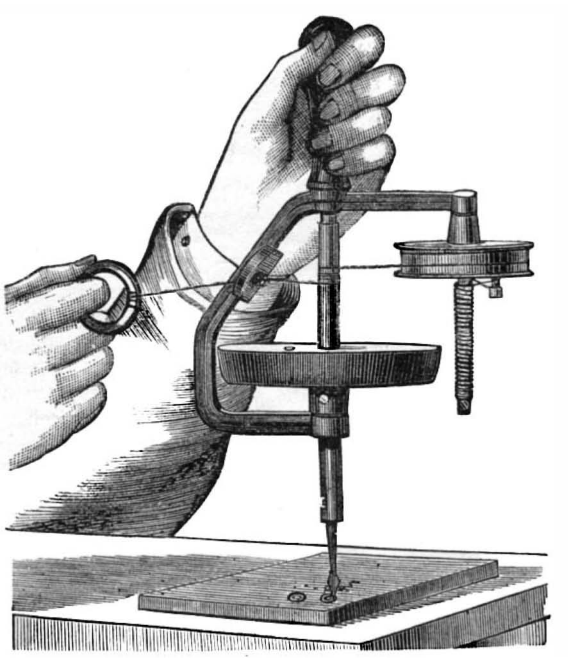
To the Editor of the Scientific American:

I notice your article of January 9, on burning coal dust with a blower, and wish to speak of the disadvantages of this method and its remedy. When a blast is used on fine coal dust, nothing can keep a large amount of fine particles of fuel from being blown out at the top of the chimney, and this has resulted in numerous cases of fire and the total destruction of mills and surrounding property. It makes an unnecessary waste of fuel by virtually melting the coal on the grates; again, it injures the boiler by having a steady blast on the same spot, and a boiler run with a blower will not last near as long as without it. It requires considerable power to run a blower, also more than the users suppose, as shown by indicating the engine on different parts of machinery. Coal dust, with small mixture of soft coal, is now being used as fuel, without the use of a blower, on boilers set with the Jarvis furnace, at Boston, Worcester, Providence, Brooklyn, Jersey City, New York, and other places. By this setting, the gases generated on the grate are utilized by hot air; the joining of the gases, carbonic oxide with the oxygen, makes an immense flame. The gas flame is formed on the principle of the blow-pipe. Three boilers set this way will make as much steam as five the old way.

Boston, Mass. A. F. UPTON.

QUICK-SPEED DRILL.

We extract from *Iron* the annexed engraving of a new quick-speed drill, which consists of a frame, a spindle with the socket for the drill, a pulley with a spiral spring, and a hollow casting which acts as a flywheel and also serves as a



QUICK-SPEED DRILL.

case to contain the ratchet and pawl necessary to prevent the possibility of the motion of the drill becoming reversed. The action is as follows: The workman on drawing his hand toward him actuates the drill, and at the same time tightens the spring attached to the pulley, which spring, on the tension of the hand being relaxed, reverses the motion of the pulley and takes up the slack of the cord; but the motion of the drill is not reversed, owing to the ratchet and pawl in the flywheel, and to the rotation of the flywheel itself. There is thus obtained for the drill a constant revolving motion, with a speed which can be regulated to suit any metal from the hardest to the softest, while the feed, which is effected by the hand, is at all times felt and controlled. These machines can be worked in any position, and, from the important fact that the motion is continually in the same direction and that there is consequently no pause in the cutting, the work can be got through in less time and with far less breakage of drills than by the older contrivances. They are as yet made only in a very small size, and are therefore serviceable chiefly to the makers of small machinery, such as clocks, sewing machines, etc.

NEW YORK ACADEMY OF SCIENCES.

A meeting of the Chemical Section of the New York Academy of Sciences was held on Monday evening, January 14, at their rooms, 64 Madison avenue, Dr. Eggleston in the chair.

Mr. George F. Kunz exhibited a specimen of alexandrite from the Ural mountains. It is purple by night and deep green by day. He also showed a specimen of harmotone, a silicate of baryta and alumina, from a new locality in Brazil.

Mr. Chamberlin exhibited specimens of anchorite from the Phœnixville Tunnel, and of fulgurites from Carrol county, Ill. The latter are partially fused and vitrified tubes of sand produced by the action of lightning.

Professor D. S. Martin announced the appearance of the first number of the "Annals of the Academy."

NITRIC ACID IN HEALTHY URINE.

Professor Albert R. Leeds then read a paper on the presence of nitric acid in healthy urine, and a method for its quantitative determination.

Fig. 2.—WIRE TESTER.

In the course of some experiments to determine the relative amounts of oxidized and non-oxidized compounds existing in drinking water (described in the SCIENTIFIC AMERICAN of January 5), it became important to ascertain this relation in the case of urine, one of the organic impurities of some drinking waters. The Passaic water consumed by the inhabitants of Hoboken contains ten times as much nitric acid as of free and albuminoid ammonia. In passing through the system, the nitrates present in the water undergo reduction, and if they are not assimilated or voided as non-oxidized nitrogenous substances, may be expected to appear to some extent at least in the urine. Although no mention is made of the presence of nitric acid in healthy urine in any of the works to which the speaker had access, he determined to submit the question to the searching methods of inquiry which a recent discovery had placed in his hands.

A retort was freed from all traces of ammonia by distilling pure water in it; 1·023 grammes of fresh healthy urine were then added, and the distillation continued. The distillate was collected in portions of 50 or 100 c. c., pure water being added as was necessary. In each case the ammonia passing over was separately determined by means of the comparator previously described. The ammonia came over in continually decreasing amounts, the total amount evolved in 15 distillations being 1·725 milligramme. The decomposition of what remained was then accelerated by the addition of a gramme of sodium carbonate. The ammonia contained in 56 distillates amounted to 7·1525 milligrammes. In the next place 50 c. c. of a solution of potash and potassium permanganate were added to what remained in the retort. The first distillate then yielded 0·32 and the twenty-second 0·005 of a milligramme of ammonia.

Total for the 22 distillates	1·31	mgrm.
" with sodium carbonate	7·1525	"
" by simply boiling	1·725	"
	10·1875	

From the last result the conclusion was drawn that all the albuminoid ammonia had been obtained, and that reducing agents should now be used to decompose any oxidized nitrogenous substances which might be present.

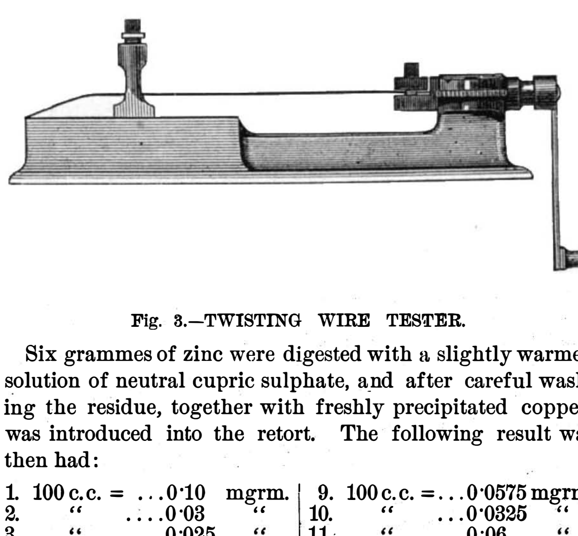


Fig. 3.—TWISTING WIRE TESTER.

Six grammes of zinc were digested with a slightly warmed solution of neutral cupric sulphate, and after careful washing the residue, together with freshly precipitated copper, was introduced into the retort. The following result was then had:

1. 100 c.c. =	0·10	mgrm.	9. 100 c.c. =	0·0575	mgrm.
2. "	0·03	"	10. "	0·0325	"
3. "	0·025	"	11. "	0·06	"
4. "	0·0125	"	12. "	0·065	"
5. "	0·04	"	13. "	0·0225	"
6. "	0·16	"	14. "	0·0005	"
7. "	0·07	"	15. "	0·0000	"
8. "	0·12	"	16. "	0·0000	"
Total				0·7955	

From this result must be subtracted 0·29 mgrm., the amount of ammonia previously ascertained as existing in the form of an impurity in 50 c. c. of the permanganate solution used in the distillation.

This leaves 0·5055 mgrm. of ammonia due to the reduction of nitrates in the urine, and corresponds to 1·887 mgrm. of nitric acid or 0·18 of 1 per cent. Professor Leeds concluded by reading letters bearing upon the subject from Professor Theodore Wormly, Dr. Ezra M. Hunt, and Professor Robert O. Rogers.

Remarks were made by Drs. Ellsberg and Hopper, who expressed their belief that nitric acid might reasonably be expected to be a normal constituent of urine.

On motion of Dr. Ellsberg, a vote of thanks to the Rev. J. J. Robertson was passed for his donation of 37 volumes to the library of the Academy. Adjourned. C. F. K.

PAPER AND WIRE TESTERS.

We illustrate three testers for special materials. Fig. 1 shows a paper tester, which works with unvarying accuracy and absence of liability to derangement. As the paper is tested by the direct action of a weight, all the variations which arise in the use of springs for this purpose are entirely avoided, and continued working has no tendency whatever to cause the machine to give inaccurate tests. The machines are all graduated by the application of actual weight, in such a manner as to insure every one being perfectly accurate, and as all parts of the mechanism are fully open to view, it can without difficulty be kept clean and always ready for use. The machine is in use by many of the largest paper users. It is very portable, occupies but little space, and can be worked with considerable speed even by an inexperienced operator.

The wire testers, Figs. 2 and 3, are the invention of Mr. Carrington, of London, who having, as engineer of the Wire Tramways Company, found the want of a machine by which the wires composing the ropes used could be expeditiously and accurately tested, without the great expenditure of time required by the use of the ordinary forms of testing machines, designed the apparatus shown. By it a wire may be attached and tested both for tenacity and ductility in the space of one minute. The machine requires no foundation, when not in use occupies very little space, and can be used by one work-

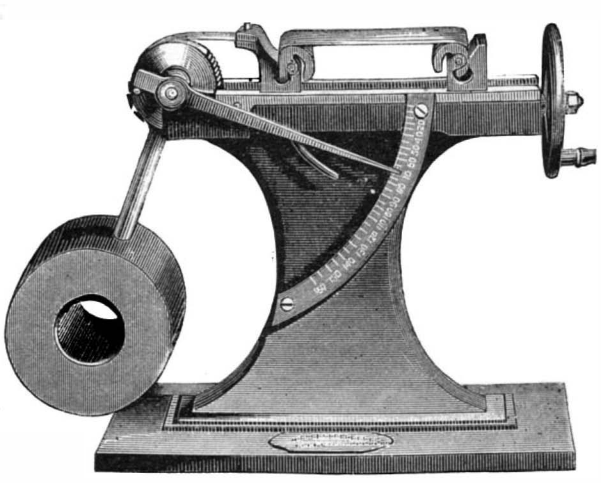


Fig. 1.—PAPER TESTER.

man of ordinary intelligence. As the strain is applied very gradually, and by the application of the same weight, all liability of erroneous tests from changing or moving of weights, as in ordinary machines, is avoided. The extension of the wire also is accurately measured, and a length of 50 inches can, if necessary, be tested, thus giving a much truer result than if a short piece were subjected to tensile strain. The smaller machine, Fig. 3, is used for testing the wire by twisting one end while the other is held firmly in the machine, the greater number of twists it will bear being the better evidence of its softness. These machines will test either up to 3,000 pounds or 5,000 pounds, as required.

We are indebted to the *British Trade Journal* for our engravings.

Soap-Bubble Lecture Experiment.

BY IRA REMSEN.

In setting fire to soap-bubbles filled with hydrogen or with oxyhydrogen gas, it is customary to make use of a taper at the end of a rod, which is managed by the assistant. Every one knows that the operation is apt to be a clumsy one, and, besides being annoying to the assistant, it is usually distracting to the audience and the lecturer. I have lately made use of a simple contrivance, which I am led to mention, as it is in every way more satisfactory than the usual arrangement, and works perfectly.

At a height of five or six feet or more above the center of the lecture table a glass funnel of the largest size is suspended by means of wires attached to the ceiling, or some other appropriate support, the broad part of the funnel being directed downward. A fish-tail gas burner is fixed horizontally at the center of the mouth of this funnel, so that, when the gas is lighted, the broad flame is spread out in a horizontal plane over as much of the space included in the mouth of the funnel as it will cover. The attachments may be made to suit the conditions of the room and table. It would be a simple matter to have a permanent gas jet arranged in an appropriate position for the experiment.

It is only necessary to allow the bubbles to separate from the pipe in about the same perpendicular line as that corresponding to the axis of the funnel; they will invariably come in contact with the flame, and this, of course, is all that is necessary. If the bubbles contain hydrogen, the flame frequently fills the funnel for a moment, and presents a very pretty appearance. The experiment is very easily performed, and success is certain.

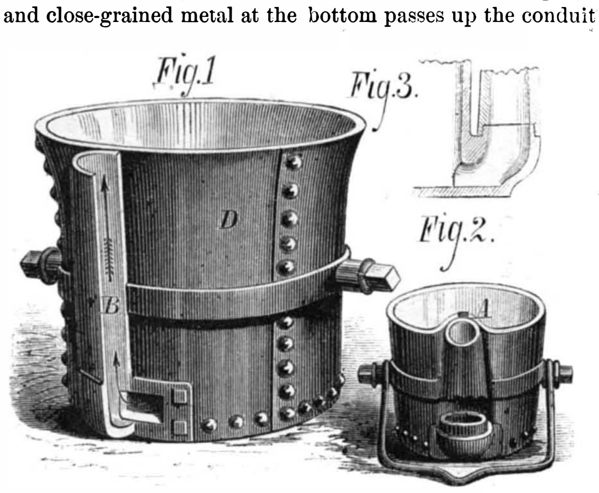
FAWCETT'S IMPROVED LADLE.

In making car wheels, manufacturers generally use great care and skill in selecting a variety of the best brands of pig iron, with a view of combining their different qualities, for the purpose of producing a uniform wheel of the required strength and necessary depth of chill. The disorders to which cupolas are liable, and the different degrees of fusibility of the several grades of iron, have a tendency to change the results and cause considerable variations in the life, strength, and mileage of car wheels. Before casting, a large ladle is filled with molten metal from the furnace. This is done without reflecting that there has been a circulation going on in the molten metal similar to that which prevails in all hot liquids. Each grade of iron tends to assume its own particular level in the molten mass, according to its density, all impurities and iron of a light and loose texture rising to the surface, while the dense and close-grained qualities sink to the bottom by their own superior gravity.

Wheels cast with iron taken from the top of a large ladle or receiver are not of the same quality of metal, strength, or depth of chill as those cast with iron from the bottom. This explains why some wheels, cast on the same day, from the supposed same mixture and ladle, have such an irregular and uncertain life.

William Fawcett, of Omaha, Nebraska, has patented in the United States, England and Canada, an improved ladle, which is designed for the purpose of giving a uniform mixture all through the heat, and prevent spotting, putting the best iron where it properly belongs, namely, the tread of the wheel. It is simple in construction, and inexpensive, and can be easily attached to any ladle, old or new.

In the annexed engraving, Fig. 1, D represents the ladle, and B the vertical conduit on the side which opens into the bottom of the ladle, so that, as the latter is tilted, the purer and close-grained metal at the bottom passes up the conduit

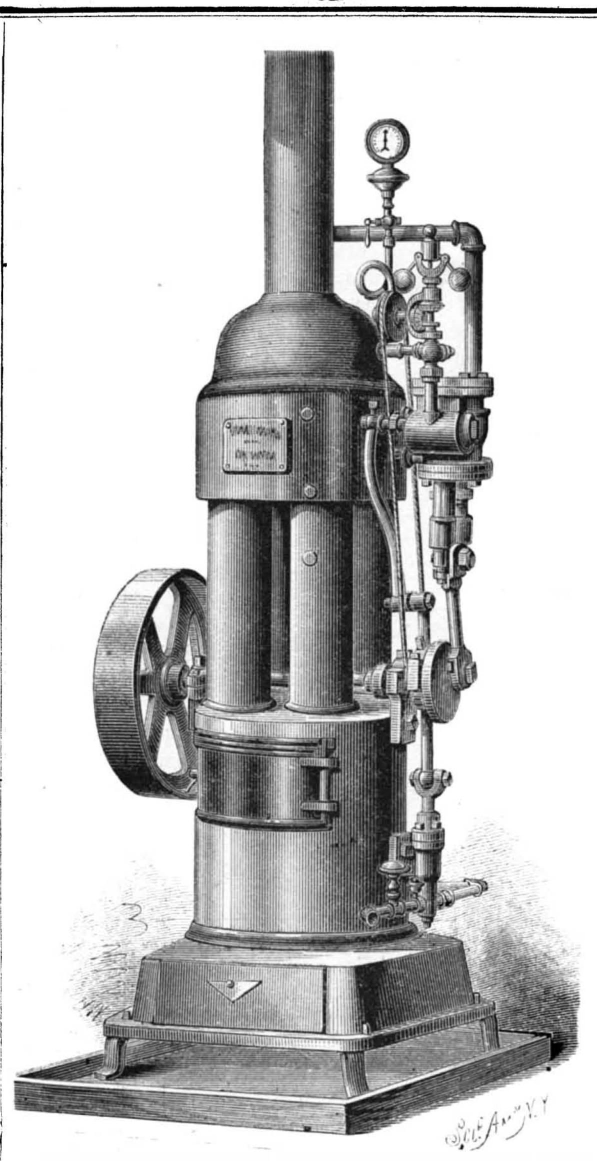


and discharges into a smaller ladle, shown in Fig. 2. This is similarly constructed for the purpose of first delivering into the mould the hot metal in its best fused and most dense state, leaving in the ladle the cold, unamalgamated iron, with the scoria floating on the top; thereby producing with the same material a greatly superior wheel, of greater purity, and of more uniform density on the tread than can be produced by the ordinary manner of pouring metal from the top of a ladle, as such a loose system as this always gives chance results. Fig. 3 is a detailed section of Fig. 2. A lip at the top of the inner wall, A, insures the discharge from the outlet in the direction of the arrows, without spilling over the lighter metal floating on the top within the ladle. The labor of skimming is thus entirely obviated. For further particulars address the inventor as above.

THE NEW BAXTER PORTABLE ENGINE.

In the annexed illustration we represent the new Baxter portable engine, a one horse power machine, designed especially to meet the large and increasing demand for small motors for light work. It was to engines of this description that we had reference in our recent article calling the attention of farmers to what good service such apparatus could be put in numerous operations about the farm. It could easily drive small barn machinery, such as grain cleaners or feed cutters, run a small circular saw for firewood, or pump water, and perform a large variety of other work at much saving of time and labor.

The chief novel features of the present machine, which is the invention of Mr. William Baxter, already well known as the inventor of the Baxter engine and steam canal boat, lie mainly in the construction of the boiler and the manner in which the engine is attached thereto. The base is 2 feet square and the total of the machine is 4 feet. The cylinder parts are about 15 inches in diameter at bottom and top, which are connected by four upright sections, all being cast in one piece of the best car wheel iron. This form is claimed to impart all the strength of a sectional boiler, with no large flat surfaces, nor any great volume of water or steam in any one



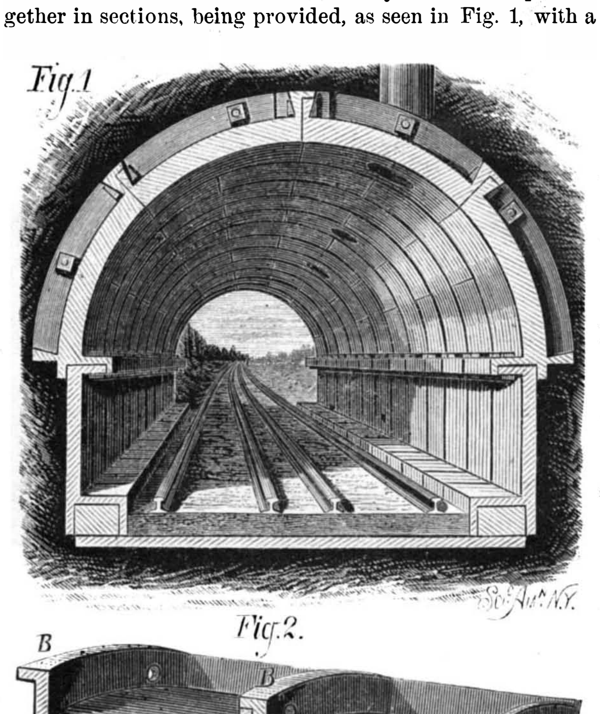
THE BAXTER PORTABLE ENGINE.

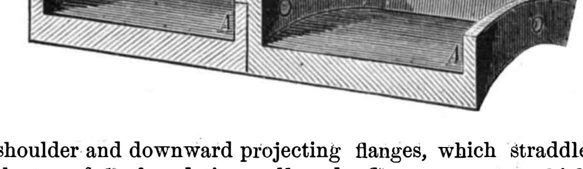
part. The tubes through which the heat passes are of the best lap welded boiler tubing, and act as braces to the lower and upper heads, as in any ordinary flue sheets. There is a water space all around the furnace, as in ordinary upright boilers. Steam and water gauges, gauge cocks, safety valve, blow-off and check valves, and a rocking grate to dump the fire should occasion require, are all provided. Every boiler is, we are informed, tested to a hydrostatic pressure of 200 pounds to the square inch. The engine has a 3 x 3 inch steam cylinder, which is rated at from $1\frac{1}{2}$ to 2 horse power, all made in simple and substantial manner, with a plunger and pump attached to feed the boiler regularly while the engine is in motion. The manufacturer claims that the engine can be run on about 10 cents' worth of coal or wood per day. The entire weight is 650 pounds.

For further information address the manufacturer, Mr. Joseph C. Todd, 10 Barclay street, New York city.

METALLIC ARCHES FOR TUNNELS.

We illustrate herewith an improvement in the construction of arches to be used for tunnels, buildings, sewers, and all other purposes. In building the tunnel it is preferable that the side walls should be made entirely of iron and put together in sections, being provided, as seen in Fig. 1, with a





shoulder and downward projecting flanges, which straddle the top of the foundation wall, and a flange on top to which the bottom section of the arch is bolted. The arch consists of any desired number of cast iron sections, Fig. 2, having upward projecting flanges, A, through which bolts pass for securing the sections together. Other flanges, B, parallel with the body of the section, lap over the other sections for the double purpose of supporting the sections in position and closing the joints, where they come together, to prevent leakage.

In erecting the arch it is necessary to erect only a single center at the beginning, upon which the first line of sections is secured, and then all the other sections require only to be hoisted into position, and the flanges, B, overlapping those already up, will hold the sections in place, without any further fastenings in any form. In order to make secure a bolted coupling is passed over the top of the flanges wherever three or four come together. As the space on top of each section is intended to be filled in with cement or brick work, the flanges are constructed with a bevel, which projects inward over this filling, so that any uneven pressure only tends to pack it solidly under this projection.

An opening can be made at any point through the sections, communicating with the outer air, through which the smoke and gas from the locomotives can escape.

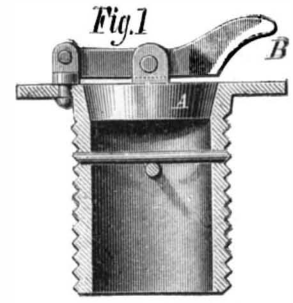
The Board of Managers of the Maryland Institute in 1875 resolved that the design was a valuable improvement. It was patented July 1, 1873, by Josiah Groves, of Ellicott City, Md.

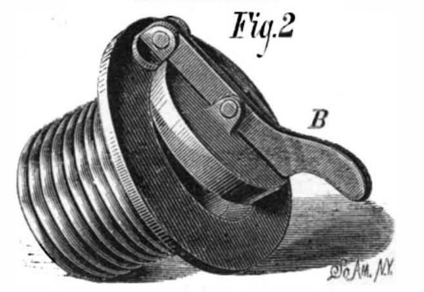
For further information address John F. Corcoran, attorney, 63 N. Eutaw street, Baltimore, Md.

CARNES' IMPROVED BASIN STOPPER.

We illustrate herewith a new mode of attaching stoppers to washbasins, which dispenses with the chain ordinarily used for that purpose. It will be seen that the stopper, A, is suspended by lugs and a pin to a lever, B, one end of which is hinged to the strainer pipe and the other is provided with a handle. A space for clearance is left between the lever and stopper, so that the latter may oscillate slightly on the pin of the former. This enables it to be inserted vertically on its seat in the strainer independently of the circular motion of the pin on the hinge.

The device is exceedingly simple, and constitutes a neat and handy attachment. Patented through the Scientific





American Patent Agency November 27, 1877. For further information address the inventor, Mr. H. W. Carnes, box 143, Brookline, Mass.

New Inventions.

In an improved Trace Holder devised by Mr. William K. Hardenbrook, of Albia, Iowa, there is a combination of a double hook or holder with the frame that connects the back strap, crupper strap and straps that support the breeching. The traces are securely held in whatever position the horse may be.

An improved Button Fastening, invented by Mr. Charles M. Underwood, of New York city, consists of two plates placed together, one having an aperture and slot, the other a central aperture. The edges of the second plate are folded over those of the first. A loop of metal is slipped through the eye of the button and its ends brought together from a neck having a head which is passed through the slot in the plates, and secured by drawing the latter apart.

Messrs. George H. Thompson and George P. Muldoon, of Omaha, Neb., have devised a Wooden Spring for vehicles which is so constructed that it may be adjusted to sustain a greater or less load, and which will quickly recover its shape when pressure upon it is removed.

Mr. Alonzo T. Decker, of New York city, has patented a new Rear Sight for Firearms. It consists of a plate made elastic fastened at one end and provided with a sight at the other, combined with a slide and bed having stepped side flanges. It is arranged to give a lower elevation and consequently a more accurate aim for short distances than the rear sights now in use.

A Fastening for Pocket Books, invented by Daniel M. Read, of New York city, consists of a base plate with a longitudinal slot for the catch and a lateral slot beneath for the handle of the latch. The catch is inserted, and the prongs of the latch, which is pivoted on an inner plate, engage with it and hold it fast. It is a compact and serviceable fastening.

THE LIQUEFACTION OF OXYGEN.

BY M. RAOUL PICTET.

The object I have had in view for more than three years is to demonstrate experimentally that molecular cohesion is a general property of bodies to which there is no exception. If the permanent gases are not capable of liquefying, we must conclude that their constituent particles do not attract each other, and thus do not conform to this law. Thus, to cause experimentally the molecules of a gas to approach each other as much as possible certain indispensable conditions are necessary, which may be expressed thus: 1. To have the gas absolutely pure, with no trace of foreign gas. 2. To be able to obtain extremely energetic pressures. 3. To obtain intense cold and to subtract heat at these low temperatures. 4. To utilize a large surface for condensation at these low temperatures. 5. To be able to utilize the rapid expansion of the gas from extreme intense condensation to the atmosphere pressure, an expansion which, added to the preceding means, will compel liquefaction. Having fulfilled these five conditions, we may formulate the following alternative: When a gas is compressed to 500 or 600 atmospheres and kept at a temperature of —100° or —140°, and it is allowed to expand to the atmospheric pressure, one of two things takes place: either the gas, obeying the force of cohesion, liquefies and yields its heat of condensation to the portion of gas which expands or loses itself in the gaseous form, or, on the hypothesis that cohesion is not a general law, the gas must pass to the absolute zero and be come inert—that is to say, an impalpable powder.

The work done by expansion will not be possible, and the loss of heat will be absolute.

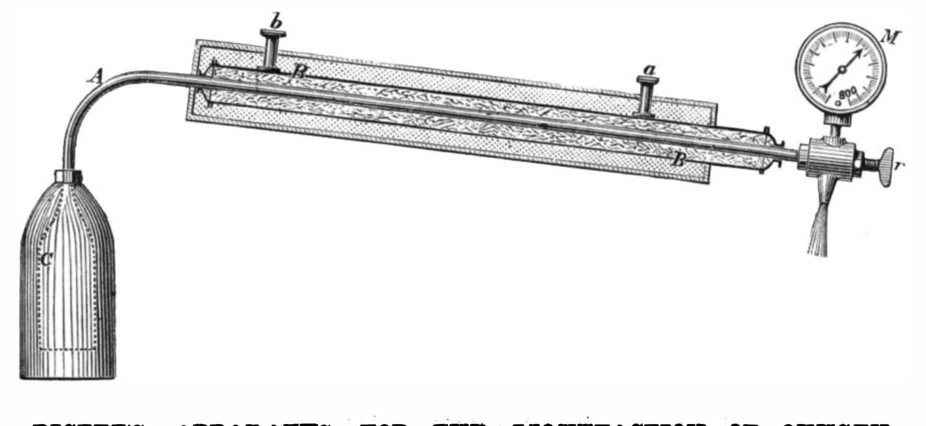
Struck with the truth of this alternative, which is rendered certain by thermo-dynamic equations based on accurate data, I have sought to produce a mechanical arrangement which should entirely satisfy these different conditions, and I have chosen the complicated apparatus of which the following is a brief description:

I take two pumps, P_3 and P_4, for exhaustion and compression such as are used industrially in my ice-making apparatus. I couple these pumps in such a way that the exhaustion of one corresponds to the compression of the other. The exhaustion of the first communicates with a tube, R, of 1·1 meter long and 12·5 centimeters in diameter, and filled with liquid sulphurous acid. Under the influence of a good vacuum the temperature of this liquid rapidly sinks to —65° and even to —73°, the extreme limit attained. Through this tube of sulphurous acid passes a second smaller tube, S, of 6 centimeters in diameter and the same length as the envelope. These two tubes are closed by a common base. In the central tube is retained compressed carbonic acid produced by the reaction of hydrochloric acid on Carrara marble. This gas being dried is stored in an oil gasometer, G, of 1 cubic meter capacity. At a pressure of from 4 to 6 atmospheres the carbonic acid easily liquefies under these circumstances. The resulting liquid is led into a long copper tube, B, 4 meters in length and 4 centimeters in diameter. Two pumps, P_1 and P_2, coupled together like the first, exhaust carbonic acid either from the gasometer, G, or from the long tube, B, full of liquid carbonic acid. The ingress to these pumps is governed by a three-way tap, H. A screw valve cuts off at will the ingress of the liquid carbonic acid in the long tube; it is situated between the condenser of carbonic acid and this long tube. When this screw valve is closed and the two pumps draw the vapor from the liquid carbonic acid contained in the tube 4 meters long, and the greatest possible lowering of temperature is produced, the carbonic acid solidifies and descends to about —140°. The subtraction of heat is maintained by the working of the pumps, the cylinders of which take out 3 liters per stroke and the speed is 100 revolutions per minute.

Both the sulphurous acid tube and the carbonic acid tube are covered with a casing of wood and non-conducting stuff to intercept radiation.

In the interior of the carbonic acid tube, B, passes a fourth tube, A, intended for the compression of oxygen; it is 5 meters long and 14 millimeters in external diameter. Its internal diameter is 4 millimeters. This long tube is consequently immersed in solid carbonic acid, and its whole sur face is brought to the lowest obtainable temperature. These two long tubes are connected by the ends of the carbonic acid tube, consequently the small tube extends about 1 meter beyond the other. I have curved this portion downward and given the two long tubes a slightly inclined position, but still very near the horizontal, as I have shown in the accompanying drawing.

The engravings given herewith, which we take from the *Chemical News*, will be more clearly understood from the following references: A. A tube 14 millimeters external diameter and 4 millimeters internal diameter, in which the oxygen condenses. It is furnished with a screw tap, 2, from which the liquid oxygen jets out. A pressure gauge, M, measures the pressure up to 800 atmospheres. B. A tube 4 meters long, in which is solid carbonic acid. The stock of carbonic acid is contained in a gasometer, G, of 1 cubic meter capacity. A three-way tap, H, puts it when desired into communication with the apparatus. C. A howitzer shell containing 700 grammes of chlorate of potash mixed with chloride of potassium. It is heated with gas.

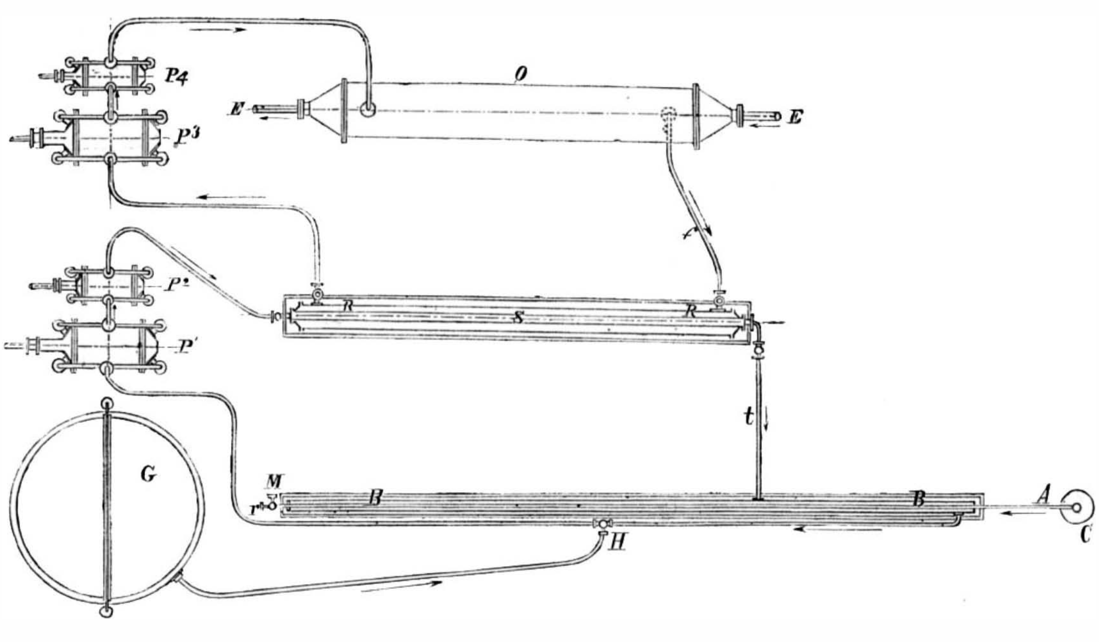


PICTET'S APPARATUS FOR THE LIQUEFACTION OF OXYGEN.

P_1 P_2. Double-action exhaustion and force pumps, drawing carbonic acid from the tube, B, or the gasometer, G, according to the position of the tap, H. S. A tube 60 millimeters in diameter and 1·1 meter long, in which is condensed the liquid carbonic acid compressed by the pumps. This liquefied gas returns by the small tube, *t*, to the tube B. R. A tube 125 millimeters in diameter and 1·1 meter long, containing liquid sulphurous acid. P_3 P_4. Double-action exhaustion and force pumps, exhausting sulphurous acid gas from the tube R. Q. A tubular condenser of sulphurous acid compressed by the pumps. This body when liquefied returns by the small tube, *f*, to the tube R. The cold water for condensing the sulphurous acid passes through the apertures, E E. *a*. Entry for liquid carbonic acid. *b*. Exit for the vaporized carbonic acid caused by the suction of the pumps.

The small central tube is curved at A, and screws into the neck of a large howizer shell, C, the sides of which are 35 millimeters thick; the height is 28 centimeters, and the diameter 17 centimeters.

This shell contains 700 grammes of chlorate of potash and 256 grammes of chloride of potassium mixed together, fused, then broken up, and introduced into the shell perfectly dry.



PICTET'S APPARATUS FOR THE LIQUEFACTION OF OXYGEN.

When the double circulation of the sulphurous and carbonic acids has lowered the temperature to the required degree, I heat the shell over a series of gas burners. The decomposition of the chlorate of potash takes place at first gradually, then rather suddenly toward the end of the operation. A pressure gauge, M, at the extremity of the long tube, lets me constantly observe the pressure and the progress of the reaction. This gauge is graduated to 800 atmospheres, and was made for me expressly by Bourdon, of Paris.

When the reaction is terminated the pressure exceeds 500 atmospheres; but it almost immediately sinks a little, and stops at 320 atmospheres. If at this moment I open the screw tap, *r*, which terminates the tube, a jet of liquid is distinctly seen to spurt out with extreme violence. I close the tap, and in the course of a few moments a second jet—less abundant, however—can be obtained. Pieces of charcoal, slightly incandescent, put in this jet inflame spontaneously with inconceivable violence. I have not yet succeeded in collecting the liquid, on account of the considerable projectile force with which it escapes, but I am trying to arrange a pipette, previously cooled, which possibly may be able to retain a little of this liquid.

Yesterday I repeated this experiment before the majority of the members of our Physical Society, and we had three successive jets, well characterized. I cannot yet determine the minimum pressure necessary, for it is evident that I have a surplus pressure produced by the excess of gas accumulated in the shell, and which could not condense in the small space represented by the interior tube.

I hope to utilize a similar arrangement in attempting the condensation of hydrogen and nitrogen, and I am especially occupied with the possibility of maintaining low temperatures very easily, thanks to four large industrial pumps which I have at my disposal, worked by a steam engine.

GENEVA, December 25, 1877.

Since receiving the above we have been favored with further particulars of an experiment which was performed for the fourth time on Thursday, December 27th, in the presence of ten scientific men—among others, Professor Hagenbach, of Basle, who came expressly to assist at this important experiment.

At 10 o'clock in the evening the manometer, which had risen to 560 atmospheres, sank in a few minutes to 505, and remained stationary at this figure for more than half an hour, showing by this diminution in the pressure that part of the gas had assumed the liquid form under the influence of the 140 degrees of cold to which it was exposed. The tap closing the orifice of the tube was then opened, and a jet of oxygen spurted out with extraordinary violence.

A ray of electric light being thrown on the escaping jet showed that it was chiefly composed of two parts—one central, and some centimeters long, the whiteness of which showed that the element was liquid, or even solid; the other exterior, the blue tint of which indicated the presence of oxygen compressed and frozen in the gaseous state.

The success of this remarkable and conclusive experiment called forth the applause of all present.

We understand that Messrs. Pictet and Co., of 22 Rue de Grammont, Paris, are fitting up apparatus with the intention of having these experiments repeated at their Freezing-Machine Works, at Clichy, Paris. We read in the *Times* that on the morning of Monday, December 31st, 1877, in the presence of three members of the Institute, M. Cailletet effected the liquefaction of hydrogen, nitrogen, and atmospheric air, thus proving that all gases can be liquefied.

A New Chimera.

The discovery of a new fish in American waters has been announced by Professor Gill to the Philosophical Society of Washington, D. C. It is of a uniform lead color, and has been named *Chimera plumbea*. It was caught near the La Have Bank, about 250 miles southeast of Halifax. Its form is said to be quite distinct from the European *Chimera monstrosa*, which is fortunate, since that appropriately named fish is one of the ugliest in existence.

DEATH OF THE DISCOVERER OF FŒTAL AUSCULTATION.—The Count de Kergaredec, the first to apply auscultation to the detection of the fœtal heart in pregnancy, died lately in Paris at an advanced age. His son in announcing his death to the French Academy said: "Among his children who stood around his death bed was that beloved daughter, the beating of whose heart her father heard while she was still in her mother's womb."

A TOLLING machine has been erected at Ealing cemetery at the cost of £80, and seems to give universal satisfaction. It was calculated that this method of doing things would (at 300 funerals a year) be in the long run cheaper than paying a man threepence an hour to ring the bell. Thus we mourn for the departed.

OUR public schools should embrace the science of man, the science of agriculture, the science of mechanics, the science of housewifery, and the moment we enter the domain of nature our range is unlimited.—*William Crandle.*

MACHINE FOR PREPARING RAMIE FIBER.

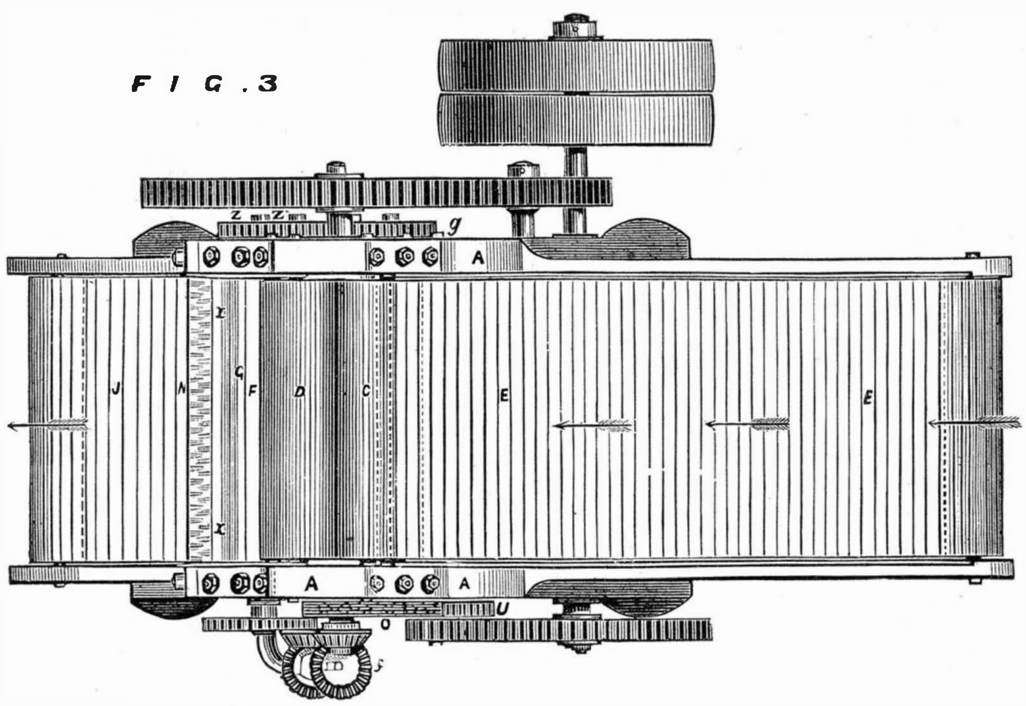
We have already called attention to the large reward of $24,000 offered by the British Government to the inventor of a successful machine for preparing the fiber of the rhea plant or ramie. In 1870 a like reward was offered, with the same object. Thirty-two competitors entered, but only one appeared for trial at Sahranpur, India, in August, 1872. This was Mr. John Greig, who received an award of $7,500, and of whose machine we extract the annexed engravings from *The Engineer*.

The stalks of rhea or China grass to be operated upon are in the first place spread on the traveling platform or table, E, and as this is traversed the stalks are caught between the fluted rollers, B, C, and D, where their cores or pith are broken and the outer shell or skin is also broken up. The fibers then pass down between the roller, B, and the pressure roller, F, as shown at Fig. 1, and are thence conducted between the revolving drums or rollers, G, and by means of the knives or scrapers, *x*, attached thereto, the short pieces of pith which have been broken by the action of the fluted rollers, B, C, and D, are separated and thrashed away, and at the same time the skin of the grass is divested of the mucilaginous and vegetable matters adhering thereto. As the ribbons or strips of fibers pass from contact with the scrapers, *x*, they become suspended vertically and are blown between the pressure roller, I, and the traveling table, J, by means of the revolving brush or fan, H. When the roots or thicker ends of the stalks of the fiber have passed between the fluted rollers, B, C, and D, they fall downward by their own weight, and being suspended by the portions of the fibers held between the pressure roller, I, and table, J, they come in contact with the lower set of revolving scrapers, *r*, attached to the drums or rollers, M, by which the fibers of the roots or thicker ends of the stalks are divested of the pieces of pith and adhering mucilaginous matters, and the now cleansed fiber is drawn upward by the friction between the pressure roller, I, and the traveling table, J, by which it is conducted away from the machine. The whole length of the fiber it was intended should be cleaned at one operation, and in order to still further cleanse the fiber while it is being operated upon, a tank, *v*, is placed at the top of the framings, A A, as shown at Figs. 1 and 2. This tank is provided with a cock, *w*, and perforated rose, *z*, extending across the upper part of the machine, by means of which water may be discharged on the rhea fiber being operated upon. In order to prevent the vegetable and mucilaginous matters from adhering to the scrapers, *x* and *r*, while they are removing the different substances from the fibers under treatment, the scrapers during their revolution are caused to come in contact with the brushes, N, N¹, and N², and are thereby kept free from those substances.

The machine was designed for working upon green stems, and the speeds of the principal parts are: First motions, revolutions per minute, $a=65$; fluted roller, $\frac{1}{6}a=10{\cdot}83$; scraping cylinders, $8a=520$; blower cylinders, $8a=520$.

The traveling webs of both feed and delivery have a speed of 21·67 feet per minute. The weight of the machine is 30 cwt. The machine did not succeed in turning out fiber clean and fit for market in one operation, and a scutcher of ordinary construction was attached, which removed the small portions of stalk and green bark not removed by the machine. In working, the machine broke up the stems without injuring the fiber, and the action of the fluted rollers was considered good, but that of the scrapers was defective, especially when the supply of water was deficient. The more freely this was supplied the better the fiber was turned out, and considerably more than 40 gallons per hour was found to be necessary. The inventors intended that the curves of the fluted rollers and the blades of the cylinders should be so accurately struck that the clearance should be barely the thickness of the fiber which should intervene, but as this is only about $\frac{1}{200}$th of an inch, it may be imagined that this was not realized. The blower was also found to be inefficient in directing the lower end of the fiber as it fell from the upper rollers into the second rollers, so that the fiber became entangled instead of being kept straight. The separation of the bark and woody stem was, moreover, not efficiently effected. The cost of preparation was found to be nearly £35 instead of the stipulated £15.

FIG. 3



GREIG'S MACHINE FOR PREPARING RAMIE FIBER.

Photo-Electricity of Fluorspar.

M. Hankel, at the Saxon Academy of Sciences, recently described the results of some experiments he had made on the electric action of light on crystals of fluorspar. After exposure to sunlight, the center of a face of the crystal is found to have a marked negative potential, while the potential of the sides of the face is much less strong and sometimes positive. On sifting the sunlight through colored glasses, a layer of water, or a solution of alum or sulphate of quinine, it was found that the chemical rays are the most active. A too strong concentration of light on the face of the crystal destroyed its sensibility to the further action of light. An exposure of the crystal to a temperature of 95° produced the lowest positive potentials at all points of the crystal while it was cooling.

A Novelty in Washstands.

We were recently shown by Mr. N. O. Bond, the inventor, an excellent arrangement of washstand designed for country houses, aboard steamers, and for other localities where the time-honored ewer and basin are used.

Mr. Bond constructs basin, slab, and water receptacle of his stand all in one piece and of marbleized pottery. The water reservoir is under the slab at the right and communicates with the basin on the left, so that by simply pressing a button near the latter a spring valve is lowered and the water rises in it from an aperture near its bottom. Pressure on another button opens another valve, and the water runs out at the same orifice at which it entered. The valve seats and the conduits are all made in one piece with the rest, and the valves are merely conical pieces of rubber. The reservoir holds four or five times as much water as the ordinary ewer, and hence when once filled it contains a supply for some days. The slab, basin, etc., are mounted on an ordinary washstand casing, which may be as ornamental as desired.

Mr. Bond has patented this device both in the United States and in many foreign countries.

New Illuminating Rocket.

Some experiments, leading to highly favorable reports, have lately been made in the German and Austro-Hungarian artillery service, on a new illuminating star rocket. The pot, which is very small, contains 57 illuminating stars of magnesium, and 72 others smaller. The fuse is generally arranged for eight seconds, so as to project the stars when the rocket has gone 1,100 metres; the stars then burn while falling, till they are about 5m. from the ground; the rocket weighs 11·7 kil. To illuminate an object continuously a series of the rockets are fired an intervals of six to eight seconds, for which purpose two rocket stands are placed about 10m. apart, and directed to the same point; when one rocket is lit the man goes to the other and lights it. The luminous effect of these rockets is said to be quite equal to that of daylight.

FIG. 1

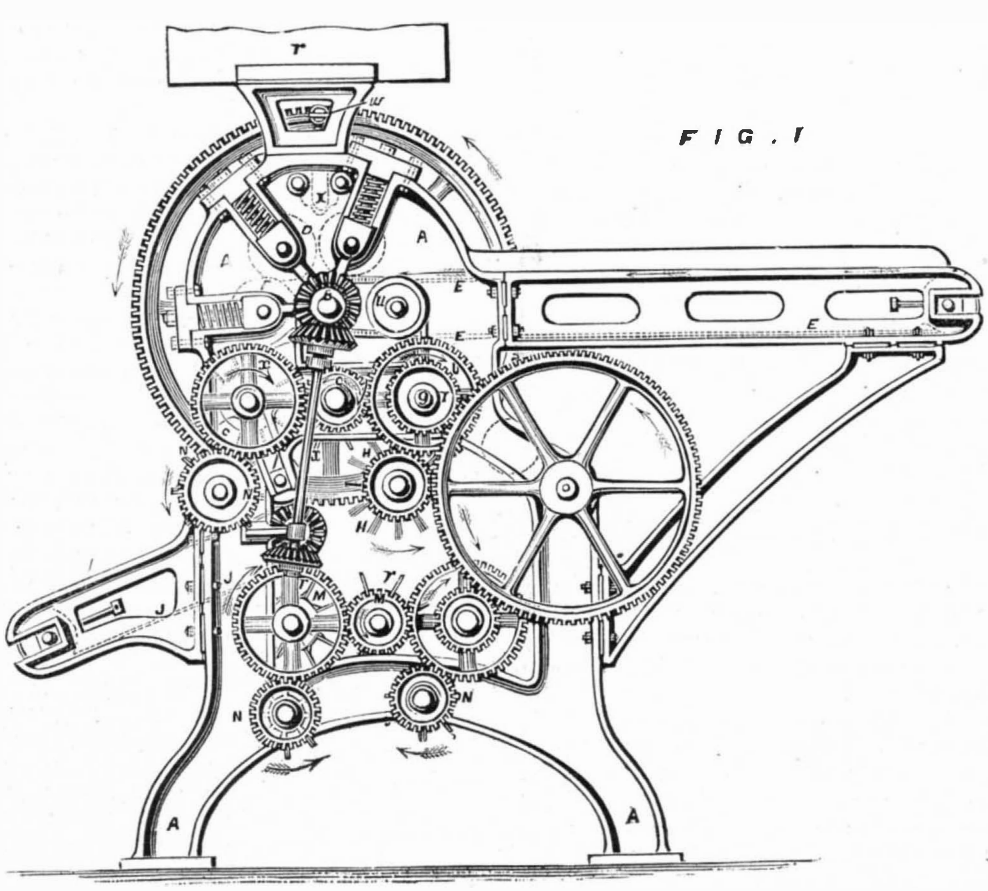
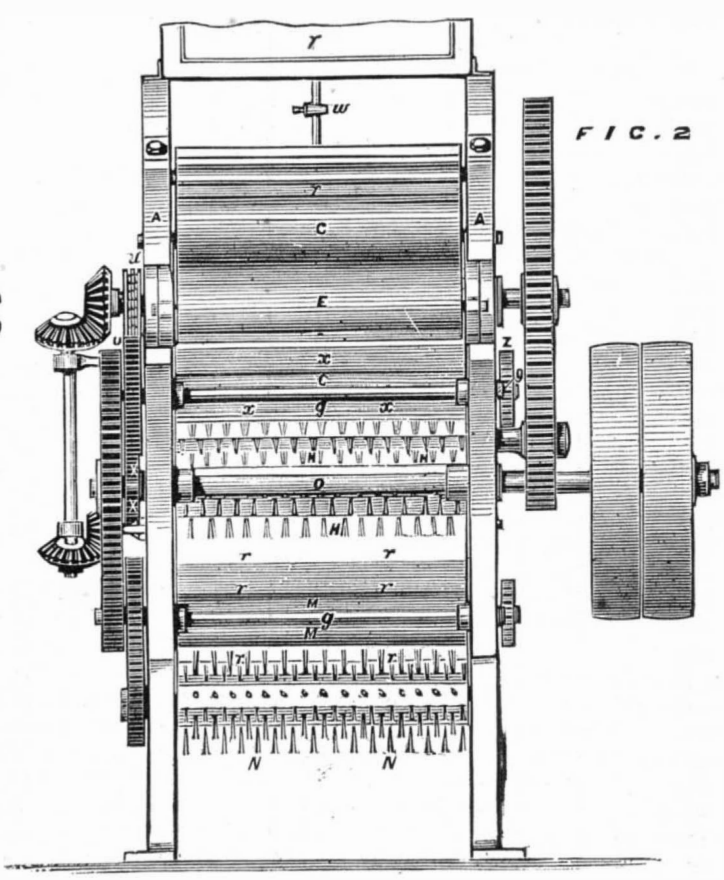


FIG. 2



GREIG'S MACHINE FOR PREPARING RAMIE FIBER.

HOW SUBMARINE CABLES ARE DESTROYED.

It might reasonably be supposed that after a well-protected telegraph cable once reaches its place upon the ocean bed it would not be liable to very many causes of injury beyond the natural deterioration of its protecting envelope. But that such is not the case will be seen from the following facts, for which, with the accompanying illustrations, we are indebted to *La Nature:*

In northern latitudes cables are frequently ruptured by icebergs or floes. The former often draw several hundred feet of water, and where the sea is shallow come in contact with and so break the cable. Another cause of rupture is sharp rocks on the ocean bottom, against the edges of which the cable chafes until the outer envelope and layer after layer of the protecting material are worn through. Earth contact of the interior conducting wires then usually occurs, and the cable no longer transmits signals. Other natural causes of destruction are coral banks, earthquakes, submarine currents, and the elevated temperature of tropical waters.

Numerous instances have occurred where cables have been damaged by fish, a notable example happening in the cable between Brazil and Portugal, and the coasting cables which run along the eastern shore of the South American continent. On these lines the cable is almost chronically attacked by sawfish. Pieces of the bone of the saw of this animal have repeatedly been found imbedded in the coverings so deeply that the interior conducting wires themselves are injured. Fig. 3 shows a section of the cable with the bone found inclosed therein. No less than five times have the cables above named been injured by sawfish attacks. It is supposed that the fish runs into the cable, and as its temper is none of the best, it becomes enraged and vents its anger on the obstruction by blows of its saw. An even more curious instance occurred not long ago in the cable across the Persian Gulf, which suddenly became inoperative. On examination it was found that a large whale had become entangled in the line. The animal was covered with parasites, and it is supposed that it attempted to use the cable as a rubbing post in order to rid itself of its annoying appendages. One stroke of its powerful tail probably broke the line, and then in rolling over and over the whale wrapped itself so tightly in the coil that it committed suicide by strangulation.

Among the worst enemies of submarine cables are three insects. The *teredo navalis* and its congener the *xylophaga*, which Huxley first discovered in 1860 in one of the cables of the Levant, enter the hemp covering and penetrate to the gutta percha, wherever the interstices of the wires of the exterior envelope afford them an opening. The *teredo* is a worm that constructs a tube for itself out of its calcareous secretion. The *xylophaga* is a bivalve, which does not penetrate deeply into the gutta percha, but simply attaches one of its shells thereto, chafing the material so that considerable losses of current occur. The *teredo norvegica*, Fig. 1, is quite a large worm, having two shells on its anterior part, with which it can cut through the hardest wood. It belongs to the genus of acephalous mollusks, and no less than 24 different species of it have been recognized.

The *limnoria lignorum*, Fig. 2, is a small crustacean about the size of an ant. It penetrates into the interstices of the wire envelope of the cable and makes its way to the core. The cables in the Persian Gulf and Indian Ocean and also on the Irish coast have been seriously damaged by the ravages of this creature.

NEW APPARATUS FOR THE COMPRESSION OF HYDROGEN AND OXYGEN.

M. Bouvet has recently addressed a note to the French Academy of Sciences, calling attention to the new apparatus illustrated herewith, by means of which he is enabled to subject oxygen and hydrogen to very high pressures. A is a voltameter formed of a block of glass in which are hollowed two cavities, C D, the cubical contents of one exactly double that of the other. The voltameter is inclosed in a strong metal case, B, and the orifice through which the former is introduced is closed by the screw, F. A special opening, G, allows of the introduction of the two wires which communicate with the electrodes in the cavities, C D. The two channels, H, closed by screws, allow the air to be driven out of the apparatus before the beginning of the experiment. At J is a tube in communication with a reservoir, K. The latter is closed by a strong screw, M, which serves as a piston to cause an augmentation of pressure in the cavities, C D, during the experiment.

Supposing that these cavities to the height *a b*, will contain, the one, one quart, the other, two quarts, and that the apparatus is filled with slightly acidulated water from which the air has been expelled. Then, the apparatus being closed, the current from a battery is sent into the voltameter, the positive electrode being in cavity C and the negative one in D. As the water decomposes, it may be supposed that its level in the cavities falls to *b*, hence all the water contained in said cavities may be considered as transformed into gas; and this, therefore, must be submitted to a considerable pressure which it is easy to calculate. The two cavities contain 8·7 cubic feet of water. Water being taken as incompressible, it is therefore here replaced by 8·7 cubic feet of gas. Knowing the weight of hydrogen and oxygen, it is not difficult to find that the volumes of gas, produced as described, are submitted to a pressure of 1,854·5 atmospheres or 27,817·5 lbs. Now if the piston screw be operated in the reservoir, K, to drive water into the cavities, if the gas in the latter be thus reduced in volume in the proportion of 1 to ½, it follows that the pressure thereon is doubled and becomes 3,709 atmospheres or 55,635 lbs. The current can again be established, the water again caused to descend to the level, *b*, and the operation as above described repeated; so that ultimately pressures can be reached only limited by the resistance of the apparatus.

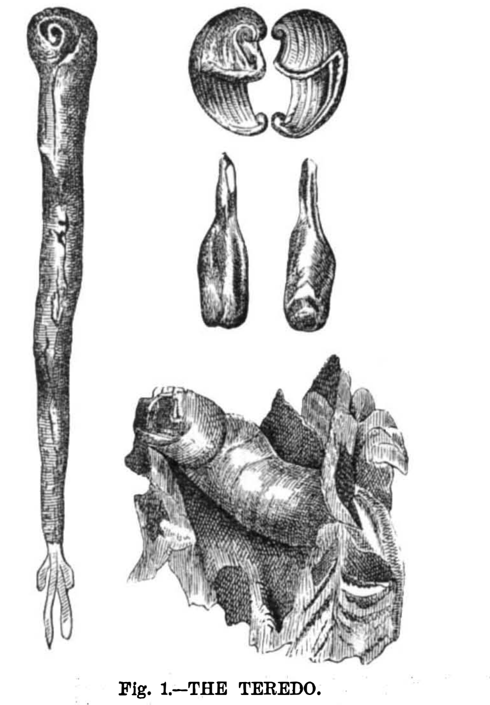


Fig. 1.—THE TEREDO.

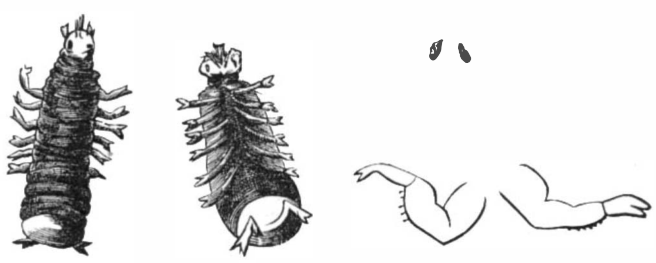


Fig. 2.—LIMNORIA LIGNORUM.

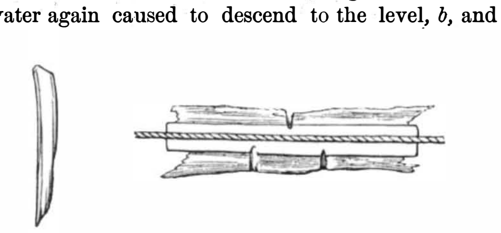
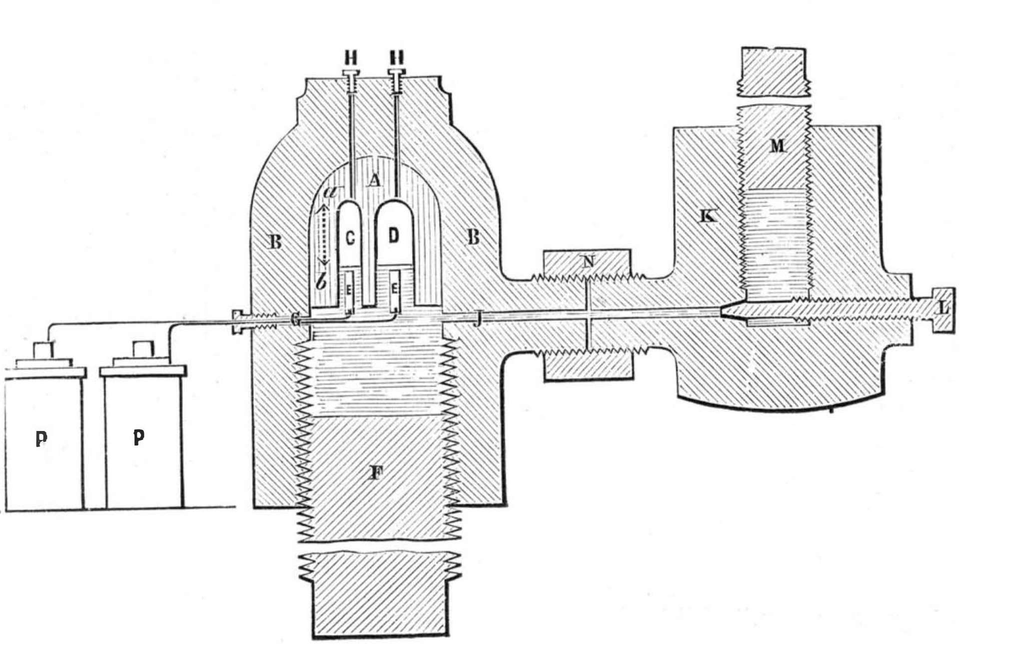


Fig. 3.—BONE IN TELEGRAPH CABLE.

JOSEPH S. LYNN, the aeronaut who on one of his ascents in England reached an altitude of 32,000 feet, recently made an ascent of 7,000 feet near Caranjah, in India. He is considering the feasibility of taking observations from a great height for the discovery of the northwest passage.



NEW APPARATUS FOR THE COMPRESSION OF HYDROGEN AND OXYGEN.

New Agricultural Inventions.

Mr. Thomas G. Bass, of Pittsburg, Texas, has devised a new Single Tree for Plows, etc., which is made wholly of wood. The construction, which is very simple, obviates vertical play and prevents the traces either from coming off or from becoming loose and falling under the horses' feet.

A new Corn Marker, patented by Mr. Michael Akerman, of Steamboat Rock, Iowa, embodies a self-dropper and marker to operate the dropping slide and to mark the ground opposite the hills. The construction embodies numerous new devices, and is ingenious and effective.

Mr. Nathan L. King, of Catskill, N. Y., is the inventor of a novel Shearing Instrument for clipping horses, removing wool from sheep, etc. The outward motion of a follower carries a plate forward toward teeth, and curved blades are caused to swing on pivots, so that their cutting edges follow those of the plate, thus making a shearing stroke. The teeth prevent the wool or hair from sliding between the edges of the instrument.

An improved Cultivator, patented by Messrs. John S. and Chas. A. Johnston, of Rockford, Ill., is so constructed that the plows may be raised from the ground by the backward movement of the driver, and that it may be easily guided and controlled. The construction is simple and ingenious.

A new Rotary Cultivator, patented by Messrs. Chas. C. Breeden and O. T. Wheeler, of Bedford, Ky., is so constructed as to stir the ground thoroughly while leaving its surface smooth. It is also of light draft, and it may be adjusted to work at any desired distance from the plants.

Messrs. Philander W. and Hiram G. Briggs, of Howell, Mich., have patented a new Grain Drill, which enables grain to be put in the ground to any depth, prevents its being covered too deeply when it may be advisable to run the drills zigzag, and stops loose stones from falling upon the seed.

A new Gate has been patented by Mr. Sanford W. Erwin, of Fayette county, Ind., which may be conveniently opened by hand or by the wheels of a passing vehicle. The construction is novel and very ingenious.

An improved Oatmeal Cutter, invented by Mr. Herbert Z. Cole, of Cortland, Ohio, consists in the combination with a cutting cylinder, formed of a series of toothed circular disks, of a stationary cutting plate provided with a series of notches corresponding in number to the circular cutters. The latter enter the said notches to effect the cutting of the oats at the point of contact with the said plate.

Mr. David E. Lupold, of Driftwood, Pa., has devised a portable fence which has panels made of rails with tapering ends and extending only to the center of the posts. Said panels alternate with other panels in which the rails are extended to half the width of the posts, so as to fit on the posts of the first panels. The posts are driven into the ground and the panels are connected by wires or ropes.

Mr. Robert Cowden, of New Richmond, Pa., has invented a new Hay and Grain Unloader which embodies several ingenious devices whereby the hay and grain may be unloaded quickly and conveniently and without being scattered or wasted.

In order to protect the udder of a cow from the dirt of a stable, and to keep it warm during cold weather, so as to increase the free flow of milk, Mr. Marshall R. Dowlin, of North Adams, Mass., has invented a Protector, which consists of a pouch made of leather and provided with straps so that it may be secured to the udder.

An improved Cotton Chopper has been patented by Mr. Sampson N. Camp, of Forksville, La. In the frame between the plows is a rimless wheel, to the spokes of which are attached cups, which cover the plants that are to be left for a stand, and protect them from the soil thrown by the plows.

Mr. James Higgins, of Westfield, N. J., has also devised a new Cultivator. In this machine, by pressing a rod and operating a lever the plows may be raised from the ground or forced down to enter more deeply, as desired. The middle beam, or any desired number of the beams, may be detached as circumstances may require.

A new Reciprocating Churn, devised by Mr. Thos. J. Murphy, of Busti, Iowa, has two dashers connected to an oscillating arm on each side of its fulcrum or pivot. The churn body is divided into two compartments by a vertical partition which has slots formed through it to allow the milk to pass freely from one chamber to the other. Many other ingenious devices are added, improving the general efficiency of the machine.

A new Cultivator, devised by Mr. Reuben H. Slifer, of Holden, Mo., is so constructed that the whiffletrees cannot drop to the ground to injure or break the plants; that it may be adjusted to work to any depth; that the plow beams may have sufficient play to be properly guided, or be raised out of contact with the ground in moving the machine from place to place. It is well suited for farm use.

Testing Tissues, etc.

We are indebted to the *Textile Manufacturer* for the following extract from the *Guide Practique pour l'essai des Matieres Industrielles, etc.*

ASCERTAINING AMOUNT OF DRESSING.

In order to ascertain the amount of dressing and other matters contained in tissues, the authorities in French naval matters and railway companies submit a sample to two prolonged macerations, one in tepid water, the other in boiling soda lessive, under the following conditions:

1. Measure the sample, and withdraw all threads which might ravel out in the maceration and other processes, and thus interfere with the weight and consequent result. Avoid testing too small samples: a piece half a yard long will suffice, and will not require large apparatus for the testing; if it be of the whole width of the stuff, of course there is no fear of lateral unraveling, but the ends must be carefully looked to.

2. Dry the sample completely in a stove heated to about 70° centigrade, or, in the absence of a stove, in a closed sand bath, or, still better, in a closed box containing chloride of calcium. Care must, however, be taken that the sample be not scorched. Then fold the piece quickly to get it into the balance, and weigh it immediately, while hot, as, being very hygroscopical, it absorbs humidity from the air, and thus soon gets an increase of weight that must not be disregarded.

3. To ascertain the amount of dressing macerate the sample for eight hours in a bath at 50° C., rain water being preferable, the water to be 18 or 20 times the weight of the piece of stuff. The bath must not be allowed to diminish, sufficient water at the same temperature being added every hour, or oftener, to keep up the same quantity.

4. After the above maceration each sample must be rinsed in ordinary or rain water in an earthen vessel, without wringing, and taking heed that no threads escape. Then dry immediately and weigh without delay, as described above; the difference between the present and the previous weighings will give the amount of the dressing, dissolved or detached. In naval and railway contracts, difference allowed is 2·5 per cent, which represents the inevitable loss due to the matters which form part of the yarn itself. If the difference be greater, there has been artificial dressing or insufficient preparation, the yarn has been soiled by matters soluble in tepid water. The following method determines the other matters separated:

5. To find then the amount of matters which the original lessivation had failed to eliminate, the samples are boiled for six hours in soda solution, marking from 3° to 5° of the alkalimeter, that is to say, about 3 to 5 grammes of soda per liter of water. The soda employed is common caustic soda, costing little more than 1s. 8d. per pound. The same precautions as mentioned above, and even greater, must be taken to keep the bath replenished, or the alkaline solution will become too strong and affect the tissue. After the maceration is completed, the rinsing, drying, and weighing must be carried out with all the precautions noted above. The difference between the third result and the second is the measure of the deficiency of the original lessivation.

TEST OF RESISTANCE OF TISSUES AND CORDAGE.

The test of resistance of tissues and cordage shows the nature of the yarn and the quantity of matters contained therein by the following triple method:

a. The weight of the tissue per square yard is taken after the samples have been well dried in the stove or in the sun.

b. The number of threads in warp and weft is ascertained by the ordinary thread counter of a quarter-inch field.

c. The resistance to traction of either tissues or cordage is measured by means of an apparatus which has two jaws, between which the tissue or cord is fixed, one jaw being stationary and the other connected with a lever, which is loaded until the sample breaks. In France the apparatus used is the dynamometer of Perreaux, which costs about £8. For tissues the trials are made with bands sixteen inches long and two inches wide, one cut lengthwise and another crosswise of the stuff.

REQUIREMENTS OF THE NAVY, ETC.

The following are the conditions required by the navy and public offices for the following principal tissues:

Kind of Tissue.	Threads per centimeter.		Weight per square meter.	Resistance of a band 5 cm. wide.	
	In the Warp.	In the Weft.		Length-wise.	Cross-wise.
			k.	k.	k.
Hand loom cloth	—	—	435	220	230
Ditto, ditto	—	—	345	130	140
Tilt cloth	32–33	10–11	540 to 560	270	330
Double yarn hammock cloth	—	18	330 to 370	200	290
Sail cloth No. 1	22	7	550	275	410
Ditto No. 6	24–25	10	350	170	255
Ditto No. 8, single yarn	16–18	13–14	270	135	200

After experimenting on samples well dried at a temperature of about 30° C., the same should be repeated with others damped with water, which, of course, generally offer greater resistance than dried samples.

TESTING FIBERS.

With respect to fibers, there is the double question of actual resistance and of durability, and there is often a difference of opinion respecting their fitness for certain purposes; some, for instance, as jute and phormium tenax, are definitely objected to in tissues of first quality; but all are agreed that tissues and cordage should always be of one kind (with exceptions), for the reason that, not being of the same elasticity and texture, the tissue will be less durable, and it is very difficult to distinguish flax, hemp, and jute by eyesight.

VETILLARD'S METHOD.

A great many methods have been proposed, but the best known is that of M. Vétillard, which is very ingenious, but delicate, and requiring an excellent microscope, enlarging 120 times. The object being a piece of the fiber, colored according to its nature by means of two solutions: one of iodine, dissolved in a solution of iodide of potassium; the other, glycerin, mixed with sulphuric acid, and the process is as follows:

a. From the tissue, perfectly washed, lessivated, and cleared of all impurities, threads are drawn from warp and weft, and are observed separately.

b. Dip the thread in the iodic liquid, and dry it with a piece of linen, or, better still, white blotting or filtering paper.

c. Lay it on a piece of glass, such as is used for microscopic observation, and divide and spread out the fibers with the aid of the point of a needle.

d. Place another glass on the fibers, set the whole in the microscope, and then introduce a single drop of the sulphuric solution between the two pieces of glass, and observe the color which the fibers assume when the acid touches them: flax turns blue, mixed more or less with yellow; hemp, green, mixed with gray; jute and phormium, yellow; China grass, gray; flat-rib, of gray-blue color. With a little practice of this method it is easy to see the difference between jute and phormium on the one hand, and flax and hemp on the other, which is of itself of great importance when there is a question of adulteration; but it is very difficult to distinguish jute from phormium and flax from hemp, as, according to the manner in which they have been prepared, they assume each other's tints, or so nearly as to deceive the eye. By means of nitric acid, in which the fibers are steeped, the distinction between flax and hemp and jute and phormium is clearly shown, the former not being affected at all, while the latter takes a fine red tint.

TESTING MIXED SILK AND WOOL.

If a piece of tissue of mixed wool and silk is plunged in hydrochloric acid, the silk is soon dissolved, while the wool remains, so that by careful weighing before and after the operation, the proportion of the two fibers is easily ascertained.

COTTON IN WOOL.

Finally, to ascertain if a woolen fabric contain cotton, treat it with sulphite of sodium, and all the wool will be dissolved, leaving the cotton untouched.

TEST FOR INDIGO.

A good test for indigo is supplied by sulphuric acid, mixed with its own weight of water. Steep a dyed specimen in the mixture for five minutes, wash well and dry in the open air; if nothing but indigo have been used, the color will be unaffected.

Vanilla.

Indigenous to Eastern Mexico, vanilla has been gradually diffused by cultivation through the adjoining countries, and is now grown also in Java and other islands of favorable climate. It is an orchidaceous plant with a trailing stem not unlike that of the common ivy, and, attaching itself to any tree standing near, it rises to the height of eighteen or twenty feet. The flowers are of a greenish-yellow color mixed with white, and the fruit or capsule, the part for which the plant is cultivated, is from three to eight inches long, of a yellow color when gathered, but gradually turning to a brownish black. The vanilla of commerce has been ascribed to a number of species of the plant, but it is now generally admitted that *Vanilla planifolia* furnishes the most of our supply.

The fruit of the vanilla, or vanilla "bean," as it is usually called, is, when fresh, of the thickness of the little finger, and is fleshy, smooth, and firm, but in drying it contracts to flattened cylinders from three tenths to four tenths of an inch wide. The surface is finely furrowed lengthwise, shining and unctuous. The pod contains a multitude of minute, black seeds, imbedded in an aromatic pulp.

Vanilla is principally gathered by the native Indians, who sell it to the whites, the latter preparing it for market. In this process it is spread out to dry in the sun for several hours, and then wrapped in woolen cloths to "sweat." Like pepper, it undergoes its principal change of color and flavor during this operation, and is finally dried by exposing it to the sun for a day or two. There are several varieties of vanilla, differing in excellence and price, the long beans being preferable to the short kinds. The best come from Mexico.

The fragrance of vanilla is not due to an otto, but to a crystalline substance found in the fruit and known as *vanillin.*

Vanilla serves the double purpose of perfume and flavor. While it lacks the quality necessary to make it acceptable for the former use in a pure state, it is largely employed in compounds, forming an excellent ingredient in sachet powders and scents for pomades, and a basis for some delightful handkerchief essences.

As a flavor, vanilla undoubtedly occupies the first rank, and here is at its best when used pure and simple. The only problem connected with its culinary use is how to secure its delicious aroma without adding the bean, woody fiber and all, to the delicacies in which its presence is coveted. The primitive mode is simply to boil a bit of the bean in some of the water or milk, as the case may be, which is to be used in making the cream, ice, or sauce to be flavored. But as this is rather wasteful, and the vanilla is always expensive, the assistance of the apothecary is usually called for, and he furnishes, in response, a liquid extract which, when properly made, contains all the aromatic virtues of the bean.

So much has been written about the preparation of this extract, and so many formulæ for it published, that one would think that its manufacture was attended with many perplexities. This is not the case, however, so far as the experience of the writer is concerned. Everybody, at least every apothecary, knows that water and alcohol are the two almost universal solvents, and that a mixture of the two serves to extract all the virtues of most roots, barks, leaves, and flowers.

Fruits are no exception to the rule, and the vanilla fruit readily yields up its aromatic constituents to diluted alcohol. Applying, then, the principles on which the apothecary prepares his tinctures in general, we may easily construct a formula for the tincture, or, as it is commonly called, vanilla extract: Take vanilla beans, one avoirdupois ounce; refined sugar, one avoirdupois ounce; alcohol, 95 per cent, eight fluid ounces; water, eight fluid ounces.

Beat the beans to a coarse powder in a mortar with the sugar, macerate them in the mixed alcohol and water for a week, shaking frequently, and finally strain the liquid through cotton cloth, using pressure, and adding enough diluted alcohol through the strainer to bring the finished product to the measure of one pint. The sugar is added merely to aid in dividing the vanilla.

If I felt myself called upon to imitate the example of certain foreign writers who give recipes for handkerchief extracts by the keg and cologne water by the barrel, it might be necessary to revise my formula to make it workable, but "small dealers" will have no difficulty with it as it is, except in regard to its costliness. With vanilla beans at the present price ($14 to $16 per lb. wholesale), the extract can be sold at, say, $2 per pint, and yield such a profit as the retail druggist must usually demand; but when the price of the beans advances, as it sometimes does, to more than double this figure, it is almost impossible to sell it to advantage.

As every one in the trade knows, vanilla extract is frequently adulterated with a mixture of tonka essence. The flavor of the latter somewhat resembles that of vanilla, but is much inferior in every respect.—*J. H. S., in Boston Journal of Chemistry*

Astronomical Notes.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, February 2, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury rises	5 46 mo.	Saturn sets	8 07 eve.
Venus sets	7 50 eve.	Uranus rises	6 24 eve.
Mars in meridian	5 06 eve.	Uranus in meridian	1 13 mo.
Mars sets	11 52 eve.	Neptune in meridian	5 21 eve.
Jupiter rises	6 04 mo.	Neptune sets	0 5 mo.

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Antares rises	3 12 mo.	Altair sets	5 23 eve.
Regulus rises	6 26 eve.	Fomalhaut sets	5 58 eve.
Spica rises	11 3 eve.	Algol in meridian	6 08 eve.
Arcturus rises	10 05 eve.	Capella in meridian	8 15 eve.
Sirius in meridian	9 47 eve.	7 stars (cluster) in meridian	6 48 eve.
Procyon in meridian	10 40 eve.	Betelgeuse in meridian	8 56 eve.
Aldebaran in meridian	7 37 eve.	Rigel in meridian	8 16 eve.
Vega sets	6 35 eve.		

REMARKS.

The sun is moving northward rapidly, changing in declination 44″ per hour. Day's length, 10 h. 9 m., 53 m. longer than the shortest. Duration of twilight, 1 h. 33 m., which is slowly shortening, reaching the *winter* minimum March 4. Mercury attains his greatest western elongation February 2. He can only be seen at or near the time of greatest elongation, as he then is at his greatest angular distance from the sun. Taking mean values, we find Mercury is brightest three days after greatest elongation west, and three days before greatest elongation east, or between greatest elongation and superior conjunction. But cases may and do arise when the time of greatest brilliancy falls before greatest elongation west and after greatest elongation east, or between greatest elongation and inferior conjunction, which fact, so far as I know, is not mentioned in any treatise on astronomy. To cause the point of greatest brilliancy to occur, as last mentioned, the earth must be at or near perihelion, and Mercury at greatest elongation, and at or near aphelion. This will be the case when Mercury is at aphelion and greatest elongation, about January 1. The elongation of Mercury, which occurs this day, happens to fall within the limits of this case. The earth being only 33 days from perihelion, and Mercury 16 days from aphelion, the time of greatest brilliancy occurs a few hours before greatest elongation west. Jupiter rises 1 h. 6 m. before the Sun, and 7° 9′ south of the sunrise point. Saturn's rings disappear February 6; the sun passing below their plane, and the earth remaining above. The earth will not reach their plane until March 1, when we shall see the southern surface, the rings reappearing as slowly as they disappeared. Algol is at minimum brilliancy February 3, 5 h. 25 m. morning; February 6, 2 h. 14 m. morning; and February 8, 11 h. 3 m. evening. θ Ceti (*Mira*) is fast disappearing, becoming invisible during the latter part of February. *Mira* in meridian February 2, 5 h. 21 m. 17 sec. evening.

New Mechanical Inventions.

An ingenious Sounding Machine, by which the depth of water is quickly and accurately shown, has been invented by Mr. F. E. Schrom, of Whitewater, Wis. There is an endless graduated indicating belt, combined with the reel that carries the sounding line, to which a relatively low velocity is imparted in such a manner that equal lengths of the line, when winding upon or unwinding from the reel, are represented by much shorter distances moved by any point on the belt. The graduations on the latter are numbered to indicate fathoms and quarter fathoms on the line.

Mr. Daniel H. Merritt, of Marquette, Mich., has patented a new Friction Gearing, the improvement in which consists in making a triangular or V-shaped groove between the bases of the teeth, at a more acute angle than the latter. The teeth or ribs travel faster at the periphery than at the bases, and are consequently liable to the greatest wear at the outer portion of their surface. By the present arrangement, it is claimed that as the ribs wear away they will maintain their original form.

Mr. Lorenzo Meeker, of Oswego, N. Y., has invented a new Lifting Jack by which a heavy weight may be lifted either from the ground or from the top of the device. There is a combination of a vertically sliding bar, a peculiarly constructed clutching device, and a lever fulcrumed on the tubular standard, by which the vertically sliding bar is guided.

In a new Car Wheel patented by Messrs. H. Scheibel, Jr., George M. Seeley, and John Schneider, of Bridgeport, Conn., annular elastic packing is interposed between the cylindrical faces of the tire and the web, the object being to absorb the jar, deaden the sound, and diminish the force of concussion, thus affording a better riding wheel and reducing the wear on the tire.

Mr. L. Morgenthau, of New York city, has devised a new Paper-feeding Machine, which consists of a vertically reciprocating and oscillating casing or receptacle, that is arranged with a narrow longitudinal slot at the curved bottom, and filled with some adhesive substance for the purpose of taking up and lifting a sheet of material at the down stroke of the receptacle and carrying it by the up stroke and by contact with a top stop screw to the feed rolls, so as to be taken up by the same.

Mr. T. A. Blake, of New Haven, Conn., has recently devised a new Ore Crusher, the object being to secure a regular feed and the avoidance of sudden strains upon the frame or the rods of the machine. The materials to be crushed are broken to uniform size and placed in a hopper. A sliding cover is then adjusted to supply the required material to the rolls. The rotation of a roll beneath the hopper causes an even supply of material to fall from the latter to the crushing rolls, where it is reduced to a uniform powder, either coarse or fine, as may be desired. New devices are provided, so that under sudden strain the rolls are permitted to yield without the necessity of overcoming increased resistance.

Mr. Carl A. Schumacher, of Walla Walla, Washington Territory, has devised a new Sewing Machine Shuttle, one advantage of which is that the tension spring and its fastening are permanently attached to the shuttle case, and consequently none of the parts are likely to become mislaid or lost.

A new Cross Tie for railways devised by Mr. David Horrie, of Keokuk, Iowa, consists of a cast or wrought iron tie made of a broad bearing surface, center bottom rib, and with lateral top flanges, that bind on the base of the rails and firmly secure the same. With this are combined straight screw bolts, having spiked heads that pass in grooves of the tie across the bottom of the rails.

Mr. Clark P. Hayes, of Brooklyn, N. Y., has invented a Machine for Cutting and Grinding Logwood, which is intended to take the place of the separate machines now used for that purpose. It works rapidly and separates the fine particles from the coarse chips, which last are conducted away and reground.

Mr. Elson Towns, of Cisne, Ill., has devised a new Governor for Steam Engines, which is so contrived that the relation of the centrifugal force of the rotating balls to the resistance changes as the balls rise or fall; and the relation of the motion of the balls to that of the moving sleeve is also variable, so that the governor is most sensitive when sensitiveness is required.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion.

NEW BOOKS AND PUBLICATIONS.

Upland Game Birds and Water Fowl of the United States. By A. Pope, Jr. Published by Scribner, Armstrong & Co., 743 and 745 Broadway, New York city.

We have received the first part of one of the most elegant ornithological works that has been published since Audubon produced his colossal volumes. The idea is to present a series of exact illustrations of many of the principal game birds and water fowl of the United States, drawn from and colored to the life by an artist sportsman who has studied them for years, and whose ability as a pa nter in water colors is of high order. The sketches, which are reproduced in fac-simile in the highest style of chromo-lithographic art, represent the male and female of each variety of birds, and the descriptive text is taken from Wilson's, Audubon's, Baird's, Cone's, and other standard ornithological books. The entire work is being published in the mosts umptuous manner, and when complete will form one of the handsomest productions of a publishing house already renowned for the artistic excellence of what it puts forth. The part before us relates to the American Snipe and the Green Winged Teal. The four following parts—there are to be five in all—describe the wood-cock, mallard duck, quail, black duck, ruffled grouse, blue billed duck, prairie chicken, and red headed duck. The work is sold by subscription only, at $2.50 per part.

Ames' Compendium of Practical and Ornamental Penmanship. By Daniel T. Ames. Published by A. J. Bicknell & Co., 27 Warren St., New York. Price, cloth, $5.

This is a large quarto volume containing 48 plates, finely executed by photo-lithography, and placing before the penman a great variety of models for imitation, ranging from simple elements of letter formation to the most elaborate engrossing. Twenty ornamental alphabets (many entirely new) are embodied, besides numerous designs for borders, monograms, and the various formal documents, such as resolutions, testimonials, etc., in preparing which the penman's skill finds its crucial test. The author states that it is the most complete handbook of ornamental penmanship extant. It is very handsomely published.

Palliser's American Cottage Homes. Published by A. J. Bicknell & Co., 27 Warren St., New York. Price $5.

The above-named publishing house is doing valuable service in its frequent publication of copiously illustrated works containing designs for dwellings which are not only moderate in price but in accordance with a constantly improving popular artistic taste. American village architecture has long been remarkable for lack of beauty, chiefly perhaps on account of the rapidity with which new towns spring up in this country, and the necessity of building at low cost. Now that the best architects do not think the planning of a workman's cottage unworthy of their skill, we may look for the application of better principles both in construction and exterior appearance. The present work is a notable instance of what may be done toward adapting really tasteful and new designs to the exigencies of moderate outlay. Here are 50 designs, each giving the necessary plans, elevations, and perspectives of cottages, none costing more than $3,500 to erect complete, and ranging from that figure down to as low as $325 for a very neat 2 room 1½ story dwelling. All are tasteful, many picturesque and elegant. They are intended for the country and look rural, which is much more than can be said of the ineffectual attempts to imitate French city architecture on a reduced scale, which of late years many architects have made, in planning country homes. Full forms of specifications and agreements are given, so that the reader has only to select his design and make a contract with a builder to have it constructed.

Practical Studies in Lineal Drawing. Designed and engraved by E. Becker. Price 75 cents. For sale by the author, Box 140, Stapleton, Staten Island, N. Y.

This is a portfolio of six finely engraved plates, exhibiting mouldings, volutes, and pedestals, and the Tuscan, Ionic, Doric, Corinthian, and Composite orders of architecture. Problems and solutions and various explanations are engraved upon the plates.

Notes & Queries

(1) C. L. asks: Is there any way to prevent a lignum vitæ block from checking? I have a piece that I use for cutting stencil plates on, and it has begun to check quite badly. I should like to prevent it without injuring the wood. A. Oil would have a tendency to stop it if frequently applied. A coat of paraffin would close the pores and prevent the action of the air upon the fibers. It might be bound with an iron ferule.

(2) F. B. asks what papier mache is composed of for making ornaments, also how to mix it for casting. A. It is a mixture of paper pulp and hot melted glue; the mixture is poured or cast while hot in moulds which may be made of plaster of Paris, and as soon as it sets by cooling is removed from the mould, and allowed to dry by exposure to the air; and when dry it is varnished or polished, according to the degree of finish that is required.

(3) S. A. H. writes: Please inform me how screw taps are hardened; those we have with the dies are a reddish color, and stand quite well, but we cannot make any that will stand at that color. A. It may be that you harden at too high a heat. Sprinkle pulverized yellow prussiate of potash over your taps. When they are heated to a dull red, again place them in the fire and increase the heat for a few moments until the prussiate is thoroughly fused or fluxed over the surface, and then immediately plunge and shake them (so that they will chill quickly) into and under clear cold water. When thoroughly cool, the tap or taps are to be removed from the water, then cleaned, polished, oiled, and tempered.

How are those collapsible tubes made used to put artists' oil colors up in? A. On very much the same principle as lead pipes are made—the metal is heated and drawn (in dies) to the required shape by pressure.

1. I have a Daniell battery (zinc was cast from chain pump buttons). It will not work sometimes for a long time, and then very weak. I would like to know the reason? A. It is likely that your battery zinc contains lead. 2. Can the sulphate of copper solution be made so strong as to impair the action of the battery? A. Not in Daniell's form of battery.

(4) J. L. P. says: In the Scientific American of December 15, 1877, under "Notes and Queries," is the following by H. R. H. (16): "What is the correct answer to the following example? 714—·714÷(·34—·034 ×·25 of 6)." There were two answers given, ·1554 and 711·52942+. In your answer you say the second solution is the correct one. I claim the first (1554) to be the correct answer, and give my reasons below. A. The statement is ambiguous; it may be rendered in four different ways, thus: 1. (714−·714)÷[(·34−·034)×·25×6] =1554. 2. (714−·714)÷[·34−(·034×·25×6)]=2468·117. 3. 714−[·714÷[(·34−·034)×·25×6]]=712·444. 4. 714−[·714÷[·34−(·034×·25×6)]]=711·529. In the quotients, the decimals are carried out to only the third place.

(5) M. H. R. says: It is desired to deaden the floor in a schoolroom. The room is about 45 x 30, the ceiling underneath is of ½ inch boards. What would be the best and cheapest mode of doing it? A. Lay down two or three thicknesses of building paper under the floor plank.

(6) A. S. asks: How are blue photographic pictures made? A. First solution: Potassium ferrocyanide, 120 grains; water, 2 ozs. Second solution: Ammon-ferric citrate, 2 ozs.; water, 140 grains. Mix the separately made solutions, filter into a flat dish and float plain photographic paper on it for 3 or 4 minutes. Dry the paper in the dark and expose it to strong sunlight under the negative for 8 or 10 minutes. Wash the print in running water, dry, and mount. A little gum arabic in the bath is said to greatly improve the picture.

(7) J. M. S. asks: What are the coloring matters used by confectioners—red, blue, yellow, and green? A. Blue: Indigo powder, soluble indigo (sulphindigotic acid), Prussian blue. Yellow: Saffron, Turkey and Persian yellow berries, quercitron, fustic, and aluminous lakes of these. Mixtures of blue and yellow make green. Red: Cochineal, carmine or lake, Brazil wood lake, madder lake. Carmine is often adulterated with vermillion (mercury sulphide); it should, if pure, dissolve without residue in strong aqua-ammonia.

(8) A. H. J. writes: Can you inform me how I can obviate the following difficulty with my cook stove? A thick, black, tarry substance almost continually oozes through the joints of the pipe and drips on to the stove and carpet, and has a strong, disagreeable odor. The draft is good; the wood used is beech and maple, thoroughly seasoned. The pipe is nearly new and perfect, about 16 feet in length from stove to chimney, with only one elbow. The stove, with this exception, is an excellent one. A. The tarry substance you mention is a product resulting from the destructive distillation of wood, and consists principally of pyroligneous acid. Your stovepipe acts as a condensing worm to a still or retort, such as is used in chemical manipulations; in fact, you are making pyroligneous acid; but as you seem to take no interest or pleasure in this manufacture, we suggest as a means of preventing it that you connect your stove directly with a brick chimney, so as to use as little metal stovepipe as possible.

(9) F. H. S. asks for a good indelible ink to use with stamps? A. Mix equal parts black oxide of manganese and hydrate of potash, heat to redness, and rub with an equal quantity of smooth white clay into a paste, water being added for that purpose; or, sulphate of manganese, 2 drachms; lampblack, 1 drachm; powdered loaf sugar, 4 drachms; rubbed into a paste with water. After stamping, dry the linen and wash well in water. Mix aniline red or rubine extra, 2 to 4 drachms; alcohol and water, each 7 ozs.; glycerin, 15 ozs.; heat and rub together with a little tannic acid or sumac extract and alum water. For blue, use soluble water blue (aniline) dissolved in a sufficient quantity (about 150 parts) of hot dilute glycerin. Soluble nigrosine may in a similar manner be used for black ink.

(10) F. W. M. asks how to hold India ink in solution like that prepared by Winser & Newton? A. The ingredients are digested for two hours at a high temperature in a Papin's digester. A drop of clove oil should be added and a little ox-gall.

(11) J. V. asks: What is the feeding principle of the German students' lamp? A. The equilibrium of a liquid in communicating vessels. Consult some text-book on Natural Philosophy.

Will ordinary rubber bands answer for making a coating or cement by dissolving in bisulphide of carbon? A. No; use gum rubber or caoutchouc.

1. What is the cheapest manufacture of ammonia? A. By decomposing the solution of the sulphate or carbonate obtained from the liquor of gas works, by slaked lime aided by heat. 2. About what is the cost of manufacture per lb.? A. If you refer to aqua or liquor of ammonia, crude, 10 cents; chemically pure, 75 cents.

(12) D. S. asks: Is there any method of keeping the worm out of white hickory? A. The application of a dilute solution of tannin mixed with about 10 per cent of zinc chloride is said to preserve the wood to some extent.

(13) J. S. asks: Is it practicable to manufacture ice by utilizing the cold given out by the expansion of compressed air (say to five atmospheres)? A. Yes, but the processes involving ether, anhydrous sulphurous oxide and other chemicals are more economical.

(14) S. S. asks: What can be added to common black writing ink to make it a copying ink? A. A little loaf sugar dissolved by heat.

(15) G. F. and others ask for recipes for permanent black, blue, and red inks that will not mould? A. Bruised Aleppo nutgalls, 12 lbs.; water, 6 gallons; boil in a copper vessel for an hour, adding water to make up for the portion lost by evaporation; strain, and again boil the galls with four gallons water for half an hour, strain, and boil a third time with $2\frac{1}{2}$ gallons, and strain. Mix the several liquors, and, while hot, add green vitriol (copperas) coarsely powdered, 4 lbs.; gum arabic, powdered, $3\frac{1}{2}$ lbs. Agitate until dissolved, and after settling strain through a hair sieve. Product 12 gallons very fine and durable. Sumac, logwood, oak, and hemlock bark are frequently substituted for galls in the preparation of common ink. When such is the case, only one sixth or one seventh of their weight of copperas should be employed. A few drops of creosote will prevent mould. A very bright blue ink is made by dissolving laundry blue in a sufficient quantity of hot water; or mix, by grinding into a paste with water 20 parts of finest Prussian blue and 3 parts yellow prussiate of potassa, and dilute sufficiently with water, to which a little gum may be added. Or use Hoffmann blue 3 B., dissolved in 300 parts of water. Red: Pure carmine, 12 grains; aqua-ammonia, 3 ozs.; dissolve, then add powdered gum, 18 grains. Drop lake is generally used in place of the more costly carmine; use $\frac{1}{2}$ drachm as above. Or use "rubine extra" dissolved in 150 parts of water.

(16) J. N. asks: What ink is used by bookbinders for printing the covers of books in black? A. Ordinary printing ink.

(17) F. F. asks how dextrin is prepared? A. Mix a grain or two of starch with about three spoonfuls of cold water and a drop or two of sulphuric acid, and boil the mixture for a few minutes. When sufficiently boiled, a drop of the solution should no longer be colored blue by iodine solution. Agitate the liquid with a little chalk to remove the acid, filter and evaporate to dryness. The product is dextrin. A similar conversion is produced by boiling with malt. Dextrin or British gum is produced commercially by heating dry starch to about 320° Fah. in revolving sheet iron cylinders and grinding to flour the hard yellowish product.

(18) A. H. asks: How can I temper American tool steel after welding it in a piece of iron so it will do for cold chisels? I have tried it different ways, but it gets so brittle it will not stand. I wish to manufacture knives for straw cutters, welding steel on iron, and draw it out. What is the best steel to use for that purpose? A. If you use chrome steel you will find no difficulty.

(19) L. N. says: 1. I wish to make a flask 18 by 6 inches, to hold liquid carbonic acid. Of what thickness ought the iron to be? A. Vessels of this kind are made of cast bronze an inch in thickness. 2. What would be the weight of such a flask made of the safest material? A. About 90 lbs. 3. How many lbs. would it hold? A. It would contain about 5·8 of the liquid oxide. 4. In 1 lb. of liquid how many cubic feet of gas? A. About $8\frac{1}{2}$ at the ordinary temperature.

(20) A. S. C. asks how to produce a thin enamel or skin upon paper board that will dry quickly, without penetrating, and give additional strength, and at the same time be porous and indestructible, or as nearly so as possible, to fire at ordinary heat? A. You may try strongest solution of water glass, made white hot into a thick paste with siliceous earth—tripoli, rottenstone, etc., powdered felspar or kaolin.

(21) X. X. X. asks how to mix the best solder that can be made for soldering brass to iron and iron to iron? A. Mix equal quantities of tin and lead. I want about 3,500 turns on a foot lathe; would you run a countershaft in centers or in bearings to get that speed? A. In bearings; centers would give too much trouble, requiring so much lubrication.

(22) W. E. G. writes: 1. I wish to make a pair of experimental telephones, to work on a short line. Will the following materials answer the purpose? I have a pair of round steel bar magnets; each is $6\frac{1}{2}$ inches long by $\frac{7}{16}$ inch in diameter; also 1 oz. No. 40 silk covered copper wire, and two thin iron plates ($\frac{1}{100}$ of an inch thick). Is anything else necessary? A. You have all the requirements for a pair of instruments described in our issue of October 6, 1877. You will, of course, find it necessary to use some form of sounding box in which to set the membrane or diaphragm. 2. I have seen it stated that there is a piece of soft iron attached to the magnet at the end next the diaphragm, and the wire is wound round this. Is this piece of iron necessary, and if not, is it an advantage? A. It is not necessary, and in the style of instrument you describe it does not appear to us as an improvement.

(23) C. E. R. asks whether nickel plating a brass musical instrument injures its tone in the least? A. Yes, although the injury might not be noticed except by those whose sense of hearing is very sensitive. We believe the sweetest-toned instruments are made of wrought silver.

(24) C. M. L. asks how aniline inks are made? A. Red—Use "rubine extra" or aurin, dissolved in 150 parts of water. Blue-violet—methyl-violet 5 B, Hoffmann violet 3 B, or gentian-violet B, dissolved in 300 parts of water. Blue—water-blue BR, 5B, or 2B in 200 parts water. Green—methyl-green (crystals) in 100 parts water. Blue-black—aniline-gray in 200 parts water. Black—soluble nigrosine in 200 parts water. The color in each case is dissolved in the quantity of boiling water mentioned, and filtered. The addition of gum is not necessary. If the writing when dry retains a bronzy appearance, more water must be added to the ink.

(25) S. T. writes: I wish to know if an electrical cylinder, made as follows, will answer for the purpose in the experiment called "Leyden Jar Discharge," described in SUPPLEMENT 105, Jan. 5. Two well seasoned uprights, parafined between which swings, on an axis running clear through, a bottle 12 inches diameter, 24 inches long, including the neck. The axis of the cylinder has a small pulley geared by cord to one 4 times its diameter. The uprights are glued into a well seasoned walnut base. I propose to apply the silk flap, as follows: A rod running from support to support will have a piece of silk of sufficient length to hang over both sides of cylinder tacked in the middle to the rod mentioned above. Is this right? A. Yes, but instead of fastening the silk flap of your frictional machine to the wooden rod between the supports, it would be better to fasten it by means of silk thread to the friction pad or rubber, so that the silk thread will be the only electric communication between the flap and the rubber. With the size of machine you mention, the silk flap should be 18 inches wide.

(26) G. E. S. says: I am using tin to mould small articles. What can I do to have them come from the mould bright? A. Try an application of tallow as soon as the mould is cast.

(27) W. F. C. S. will find full description of steel tools for turning chilled rolls in the SCIENTIFIC AMERICAN SUPPLEMENT of September 2, 1876. They are hardened as hard as fire and water will make them. Any stiff solid engine lathe will answer.

(28) T. & Bros. say: How can we keep iron cylinders from rusting? We do not want to put any grease on them, and we find that rust will come through nickel plating. A. Give them a coat of lacquer.

(29) W. B. H. asks for the best process known for tempering mainsprings for gun locks, also the best steel for that purpose? A. The blazing process is generally considered the best. Use spring steel or English double shear steel.

(30) F. A. P. says: I am casting plates of irregular form, and I want to run the metal on chill. Thus far I have failed; the plate always cracks and wrinkles in cooling. A. Your chill was probably not thick enough. To prevent cracking, the cooling must be made to take place equally at all parts.

(31) W. Y. asks how to temper millpicks? A. Heat them to a low red heat in a charcoal fire, turning them over and over to heat evenly; dip in water with the chill off, and temper to a clear brown color.

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

J. S.—No. 1 is hornblendic schist. No. 2 is a variety of bituminous coal. No. 3 is orthoclase. No. 4 is calcspar.—S. B.—It is chlorite-hydrous silicate of monesia and alumina colored with oxides of chromium and iron. Not metaliferous.—M. F. B. (drab box).—Argillaceous limestone containing iron sulphide and arsenide, and probably a trace of copper and lead sulphides. Silver was not detected.—E. G.—It is a brown coal containing more ash, moisture, and oxygen than that used on the Mississippi. By distillation it will yield a gas and several oils; it is a good fuel.—Blue box, unlabeled—four samples of rich lead sulphide ore (salena). Nos. 2 and 3 are argentiferous and contain copper.—A. B. K.—No. 1 is argentiferous galenite in a calcareous slate gangue. An assay would be necessary to determine its value—it is valuable. Nos. 2 and 3 similar to No. 1. No. 4 is earthy celestite—strontium sulphate.

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 Standard of Beauty. By J. F. G. M.
On Gas Poisoning. By J. K.
On Making Wooden Pulleys. By B. T. D.

HINTS TO CORRESPONDENTS.

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

Correspondents whose inquiries 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.

Inquiries 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.

WANTS AND BUSINESS INQUIRIES.

Almost any desired information, and that of a business nature especially, can be expeditiously obtained by advertising in the column of "Business and Personal," which is set apart for that purpose subject to the charge mentioned at its head.

We have received this week the following inquiries, particulars, etc., regarding which can probably be elicited from the writers by the insertion of a small advertisement in the column specified, by parties able to supply their wants:

Who makes the Stoner & Whepley mill?
Who makes a good self-governing windmill for driving machinery?
Where can zirconium be bought, and at what price?
Who moulds sawdust into picture frames?
Who makes electrical batteries for gas lighting?

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

December 18, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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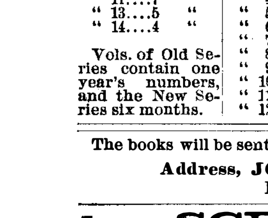

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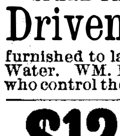

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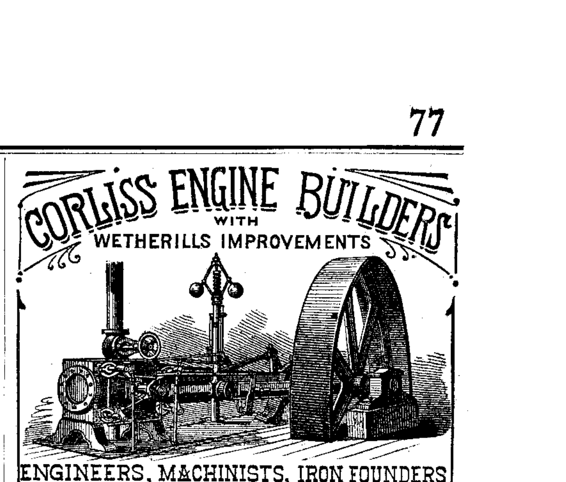

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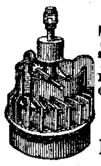

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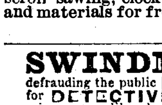

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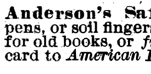

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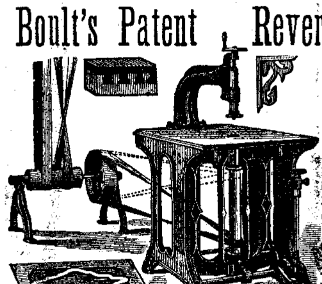

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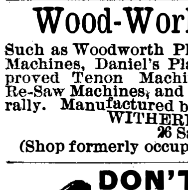

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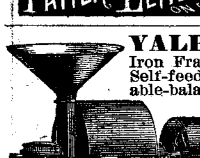

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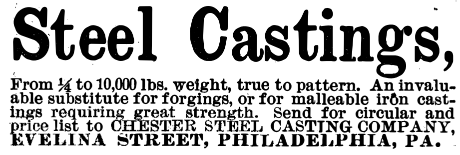

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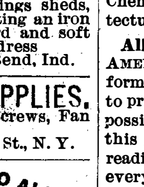

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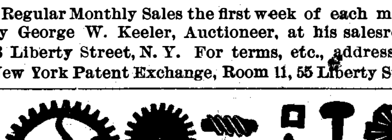

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