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JOSEPH GILLOTT.

The early history of the steel pen is curiously obscure. The most diligent search fails to discover the first maker or the earliest date of this implement. There were steel, or rather iron, pens—made, we believe, in Holland—as early as the middle of the seventeenth century. Towards the close of last century, Mr. Harrison, an ingenious Birmingham mechanic, made steel pens for Dr. Priestley. One of them is nothing more than a tube turned out of a flat strip of metal, with the sides and point filed away into the shape of a pen. The first actual supply of such pens, it is believed—the authority for the statement is no more than local tradition—was made by a Sheffield workman, whose name is forgotten. From time to time, as far back as 1809, steel pens, hand fashioned, turned and filed, were made as curiosities or luxuries for presents; but it was not until about 1824 that such instruments were produced in considerable quantities, as regular articles of manufacture. Mr. James Perry was the first manufacturer; but the process was tedious and costly. The metal was steel, rolled out of wire, and for this Mr. Perry paid as much as seven shillings a pound. To the first person he employed he gave five shillings for making each pen; and even when the trade had become regular he gave for some years as much as thirty-six shillings per gross to his workmen. Now—thanks to machinery and modern improvements—pens, not very good perhaps, but good enough to write with, can be made and sold at a profit for 3½ cents per gross!

The first great impulse to the steel pen trade was given in 1820, when Joseph Gillott began pen-making; and since then his name has become so closely identified with the trade, and has acquired such a world-wide reputation, that he has come to be regarded as *the* Pen Maker.

Though so long resident in Birmingham, Mr. Joseph Gillott was not a Birmingham man by birth. He was born in Sheffield, on the 11th of October, 1799, the son of a workman in the cutlery trade. His own youth was occupied in this business, in which he was both industrious and skillful; indeed, according to the account of old workmen, he was a noted hand at the forging and grinding of knife blades. In 1821, when Mr. Gillott was in his twenty-second year, trade in Sheffield fell off; and work being scarce, the young workman resolved to transfer himself to Birmingham, where, owing to the variety of occupations, a skilled mechanic need never be idle.

His earlier employment in Birmingham was in the light steel toy trade—the technical name for the manufacture of steel buckles, chains, and other works and ornaments of that kind. Some specimens of his workmanship in this trade Mr. Gillott always preserved.

After being for a few years engaged in this trade, Mr. Gillott began the manufacture of steel pens. His faculties of invention and adaptation at once came into play. Such pens as were then made were laboriously cut with shears out of the steel, and were trimmed and fashioned with the file in imitation of the quill. Mr. Gillott adapted the press to the making of pens—the stamping press, then much used in the Birmingham trades, and now familiar to everybody who has ever been in the shop of a metal worker. He saw that the press would enable him to dispense with most of the slow and laborious operations of pen-making; that it would cut out the blanks, slit them, bend the metal, stamp the maker's name, and thus, by mechanical means, render production at once rapid and certain. But the conception of this idea and the means of working it out were different matters. The metal had to be prepared by rolling, pickling, and tempering for the action of the press. Then special dies had to be made for each size of pen, and for each operation of stamping to which the blanks had to be submitted. Presses of improved construction—quick, light, easily worked, and yet firm enough to strike a sharp, heavy blow—had to be made. And when these difficulties were overcome, there remained others not less formidable, such as tempering the metal after it had left the press, rendering the newly made pens flexible so as to write easily, cleaning and polishing them without injuring their fineness, and coating them with some kind of varnish, so as to render them attractive to the eye. This was the work which Mr. Gillott had to do; and with much ingenuity and unflagging perseverance he accomplished it.

One of the chief troubles was the extreme hardness of steel pens; when much used, they became pins rather than pens. After many trials Mr. Gillott effected a great and permanent improvement by cutting the side slits in addition to the center slit, which had been solely in use up to that period. To this was afterwards added the cross grinding of the points; and these two processes perfectly succeeded in imparting elasticity to the steel pen, and bringing it up, in this respect, to an equality with "the gray goose quill." It is, however, a curious fact—and one worth noting, if only as evidence of character—that Mr. Gillott himself never used a steel pen; he always wrote with the quill. For some years Mr. Gillott kept his methods of working secret, fashioning his pens with his own hands, assisted by a workwoman whom he afterwards pensioned; and many curious anecdotes of the early days of pen-making have been related by this old lady. She used, for example, to tell with great amusement how the first pens were blued in a frying pan over a garret fire. This was at the period when the pens were sold singly, at high prices. Even after the manufacture had been for some time established, the price kept up. Mr. Gillott has been heard to say that on his wedding day he made seven pounds and four shillings by producing a gross of pens, which he sold at a shilling each.

In 1872, Mr. Gillott employed about 450 persons, the manufacture of pens reached more than five tuns per week, and the prices were reduced from one shilling each to a few pence per gross—all the work of the active brain and skillful hand of one industrious and able man.

Every visitor to Birmingham very properly holds that a visit to these works is both a duty and a pleasure. The courtesy of the attendants, the interest of the processes, the cleanly, orderly industry of the various rooms, the wonderful and delicate skill of the slender fingers, and the ready hands, the millions of the little peaceful weapons fashioned for all parts of the globe, are a marvelous tribute to the genius, perseverance, and liberality of one of the most famous heroes of the arts of peace. All readers will be glad to know that Mr. Gillott's eldest son inherits his father's mechanical genius and generous spirit, and that the world-famous works are not likely to be closed to the public eyes.

It is not only, however, as a pen maker that Mr. Gillott deserves to be remembered. This record would be incomplete without mention of his great collection of pictures. The taste for art was developed early in life. So soon as he had money to spare, Mr. Gillott began to buy pictures. Apart from business, this was the work of his life; the collection constantly grew, both in quality and extent, until at last his house in the Westbourne Road, Edgbaston, and his residence at Stanmore, near London, were crowded with works of Turner, Stanfield, John Linnell, Collins, Muller, Maclise, Leslie, Mulready, Cox, Eastlake, Callcott, Webster, Wilkie, David Roberts, Frith, Hook, Poole, William Hunt, Faed, Nicol, Copley Fielding, Prout, and almost every English artist of note.

The sale of his collection—a lamentable dispersion of art treasures—is too recent to be forgotten by our readers. The enormous produce of the sale, $850,000, affords proof that art not only yields the highest pleasures, but pays in a commercial sense, for Mr. Gillott's pictures brought, in all cases, a large profit upon their purchased price.

Mr. Gillott's figure was short, sturdy, square; his hair and beard (for many years before his death) silvery and venerable; his forehead broad, well rounded, high; his eyes clear, humorous, and bright; his expression pleasant and as

JOSEPH GILLOTT, INVENTOR OF THE STEEL-PEN PRESS.

suring; his walk light, active, and firm. His chief characteristics were remarkable quickness and accuracy of observation, wonderful shrewdness, common sense, and frankness; boldness, decision, and enterprise; rare mechanical skill and constructive powers; special talent for arrangement and organization, and rapid and sound judgment on all matters that came before him.

We are indebted to the *Practical Magazine* for the admirable portrait of this remarkable man.

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Contents:

(Illustrated articles are marked with an asterisk.)

SECRET SOCIETIES AMONG COLLEGE STUDENTS.

Mortimer M. Leggett, the youngest son of the Commissioner of Patents and a student at Cornell University, was recently accidentally killed during the progress of his so-called initiation into the "mysteries" of a college secret society known as the *Kappa-Alphas*. The circumstances were that the deceased went with a party of members of the above fraternity to a creek just outside the town of Ithaca; and there, blindfolded, he was left, with two companions, standing on the brink of a gorge through which the stream runs. Shortly after, a crashing of bushes, followed by groans, was heard, when the remainder of the party, hastening to the spot, found that the three boys had fallen over a precipice some fifty feet in hight. Young Leggett, it seems struck on his head, sustaining such severe injuries that death ensued in half an hour, while the others were both seriously hurt.

As one of these college fraternities has thus been the indirect means of causing this terrible calamity, we desire just here to express our opinion on the system of secret societies as generally practiced in our institutions of learning. These associations are bodies of students, organized in principle something after the orders of free-masonry or odd-fellowship. In many, the members are numbered by hundreds, and chapters of a single society often exist in a score of colleges at once. The records are handed down from class to class; and out of each set of freshmen, a few individuals are selected for the privilege of membership. When the plan was started (during, we believe, the year 1827) the idea was simply to form clubs of young men, for mutual improvement in debate and such kindred studies as are better pursued by numbers than by single persons, and to keep alive, among *alumni*, pleasant associations of college life. In course of time, the former innocent and laudable object has been lost sight of, or rather relegated to other associations, now existing in many colleges and not included in the list of secret societies; while the cardinal principle of the younger chapters of the latter organizations seems to be nothing more nor less than simple mischief, rendered attractive by a little mystery and concealed under the cloak of such cognomens (symbolized by Greek letters) as "union of souls," "circle of stars," "lovers of wisdom," etc. If the boyish nonsense resulted in the usual students' pranks, it might be passed over with a smile; but such is not the case. The influence exerted, upon boys fresh from school and for the first time free from direct home influence, we believe (from repeated instances within our personal knowledge, and in connection with one of the oldest colleges in this country) to be in a high degree baneful and demoralizing. Unless a youth has well filled pockets, (in which case rival societies vie with each other to see who shall secure him, or rather his money) he is not invited to membership at all. Once joined, however, and held by working upon his fears through the blasphemous oaths of secresy that he is forced to take, he is inducted, by sheer force of example, through a routine of profanity, intemperance and gambling; while in many cases, if young and innocent, his course leads to graver faults, committed more through a sense of shame and false pride than depravity, and due to the tacit if not open instigation of his unscrupulous elders.

The sad and untimely fate of Mr. Leggett, just at the outset of doubtless a brilliant and honorable career in the calling which his father has so ably adorned, will, from the circumstances under which it occurred, excite a lively and widespread sympathy. It is the first death, which, to our knowledge, has been owing, though indirectly, to the proceedings of these student organizations; though we have heard of numerous cases of maiming and injury thus caused, and of idiocy and cerebral disease due to the effect of hideous and ghastly paraphernalia upon the imagination of weak minded boys.

There is a notion, which is becoming entirely too prevalent, that colleges are merely convenient places for sending young men to while they are passing through that uncertain and troublesome age, leading to manhood, during which they are expected to sow their traditional wild oats. To this idea, we believe, may be mainly ascribed the barbarities of "hazing," and the no less reprehensible practices of secret societies; while to it also may be traced many of the complaints that our seminaries are inferior in an educational point of view to those of foreign countries. Hazing, already crushed out in the government naval and military schools, is exciting so large a share of public condemnation that there is a fair prospect of its stern repression in colleges generally. The secret societies, we trust, may meet hereafter with similar treatment, at least through the influence of parents if not at the hands of faculties. Harvard forbids their existence among her students, and Cornell at this time would do well to follow her example.

PROGRESS OF PATENTS.

The following were the number of applications for patents made to the principal governments of the world in the year 1872, as given in the published statistics of the British Patent Office:

	Number of Patents Applied for in 1872.
United States	18,243
France	4,872
Great Britain	3,970
Belgium	1,921
Austria	922
Canada	671
Italy	521
Saxony	259
Sweden and Norway	200
Bavaria	164
Wurtemburg	141
Baden	113
British India	71
Victoria	60
Prussia	56
New South Wales	42
British Guiana (allowed)	28
Cape of Good Hope, from 1860 to 1869	18
New Zealand	18
Mauritius	11
Ceylon	5
Tasmania	5
Jamaica	4

The aggregate number of patents applied for in all of the countries above named, in 1872, except the United States, was 14,072, thus showing that in this country the number of patents annually applied for exceeds, by 4,171, the combined number applied for in all other countries above named. The reason for the surprising difference in favor of this country, in the inventive productions of the world, we believe to be due to the superior theory which prevails here concerning the object and uses of patents. We grant patents for the purpose of encouraging the useful arts. We regard the inventor as a benefactor, and place him under no restrictions in the sale or working of his improvement. We grant patents at so low a price that the masses, the poorer classes, among whom the best inventors are found, may readily obtain and hold them.

WOOD AND STRAW PAPER MAKING IN FRANCE.

The improved processes of making paper from wood, straw, and various grasses, as practiced in France now enables the manufacturers to recover 85 per cent of the caustic alkali, used in the reduction of the raw material into pulp. This is a very important economy.

In order to convert wood into pulp, a strong solution of the alkali is necessary. One pound of carbonate of soda is required to produce four pounds of pulp.

By steeping the wood or straw in the alkali solution, the resinous and other gummy matters are separated from the fibers of the material, and become mixed with the solution. To regain the soda for re-use is now the object of the manufacturer. This is done by evaporating the water by heat, then charring the resulting mass, which yields carbonate of soda, then converting the latter into caustic soda.

The evaporation is effected by passing the products of combustion from the fire which heats the alkaline solution through the liquid which is to be evaporated. For this purpose the liquid is thrown up in the form of a thin spray, by paddle wheels. 12½ pounds of the solution, it is stated, are evaporated for each pound of coal consumed. The carbonate of soda is then subjected to long continued washing in a peculiar apparatus until it is fit for burning, and at last 85 per cent of the original quantity of the alkali is recovered. The former methods only permitted the recovery of from 50 to 60 per cent of the alkali.

TWO INTERESTING DISCOVERIES.

The *America*, a daily journal of Bogota, in a recent issue publishes a letter of Don Joaquin Alvez da Costa, in which he states that his slaves, while working upon the plantation of Porto Alto, Parahyba district, Peru, have discovered a monumental stone, erected by a small colony of Phœnicians who had wandered thither from their native country in the ninth or tenth year in the reign of Hiram, a monarch contemporary with Solomon and who flourished about ten centuries before the Christian era. The monolith bears an inscription of eight lines, written in clear Phœnician characters, without punctuation marks or any visible separation of the words. This has been imperfectly deciphered, but enough has been made out to learn that a party of Canaanites left the port of Aziongaher (Boy-Akaba) and navigated about the coast of Egypt for twelve moons (one year), but were drawn by currents off their course and eventually carried to the present site of Guayaquil, Peru. The stone gives the names of these unfortunate travellers, both male and female, and probably further investigations will shed more light on the records they have left.

Another and more astonishing discovery, we find announced in *Les Mondes*. It appears that some Russian colonists, having penetrated into hitherto unexplored parts of Siberia, have found three living mastodons, identical with those heretofore dug up in that country from frozen sand. No particulars are given as to this, we fear, somewhat questionable find. From the statments of M. Dupont, of the Brussels Royal Academy, it would seem that, like the reindeer, the mastodon should not now be extinct, and that the animal is naturally the contemporary of the horse, sheep and pig. Hence the announcement is not without some shadow of probability.

NEW ORDER BY THE COMMISSIONER OF PATENTS.

The subjoined order, recently issued by the Commissioner of Patents, will be fully appreciated by inventors and their representatives, exhibiting, as it does, a determination at headquarters that the chronic indolence heretofore prevailing among certain examiners, shall no longer be tolerated.

U. S. PATENT OFFICE,
Washington, D. C., October 3, 1873

I have noticed, for more than two years past, that a few of the Examiners are generally from one to two months behind with the work in their rooms. The fact that they so uniformly have about the same number of cases on hand is evidence to me that, with proper effort, they might keep their work closely up to date. The answering of letters and the making of excuses, in consequence of being so far behind, are causes of great loss of time. I shall expect the work of the Office to be promptly up to date by the tenth day of November. If, to do this, it becomes necessary for Examiners to demand of their subordinates more than six hours labor per day, they will do so; but the work must be brought up to that date, and thereafter kept up.

(Signed) M. D. LEGGETT,
Commissioner of Patents

The tedious delays in the matter of official decisions often deter inventors from applying for patents, and are equally discouraging to those having cases pending in the Patent Office. With this rule inflexibly observed, early examination and quick disposal of cases will be insured, thereby largely increasing the business of the Office.

PETROLEUM AND PINE TAR GASES.

Some time ago, it may be remembered, we called attention to the interesting and novel experiments, made by Professor Benevides of Lisbon, Portugal, upon the flame of compressed carbonized gas burning in free air. Ordinary illuminating gas and marsh gas (light carburetted hydrogen) were the subjects of the investigation. Recently the same author has conducted similar inquiries, in reference to gas extracted from the residues of petroleum and of the pine and fir tree, with even more remarkable results.

The gas derived from vegetable sources, used in the experiments, was obtained by the distillation of the residue left after the distillation of the roots, by employing a jet of steam at high tension, which was injected into the distilling cylinders. A liquid was produced from which turpentine was extracted, when there remained a black and thick fluid as residue. The latter, submitted to distillation, disengaged a combustible gas which for some time past has been employed for illuminating several lighthouses on the coast of Portugal. The petroleum gas was obtained by the distillation of the residuum of petroleum by the Hirzel system. The gases, thus arising, as well as those derived from the pine, are mixtures rich in hydrocarburets, a phenomenon analogous to that observed with ordinary illuminating gas obtained by the distillation of coal, and contain, in variable proportions, protocarburet of hydrogen, bicarburet of hydrogen, carbonic oxide, carbonic and sulphydric acids, etc.

Coal gas possesses in general much of the protocarburet and little of the bicarburet. As the proportions of these gases are variable, the density and illuminating power of the mixture likewise vary considerably. The coal gas, as employed in the city of Lisbon and used in the course of the experiments, has a density of 0·4, and its illuminating power, as indicated by the Erdmann apparatus, is 29.

Pine gas has a very pronounced odor resembling that of burned turpentine: its density is 0·8, nearly double that of coal gas. It is a mixture very rich in carbon and requires burners of special construction with very small orifices, in order to avoid the production of smoke and bad odor, as happens when consuming the gas in the ordinary illuminating gas burner.

The air which combines with the flame in the latter case is insufficient to ensure the combustion of the enormous quantity of carbon contained. The illuminating power of this pure gas is much superior to that of coal gas. In experiments with the apparatus above named, while the latter gas gave 29, the former produced an indication as more than 50. The graduation of the instrument stopping at this point (the maximum width of the slit), it was found impossible to cause the brightness of the pure gas flame to disappear entirely, so that the full intensity of its illuminating power could not be accurately ascertained by this means. With the Bunsen photometer, experiments gave 5 to 1 as the ratio of the respective luminous intensities of pine and coal gas.

Petroleum gas possesses properties analogous to those of pure gas, but has however a different and very strong odor similar to that of phosphuret of hydrogen. Its illuminating power is even stronger than that obtained from gas derived from coal. On burning petroleum gas in a Bunsen burner of ordinary dimensions, the brilliancy of the flame does not entirely depart, as the quantity of air drawn in is not sufficient to cause the consumption of all the contained carbon. When the cock of the rubber sack containing the petroleum or pine gas, under examination in the Bunsen lamp, is very slightly opened, the flame disappears from the upper portion of the burner and leaps to the inferior orifice of the tube. If, however, the said bag be pressed by the hands, the flame returns to the upper part of the burner. Although this experiment may be repeated as often as desired with the gases above named, it cannot be accomplished with coal gas, of which the flame, once produced at the inferior orifice, is not displaced, even if the same pressure be exerted upon the bag as before, thus indicating the greater mechanical energy of the former gases.

Combustion not being complete in Bunsen lamps of ordinary dimensions, the characteristic bands are not clearly defined in the spectra of pine and petroleum gases. The upper part of the flame gives a continuous spectrum, while that of the lower portion is channeled: the lines have the colors of the bands, while red appears at the extremity of the spectrum. On lighting a jet of compressed pine or petroleum gas, escaping from a tube, similar phenomena to those caused with coal gas are observed. With the former gases, however, the effects are amplified by the greater density and larger quantity of carbon contained. The velocity and the escape being great, the flame never commences at the orifice, but an intervening obscure space is produced. If a tube be employed having an exterior opening 1 millimeter in diameter, the flame of compressed coal gas presents no obscure point near the pipe; for if the cock be opened too wide, total extinction of the flame follows. With petroleum or pine gas, the contrary is the case: a quite large non-illuminated space appears near the escape orifice, and at the same time an oscillation of the luminous jet in the direction of its axis is perceptible. If the flame be observed from the side of the tube, a hollow central space, from which combustion is absent, can be perfectly discerned. This, the author considers, confirms his explanation to the effect that the velocity of a gaseous current is greater at the center than at the surface of the jet, for the friction diminishes the velocity of the molecules of the exterior. The mechanical action of the current is also greater at the center; the flame is projected to a greater distance, and there is a stronger displacement of the air in the region near the axis of the jet than at the periphery.

Another experiment gives additional support to this theory If through a bent tube a current of air be directed upon the flame of compressed pine or petroleum gas, in the direction and path of the gaseous current, the obscure space augments and the flame, drawing away from the orifice of the burner, may be projected so far therefrom as to be extinguished. In this case the air, it is believed, augments the mechanical action of the gas, in throwing the flame to a greater distance. If, on the contrary, a draft be applied to the jet in the direction of its axis but in a path opposite to that of the current, the flame approaches the orifice, diminishing the obscure space until the same disappears and the flame begins directly at the escape opening. By this means the gaseous mass is impressed with a movement contrary to that which it possessed on leaving the compressing apparatus, which diminishes the velocity of escape of the current and consequently its mechanical action on the incandescent portion. Again, if the air be injected transversely to the flame, the latter will deviate to the opposite side, through the composition of the motion which the jet had at the point of escape with that impressed by the draft; and at the same time the dimensions and form, both of obscure space and luminous jet, will vary.

Petroleum and pine gases having more carbon than coal gas, in order completely to ensure their consumption more air is required than is necessary for the combustion of ordinary illuminating gas: and thus for compressed gases it is necessary that the velocity of escape be greater for those derived from petroleum and from pine than from coal, in order to have the highest temperature and to cause the complete disappearance of the brilliancy of the flame. It is also for the same reason that the velocity of escape of the former gases should be greater than that of others less rich in carbon, to enable the spectroscope to exhibit with clearness the spectra characteristic of the flame of compressed gas.

SCIENTIFIC AND PRACTICAL INFORMATION.

A NEW SERIES OF AROMATIC HYDROCARBONS.

In the reaction of zinc powder on a mixture of benzine and chloride of benzyl, there are produced, besides diphenyl-methane (benzyl-benzine) some other hydrocarbons, which M. Zincke has recently succeeded in isolating.

After the distillation of diphenyl-methane, the temperature rises rapidly up to the limit of the indications of the mercurial thermometer, and a liquid is distilled which coagulates on cooling into a clotted and crystalline pasty mass. At the end of the distillation, a solid yellow body is passed and the residue cokes. The crystalline mass was treated with a little ether and pressed between sheets of paper to carry away the liquid portion. The etherized solution slowly deposited the crystalline crusts which were joined to the solid portion, and by complete evaporation gave a non-solidifiable oil.

In boiling alcohol the solid portion is deposited in acicular crystals: the mother waters retain a liquid product and another hydrocarbon. The acicular crystals are a mixture of two hydrocarbons; one, which appears to dominate, crystal izes in boiling alcohol in fine and very brilliant layers, or, if the solutions are extended, in rhomboidal transparent tables. This substance is slightly soluble in alcohol, quite so in benzine, chloroform, and sulphide of carbon, though somewhat less in ether. It melts at about 187° Fah. and coagulates at 172·4° into a transparent mass which becomes crystallizable by heat or friction. It does not combine with picric acid.

The second hydrocarbon is much less soluble than the first, crystallizes in fine needles, melts at 172·3° Fah., and coagulates at 154 4°. The separation of these hydrocarbons is very difficult, and ether is the best agent to employ. Their composition is sensibly the same, and the author regards them as to isomeric di-benzyl-benzine, C_{20} H_{13}; one of them may, however, be tri-benzyl-benzine, C_{26} H_{24}. Their oxidation may give some indications on their molecular weights.

TO DESTROY FIELD MICE.

Smoke, it is well known, will soon destroy these little pests, but how to introduce it into their holes in an easy way may interest some of our readers. Professor Nessler, of Carlsruhe, has devised a sort of pellet which gives off great quantities of smoke when burning, so that it is only necessary to put some of these into the holes and ignite them in order to suffocate the mice. Their preparation is nearly as follows: Some fiberous substance, such as jute, is soaked in a concentrated solution of saltpeter, dried, then dipped in tar, and, when half dry, flowers of sulphur are sprinkled over it. When fully dry the jute fibers are cut into little pieces like pills and are ready for use. As soon as they are ignited they are stuffed into the hole, which is then stopped up with earth.

FLUORENE.

M. Berthelot announces, under the name of fluorene, a new and very fluorescent carburet contained in the portions of the tar of volatile oils between 300° and 340° C.

In order to extract the substance, instead of causing the portions of solid carburet which have passed the distillation between 300° and 305° C. to be crystalized in alcohol simply, a mixture of alcohol and benzine is used. By this means may be separated a small quantity of acenaphtene which remains in the mother liquor. The point of fusion of the mass, which is ordinarily 105° C. after the first distilation and crystalization in pure alcohol, increases to 112° after crystalization in alcohol mixed with benzine. The remainder of the purification consists in redistilation and crystallization in pure alcohol. The carburet possesses a quite pronounced violet fluorescence which, however, disappears promptly on its being exposed to the light. The chemical symbol is stated to be C^{26} H^{10}.

THE BRITISH ASSOCIATION.

We continue, from our last, abstracts from papers read at the late meeting at Bradford:

ON PEAT.—BY MR. F. HAHN DANCHELL.

The prime fact in relation to peat is that, in its raw condition, the combustible parts are combined with from 80 to 90 per cent of water, which, for the most part, must be removed before it can constitute fuel. The peat problem may therefore be defined as the economical separation of the two elements—the retention of the solid and the discharge of the fluid. The simplest mode of effecting this is by cutting the peat as sods or bricks, and leaving them to dry in the air and sunshine. To diminish labor, it is frequently suggested, why not dry peat by pressure? If peat were altogether composed of fibers, the water might certainly be squeezed out, as from cotton, or wool, or hair; but a large portion of peat is semi-gelatinous, which, when dry, serves to cement the whole together, and which, moreover, is good for combustion. When peat is compressed, this glutinous constituent escapes with the water, indeed as easily as the water, involving a serious loss. Drying by artificial heat is also frequently proposed; but when it is considered that to obtain 100 tuns of dry peat it is necessary to find space for 500 or 600 tuns of wet peat, which space must be so heated as to permit the evaporation of 500 tuns of water, the economy of the proposition is seen to be highly questionable. But, setting economy aside, it is to be observed that peat cannot be artificially dried without deterioration in quality. The practice of maceration is so old that Pliny refers to it in his description of the inhabitants of North Germany; and yet ever and anon it is advanced as a novelty, and made the subject of patents. The reduction of peat to pulp is one of the easiest of operations. It may be done with the feet, or with any kneading or mincing machine. The most efficient mode of drying is by slow evaporation under roof. Drying goes on more rapidly in the open air if the weather be favorable; but in this country the sky cannot be reckoned upon, and with alternate exposure to wind, rain, and sunshine the quality of peat is much deteriorated. The difference in favor of peat dried under a shed is most marked, and, though the cost of production is greater, the quality affords ample compensation. How much drainage affected the cost of production may be seen from comparing the results from a drained and undrained bog. An undrained bog contains about 90 per cent of water, while a drained one contains 80 per cent. In the one case, therefore, we have 10 per cent of perfectly dry peat, and in the other double that amount. The output will, therefore, be half the quantity from an undrained bog as from a drained one, while the labor is the same. In Holland, Westphalia, Hanover, Holstein and Schleswig, Denmark, Pomerania, and the whole northern part of Germany, Russia, and many parts of Austria, Bavaria, the North of Italy, Switzerland, and extensive districts in both the North and South of France, peat is a general article of consumption, and the inhabitants would, no doubt, hear with some amazement that what is matter of course with them is matter of inquiry with us, and that we want to know whether peat is applicable to iron smelting and other industrial purposes, when they from time immemorial have used little else.

ON THE EFFECT WHICH THE DEPTH OF IMMERSION HAS ON THE RESISTANCE OF A SCREW.—BY PROFESSOR OSBORNE REYNOLDS, M. A.

It has been stated by several writers on the screw propeller, and is, I think, generally supposed, that the resistance of the water to a screw increases with the depth of immersion below the surface. Improvements have been made by Mr. Rennie and Mr. Maudslay which appear to prove this, but I do not think that any theoretical reason has ever been given. Now this idea is so contrary to our fundamental notions of hydraulics that I thought it would be worth while to make experiments. These experiments show us that there is not any increase beyond a certain point, and that this point is that at which the screw ceases to break the surface and get air. In a paper read before the Institution of Naval Architects, I explained how the air getting down to the screw is the cause of racing. In the same way it may be shown that it was the air that was the cause of the diminished resistance near the surface, found by Mr. Rennie and Mr. Maudslay.

The conclusion is that, when a screw is once fairly down below the surface, depth of immersion is of no advantage. Experiments on the effect of immersion on the resistance of screw propeller were made June 8, 1873. The screw was 2 inches in diameter, driven by a spring, which, when wound up, caused it to make 240 revolutions. The resistance at the different depths was measured by the time taken for the spring to run down.

FIRTH'S COAL CUTTING MACHINE.—BY MR. WILLIAM FIRTH, OF LEEDS.

Enough has been said respecting compressed air as a motor to justify the expectation that it is the key to vast and important improvements upon the present system of working coal; and bearing in mind that the wealth, the power, and the greatness of this nation depend primarily upon an abundant supply of coal, it is hardly possible to over rate the importance or over value the advantage which this power places at our disposal. I now turn to the consideration of the machine for cutting the coal, which has for several years been employed at West Ardsley without any interruption. The weight is about 15 hundred weight for an ordinary sized machine; its length, 4 feet; its hight, 2 feet 2 inches; and the gage, 1 foot 6 inches to 2 feet; it is very portable, and easily transferred from one bank to another. The front and hind wheels of the machine are coupled together in a similar manner to the coupled locomotive engines. The "pick" or cutter is double headed, whereby the penetrating power is considerably increased. The groove is now cut to a depth of 3 feet to 3 feet 6 inches at one course, whereas, by the old form of a single blade, we had to pass the machine twice over the face of the coal to accomplish the same depth. The points are loose and cottered into the boss, so that, when one is blunted or broken, it can be replaced in a few moments. It dispenses with the necessity of sending the heavy tools out of the pit to be sharpened, and is an immense improvemen upon the old pick.

When all is in readiness for work, the air is admitted and the reciprocating action commences. It works at a speed of sixty to ninety strokes per minute, varying according to the density of the compressed air, the hardness of the strata to be cut, or the expertness of the attendant. As to the quantity of work in "longwall," a machine can, under favorable circumstances, cut 20 yards in an hour, to a depth of 3 feet, but we consider 10 yards per hour very good work, or say 60 yards in a shift. This is about equal to a day's work of twelve average men, and the persons employed to work the machine are one man, one youth, and one boy, who remove and lay down the road and clear away the *débris*. The machines are built so strong that they rarely get out of working condition. Some of those now working at West Ardsley, and other places, have been in constant use for three or four years. At that colliery there are about eight machines in use. One of the seams is so hard and difficult to manage that it could not be done by hand, and the proprietors had to abandon and did abandon it; but now, by the employment of the machines, it is worked with perfect ease. It is a thin cannel seam with layers of ironstone, and the machines now "hole" for about 1,200 tuns per week. The groove made by the machine is only 2 to 3 inches wide at the face, and 1½ inch at the back; whereas by hand, it is 12 to 18 inches on the face, and 2 to 3 inches at the back. In thick seams worked by hand the holing is often done to a depth of 4 feet 6 inches to 5 feet, and the getter is quite within the hole that he has made; and where the coal does not stick well up to the roof, or where there is a natural parting, there is great difficulty and danger from "falls of coal."

THE consumption of coal for the purpose of gas illumination in Great Britain is estimated at fourteen millions of tuns per annum, valued at sixty millions of dollars. The total annual production of coal in England is one hundred millions of tuns.

FEEDING AND WATERING CATTLE IN RAILROAD CARS.

A London butcher has lately taken out a patent for a convenient device for feeding and watering cattle as they stand in the railway cars. The hay rack, *b*, and the water trough, *a*, are suspended at the end of a balanced lever, *c* (seen in both our illustrations, which we reprint from the *Practical Magazine*). Water is turned on at *g*, till the weight of the trough overbalances the counterpoise, *e*, and descends to the required level. When the animals are well refreshed, the cock, *h*, is opened, the remainder of the water flows away, and the troughs rise out of the way. Our engravings show the complete apparatus in use with an open car (Fig. 1) and a closed car (Fig. 2).

The inventor, Mr. W. J. Bonser, states that such apparatus need be put up only once in every two hundred miles of continuous railway.

In addition to the misery caused by the transit, as at present conducted, it is testified by experts that every bullock, from the moment it leaves the grazier's yard, will lose eight pounds a day in weight, besides loose fat. Professor Simmonds says: "There cannot be a doubt that the feeding and watering of animals on their journey to a fat cattle market would prevent, to a great extent, that waste of tissue which invariably takes place in the traveling of cattle, and would also tend to maintain that juicy and well known superior quality of the meat which is met with in animals killed at home. From a humane point of view, also, it is exceedingly desirable that animals should have both food and water on long journeys, the latter being especially required during the heat of summer."

The cost for apparatus to feed 30 cars of cattle at once is estimated, by a firm of engineers, to be $4,260, a moderate outlay, considering the permanent value of the appliances, and the greatly improved condition of the stock. Such an arrangement is likely to be especially valuable in this country, where journeys of a thousand miles are every day matters, and where cattle suffer and lose in value proportionally to the territory over which they travel.

FIG. 1.

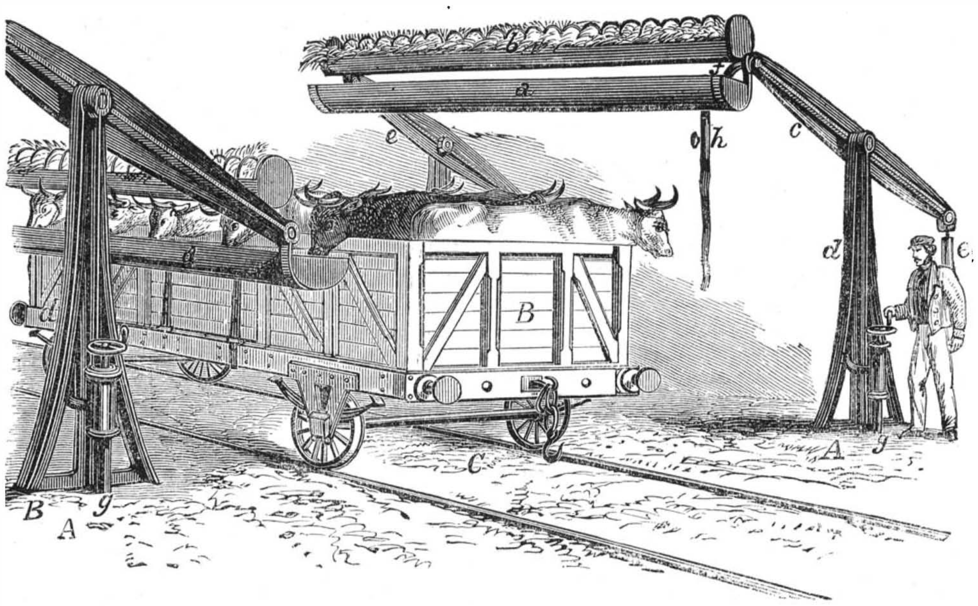
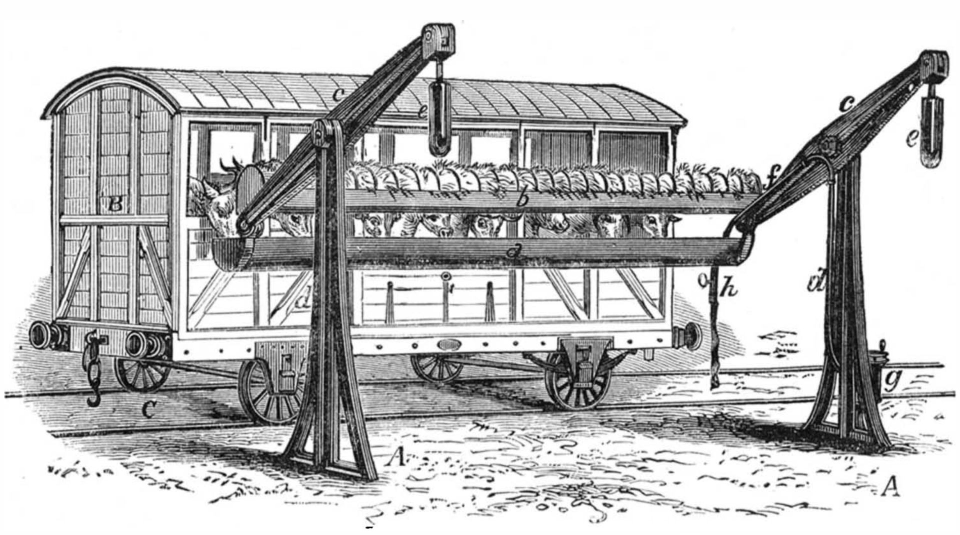


FIG. 2.



DEVICE FOR FEEDING AND WATERING CATTLE.

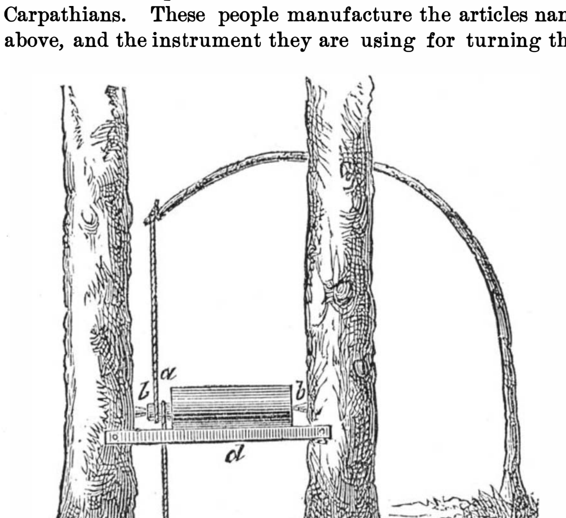
Wild Beasts and Snakes in India.

We have previously alluded to the remarkable stories which come to us from abroad of the destruction of human life in India by savage beasts and poisonous serpents. We could hardly credit the reports as true till we read, in the last number of *Land and Water*, the following, taken from official reports:

The number of human beings annually destroyed by wild beasts is one of the most extraordinary features of Indian life. In the recently issued official statement as to the condition of our Eastern Empire, we find the subject again discussed; and it is there remarked that, though rewards are offered by the Government for the killing of these animals, yet in some districts the loss of life is very great; and in others, where it is less excessive, the reason given is that goats are very abundant, and that wolves prefer kids when they can get them. Deaths by snake bites are also very frequent, no fewer than 14,529 persons having perished in that way during the year 1869; while in 1861, the total deaths caused by dangerous animals of all classes amount to 18,078. Dr. Fayrer is of opinion that, if systematic returns were kept, the annual number of deaths from snake bites (exclusive of all doubtful cases) would be found to exceed 20,000. The inhabitants of the border lands between jungle and cultivation are killed and eaten by tigers in such numbers as to require the immediate and serious attention of Government both in India and in England. The following are a few out of many instances: "A single tigress caused the destruction of thirteen villages, and 256 square miles of country were thrown out of cultivation." "Wild beasts frequently obstruct Government survey parties. In 1869, one tigress killed 127 people and stopped a public road for many weeks." "In January, 1868, a panther broke into the town of Chicola, and attacked, without the slightest provocation, the owner of a field; four person were dangerously wounded, and one died." "Man-eating tigers are causing great loss of life along the whole range of the Nallai-Mallai Forest. There are five of them; one is said to have destroyed 100 people." "Writing from Nuyclunka in 1869, a gentleman says one tigress in 1867-8-9 killed respectively, 27, 34, and 47; total, 108 people. This tigress killed a father, mother, and three children, and the week before she was shot she killed seven people." "In Lower Bengal alone, in the period of six years, were killed by wild beasts 13,401. In South Canara, in July, 1867, forty human beings were killed by wild beasts." The Chief Commissioner of the Central Provinces in his reports shows the following returns of human beings killed by tigers: In 1866 and 1867, 372; in 1867-68, 289; in 1868-69, 285; total for three years, 946. It appears that there are difficulties in the way of killing down these tigers. First, the superstition of the natives, who regard "the man-eating tiger" as a kind of incarnate and spiteful divinity whom it is dangerous to offend. Secondly, the failure of Government rewards. Thirdly, the desire of a few in India actually to preserve tigers as game to be shot with the rifle, as a matter of sport. Mr. Frank Buckland suggests an organized destruction of the tiger cubs in the breeding season, and the attraction of fully grown tigers to traps, pitfalls, and other devices, by means of a drug of valerian, of which tigers, which are only gigantic cats, are exceedingly fond.

An Ancient Lathe.

At the Vienna Exposition we find turned objects of wood, such as wooden glasses, bottles, basins, etc., manufactured by the Huculen, the remnants of an old Asiatic nation which had settled at the time of the general migration of nations in the remotest part of Galicia, in the dense forests of the Carpathians. These people manufacture the articles named above, and the instrument they are using for turning them



is worth noticing, seeing that it has been employed unaltered since times immemorial. If a Hucule wants to manufacture a turned basin, bottle, etc., he arms himself with a chisel, a hatchet, and a rope, and enters the dense forest which surrounds all human habitations in his part of the country. After having cut the tree out of which he wants to manufacture the desired articles, he looks around for two trees of about one foot or two feet diameter, and sufficiently close together for his purpose. But it is an essential point in selecting these trees that a young maple or beech should also grow near at hand. Having found this necessary combination for the work to be done, the Hucule makes two holes at a proper hight in the two trees, and inserts in these opposite holes maple cones, serving as dead centers. One of these cones is fixed, and the other removable.

In the annexed sketch of this arrangement, taken from *Engineering*, these cones are marked *b b*. The wood blank to be turned is then prepared with the hatchet, so as to be fixed between the centers, and is fitted at one end with a small cylindrical part, *a*, to take up the rope for giving a rotary movement to the piece of work.

The rope is then taken two or three times round the small cylindrical part, *a*, and is attached to the top of the young maple, as shown in the sketch. The lower end of the rope is fastened to a piece of wood, *c*, which, at its other end, is attached to one of the roots of the trees, and thus serves as a footboard. After this the man fastens a crossbar, *d*, to the trees, and begins to turn with his chisel whatever he wants to produce.

Statistics of Paper Manufacture.

From the time when paper made from cotton was first brought to Europe from the deserts of Central Asia, its manufacture has increased steadily and has entirely supplanted the papyrus of the ancients. Paper is now manufactured from the most varied materials, such as wool, cotton, flax, hemp, jute, agave, straw, potato, mulberry, esparto, and rice fibers; and a recent Austrian investigator, Dr. Albinus Rudel, calculates the yearly production in all civilized parts of the world as amounting to 1,800,000,000 pounds. This quantity is manufactured in 3,960 factories, which employ 90,000 male and 180,000 female hands, besides 100,000 workmen occupied in collecting and assorting rags. The factories, when in full working order, represent a money value of not less than $280,000,000 gold, and the value of the annual paper production is estimated at $195,000,000 gold. The production of the United States, with a population of 39,000,000, reaches up to 374,000,000 pounds, but their consumption exceeds this quantity by 3,000,000 pounds, which are supplied by importation. Every American uses annually $10\frac{1}{4}$ pounds paper, while Mexico, with Central America, consumes only 2 pounds, and British America $5\frac{1}{2}$ pounds per head. The consumption in European countries is $11\frac{1}{2}$ pounds per head in Great Britain, 8 in Germany, $7\frac{1}{2}$ in France, $3\frac{1}{4}$ in Austria and in Italy, $1\frac{1}{2}$ in Spain, and in Russia but 1 pound. But these figures by no means justify us in drawing any rigid conclusions as to the literary occupations or mental acquirements of the respective countries, though they give us a general idea thereof. It must be remembered that one third of all this immense quantity of paper consists of paper hangings, pasteboards, shavings, and wrapping sheets, one half of all the production is printing paper, and the remaining sixth is writing paper. The consumption in civilized countries averages per head 5 pounds paper, 5 newspaper copies, and 10 letters; fifty years ago, $2\frac{1}{2}$ pounds of paper were supposed to be the average. In round numbers, Dr. Rudel distributes the annual paper "crop" into the following departments: Government offices, 200,000,000 pounds; schools, 180,000,000 pounds; commerce, 240,000,000 pounds; industrial manufactures, 180,000,000 pounds; private correspondence, 100,000,000 pounds; printing, 900,000,000 pounds; total, 1,800,000,000.

A people consuming comparatively large quantities of paper will certainly occupy a high place in the scale of industrial and mental development, its use being co-extensive with commerce, manufactures, schools, and the printing press.

A VIRGINIA city (Nevada) man is said to have invented an ingenious plan of keeping his house clear of insurance agents and similar nuisances. On each side of the path leading to his door, he has fixed several sections of water pipe filled with small holes, and on the approach of a suspicious character a tap is turned, and instantly numerous jets of water enfilade the path in all directions, and effectually keep the invader at a safe distance.

AT various points on the river Thames, between Woolwich and Erith, there are visible at low water the remains of a submerged forest, over which the river now flows. This fact has led geologists to conclude that the present outlet of the Thames to the North Sea is of quite recent origin.

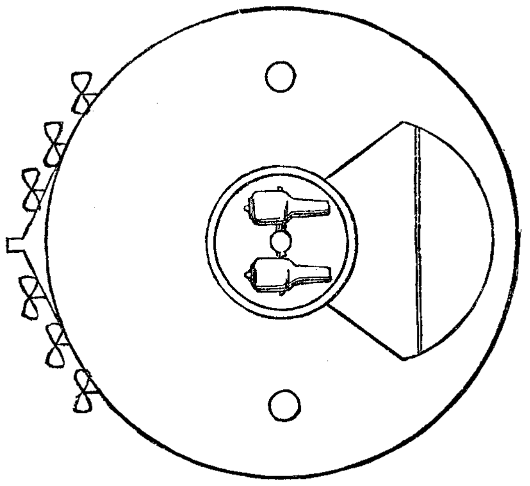
A. VOGEL has found nearly all specimens of fresh milk either neutral or slightly acid. In only two specimens, out of thirty, the alkaline action appears to have been due to traces of free ammonia. He ascribes the acid reaction of fresh milk to the presence of free carbonic acid, since litmus tincture colored red by fresh milk regains its blue color on shaking or boiling. No mention is made of the conditions of food, etc., to which the cows were subject.

CIRCULAR SHIPS.

The idea of circular vessels is not absolutely new. Probably the earliest practical suggestion was that of Mr. T. R. Timby, of Worcester, Mass., who, in 1843, filed in a working model of a revolving ship, together with specifications, in the Patent Office at Washington. His plan embraced circular ships and revolving ironclad forts and turrets, which have since come into use.

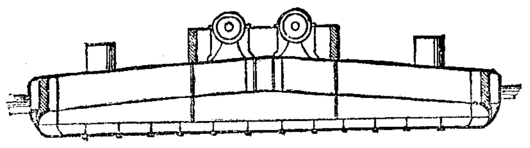
Admiral Popoff, of the Russian navy, has also adopted the idea, and quite recently two vessels, the Kiew and the Novogorod, have been successfully launched at Nikolaief.

We lay before our readers, in the accompanying engravings, sectional and plan views of these curious ships, from the pages of *La Nature*. Each vessel is 99·2 feet in diameter and constructed of iron, planked with wood and sheathed with copper. The draft of water is 12·1 feet, and the spar deck is 2·1 feet above the water line. The displacement is 2,783 tuns. The bottom is perfectly flat, and the sides are vertical, with an overhang aft, sheltering the rudder. In order to insure stability, twelve keels are affixed, each about three inches in depth.



At the center of the ship is a turret, 29 feet 6 inches in diameter and 7 feet high, containing two 11 tun steel guns (probably eight inch bores), breech loading and mounted *en barbette*. The turret has a hollow axis which serves as an ammunition scuttle, and on which pivot the supports of the guns, so that the latter can be pointed over an angle of from 30° to 35° with the fore and aft direction of the ship. The rest of the armament consists of torpedo arrangements.

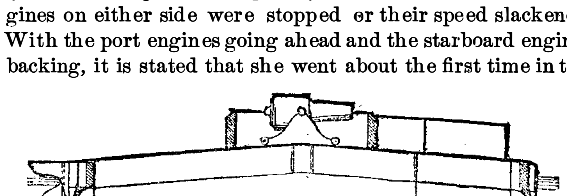
The lower portion of the hull is double, and there is a space of about 2·9 feet between the shells. The lower plating is ·62 inch in thickness and the upper ·23 inch. The hold is divided into a large number of watertight compartments. Parallel to the upper deck and about 6 feet below, is a second deck, both being united to the lower shell by bulkheads.



Forward of the turret is a light superstructure serving as a protection against the sea and as quarters for captain and other officers, eleven persons in all. The second deck comprises a forecastle for the crew of ninety men, and furthest aft the coal bunkers and boilers, each of the latter having a separate smoke stack. Amidships are other officers' quarters and a powder scuttle. There are six eighty horse power engines, built on the Woolf system, each driving an independent screw. Machines and boilers together cost $222,000, about. Below the forecastle are storerooms; and under the officers' quarters, the powder magazine and shot lockers. Two steering wheels are also on the second deck.

The armor consists of two streaks of plating about three feet broad: the upper layer is 9·1 inches thick, and is backed by solid teak 6 inches through; the lower skin is 6 inches, with a backing of 9 inches. The turret is similarly constructed, with the exception of the plates having a uniform thickness of 9 inches. At a distance of about two feet inside the walls of the ship is a watertight bulkhead formed by ·7 inch plating, dividing the battery into two parts, so that in case water should enter one of the exterior compartments, the vessel would still float.

The trial trip of the *Novogorod* was recently made at Nikolaief in presence of the Grand Duke Constantine of Russia. Although the ship was hardly completed, or entirely ready for sea, it is stated that, with a steam pressure of 5·2 pounds, and a vacuum of 21·4 inches, with 62 revolutions, a speed of six knots per hour was obtained. The ship proved herself an excellent sea boat, obeying her helm readily, and turning almost squarely on her heel when the engines on either side were stopped or their speed slackened. With the port engines going ahead and the starboard engines backing, it is stated that she went about the first time in two



minutes, and on a second trial in one minute and nineteen seconds, without hardly changing her place. On reversing both machines, the ship stopped in a few seconds and turned in the opposite direction, also without altering her position.

Correspondence.

The Hair Worm.

To the Editor of the Scientific American:

The following, apparently cut from some book, was sent to me for solution: and, if agreeable to you, I will answer it through your columns. It reads thus:

"A CURIOSITY FOR NATURALISTS TO SOLVE.—Mr. J. H. Horsford writes us from Freedom, Ill., that a horse, owned in that country by a Mr. West, has a worm or snake in his left eye, from two to two and a half inches long, and, to appearance, of the thickness of a small oat straw, squirming with the active motion of a large snake. The horse, he says, has evidently lost the sight of his eye from his snakeship having taken up his abode there; and it is only about a week since there appeared any difficulty to the eye. He thinks it has been produced by a hair getting in by some means, and changed to a snake, as hairs are known to do in water. To know its wonders is to see it, as it can be plainly, a rod from the object, wriggling about as if too much confined. *Query:* How came it there and what will the result be? Let some of our veterinarians answer."

I hoped that the old notion that a horse hair will turn into a snake had been obliterated years ago. I am surprised that any one should advance such a theory, even in this Darwinian age.

The hair snake, so called, is frequently met with; I have taken them from grasshoppers, from an apple, from a head of cabbage, swimming in the gutter along the curb of our city. I have found them in our streams and in our spring water, of various lengths and shades of color. Indeed, it seems to me, everybody ought to be familiar with the *gordius*, or hair worm, which, in my youth (as I was taught the common notion), I thought was a transformed horse hair. They are so perfectly hair-like in form that it is not very surprising that ignorant persons might so mistake them. Yet the two sexes are readily distinguished. In the male, the tail end is bifurcated, in the female trifurcated (at least in the American species). I have found the female coiled or indeed knotted up, suggestive of the Gordian knot. Could its name be derived from Gordius, king of Phrygia? If so, I am not aware that I ever met with the statement. After carefully unfolding, I discovered that it had within its folds a string of eggs, like beads, in a ball, and seemed tenaciously attached to them, gathering them up carefully, again to take them under protection. The female deposits millions of these eggs, connected in a string. These, in the course of three weeks, hatch; when the embryos escape from the eggs, they are of a totally different form and construction from the parents. Their bodies are only the $\frac{1}{450}$th of an inch long and consist of two portions: the posterior cylindrical, slightly dialated and rounded at the free extremity, where it is furnished with two short spines; and the anterior broader, cylindrical, and annulated, having the mouth furnished with two circlets of protractile *tentaculæ* and a club-shaped proboscis. I am indebted for some of these details to the patient investigation of Mr. Joseph Leidy, M.D., of Philadelphia. He also says: "No one has yet been able to trace the animal to its origin, or what becomes of the embryo in its normal cyclical course," as those he had observed always died a few days after escaping from the egg. These *gordii*, when developed, vary in their length from three inches to a foot; they occupy various positions among the viscera and even in the head, including the muscles, for their living habitation, analogous to the *trichinæ*. And so minute a larva can as well get into the eye of a horse as into the muscles of an insect or animal.

Among the known *entozoa* that infest man is the *monostomum lentis*, of Gescheidt, found in the crystaline lens, and the *distomum oculi humani*, in the capsule of the crystaline lens, others of this latter genus, *d. hæmatobium*, in the portal vein, and *d. heterophyes*, of Siebold, in the small intestines. To refer to the snake in the horse's eye, then. It is simply this: The minute animal just hatched (the *gordius* is common in streams, where horses may drink or be washe in the water abounding with the minute embryos of the hair worm) could cling to and penetrate the crystaline lens of the eye, and develope into the *gordius*, which may require some living tissues for its development, or if more carefully examined, might prove some other specimen of the entozca.

I was more astonished to find a *gordius* in an apple; true, it was worm eaten, but I can advance no theory how it got there unless it crept from a dead grasshopper into the apple or hatched in the blossom and developed with the fruit. A shower of rain could easily scatter the eggs or minute embryos. J. STAUFFER.

Lancaster, Pa.

The Variable Star Algol.

To the Editor of the Scientific American:

The periodical fluctuations in the light of the star Algol have been accounted for in two different ways, first, by supposing that a non-luminous body revolves around this star, the plane of its orbit being directed toward our system, or nearly so, and secondly, on the hypothesis that Algol is a secondary body, revolving round a dark primary in an orbit situated as in the former case.

If the variations are really produced by the intervention of a dark body, and if, at the time of minimum brightness, their dark body is entirely projected upon the disk of Algol, it is evident, from the large proportion of light cut off, that the two bodies do not differ very greatly in size. It seems to me, therefore, that if we admit the existence of a dark companion, it would be more correct to say that both bodies revolve around the center of gravity between them, rather than to say that either of the two revolves around the other.

There is a method of observation at our command, how ever, by which the truth of this theory of Algol's motion in an orbit, may be put to the test. I refer to spectroscopic observation. In case Algol moves in such an orbit, it is obvious that, at times, it must be approaching our system, and at other times receding from it.

If, therefore, the orbital velocity of the star be sufficiently great, displacement of the lines in its spectrum would result; and by observing the amount of their displacement at different times during the period of variation, the rate at which the star moves in its orbit could be determined, approximately. Of course, in these observations account would have to be taken both of the proper motion of the system from or towards us, and of the orbital motion of the earth.

Spectroscopic observations of Algol, and of other variable stars as well, if conducted in this manner, would, in all probability, lead to the most interesting results.

St. Catharine's, Ontario, Can. J. M. BARR.

Mexican Water Coolers and Filters.

To the Editor of the Scientific American:

In your issue of June 14, you have given a drawing of an Australian water cooler. That is very good for the purpose; but herein you will find a sketch of those used in this country to stand on a table, which are far prettier and more convenient. They are made of red, white, or buff colored clay, with saucers and stopples to match. Many of them are ornamented with wreaths of ivy, or bouquets of flowers in colors. The necks, stopples, and saucers, are glazed; the bodies are left porous. The white and buff become discolored sooner than the red. The latter are very pretty when made of the finest clay.

In this country there is a stone which is used for filtering water for domestic use, and I am sure that it is better than anything gotten up in the United States for that purpose. It is indurated volcanic ashes. The stone is cut in the form of a hollow, inverted pyramid, the smallest size being about 15 inches at the base, 22 inches deep outside, and 2 inches in thickness, the last dimension increasing as it approaches the apex, with the exception of being cut away near the base on the outer surface to form an offset by which it is suspended in a frame. Beneath this, upon a shelf in the lower part of the frame, six or eight inches from the floor, is placed a very thin, unglazed, earthen jar to receive the water as it drops from the stone. This jar is covered with a plate having a hole in the center, upon which rests a small, unglazed pitcher.

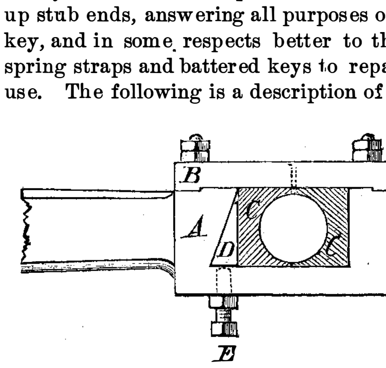
Turbid water passes from the filter as clear as crystal, remains in the jar deliciously cool, and is much more wholesome than ice water. The latter article is rarely used here, as our only sources for the supply of ice in this valley are artificial, and the peak of Popocatepetl. S. E. G.

City of Mexico.

Taking up the Wear of Journal Boxes.

To the Editor of the Scientific American:

In Mr. Crawford's suggestion, published in your issue of September 6, I see no way to take up the wear of the boxes, caused by the end strain that the rod is subjected to. I herewith send to you a sketch of a plan for which I am indebted to Mr. Charles Elms, of Chicago. I have used it, and find it a very convenient, cheap and substantial method of fitting up stub ends, answering all purposes of the strap, gibs, and key, and in some respects better to those, as there are no spring straps and battered keys to repair after a few years' use. The following is a description of the invention: A is the stub end; B, plate or cap fastened at each end by a stud, an offset fitting a corresponding one upon stub end A; C C are brasses; D is a steel wedge to take up wear of boxes or brasses, adjusted by the stub set screw, E.



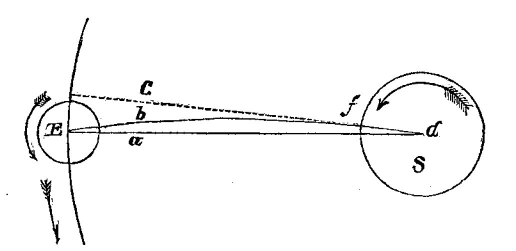
Having been benefited myself by many suggestions and much information received from your valuable paper, I submit this to you, hoping that it will be of some use to my fellow draftsmen and machinists.

New York city. ROBERT C. GRAY.

Planetary Motion.

To the Editor of the Scientific American:

I claim that the following is no mere hypothesis, but a logical deduction from known facts: The sun and earth



tend to approach each other, obedient to the laws of gravitation existing between them. This gravitating force is instantaneous, and its direction is indicated by a right line drawn through the centers of the earth and sun. If it were not for an opposing force, they would approach each other with an accelerated velocity. Such a force exists in and is radiated from the sun in all directions, and is made manifest to us by certain well known physical phenomena.

This force is not instantaneous, but it requires time to act through space. The sun revolves upon its axis: consequently the direction of a force radiating from the sun and requiring time to act through space would not be indicated by a right line. For convenience of illustration, we will suppose that the planes of the earth's and sun's equators coincide. Let S and E, respectively, represent equatorial sections of the earth and sun: then *a* will be the line of direction of their attractive forces. If the sun be at rest, the direction of force emanating from the point, *f*, on the sun's equator would be indicated by the dotted line, *c;* but, as the sun revolves, this force, which requires time to act through space, will be deflected in the direction of the curved line, *b*. This line, *b*, is the center of direction of the force projected from the sun and acting in oppositon to the attractive force. I should have said that the arc of the sun's equator, intercepted by the angle, *a d c*, is equal to the distance traversed by a point on the sun's equator during the time required for the transmission of this force to the earth. This curve will be increased by the amount of the earth's orbital motion for a like interval of time. Now with your knowledge of mechanics, you will see at a glance the inevitable consequences of this slight difference in direction of these two opposing forces. Slight as it is, it is more than sufficient to account for the movement of the planets, as it will explain other questions. Now lay down an axial section of the sun and project the curves caused by the centrifugal force: the axis and equator will be represented by right lines: but from the intermediate degrees all the lines will be deflected towards the equator, the curves shortening as we leave the axis. In this we have an explanation of the cause of the planets being confined to the zodiac. I have forwarded substantially the same communication to three eminent astronomers. JOHN LINTON.

Baltimore, Md.

REMARKS BY THE EDITOR.—The nebular hypothesis finds general acceptation at present. The solar system is supposed to have been originally a nebula or vapor cloud of unequal density. Such a mass, in condensing by the mutual attraction of its particles, would rotate with increasing velocity. Rings of vapor thrown off, or rather left behind in condensation, formed the planets. The planetary nebulæ themselves throw off rings, forming their satellites and, in the case of Saturn, a multitude of asteroids. As force is as indestructible as matter, and as light, heat, motion, electricity and chemical action are convertible terms, the planets, resisted by the ether of space, will fall to the sun, and the solar system will ultimately resume its original gaseous form.

A sphere of oil, supported in a mixture of alcohol and water of the same density, and set whirling by introducing a rotating disk near its equator, flattens at the poles and throws off rings which form revolving satellites, in a very instructive manner.

The Proper Length of Crank Pins.

To the Editor of the Scientific American:

In your issue of September 27, I find just the thing I have been looking for for years, namely the proper rule for the size of a crank pin of an engine, as laid down by Theron Skeels, C. E. I think the rule beautiful in the extreme, and so simple that any one ought to understand it. Yet there are one or two things that are not fully clear to me, but this is probably from a lack of education on my part. The last part of his rule says "multiplied by a coefficient which is determined by an experiment." If we are to find out, by experiment, this point, why not the whole thing?

It seems to me that there may be more causes than the one named. In practice, we first look to see if the box is not too tight, and second, if the pin is in line with the main bearing. Then we see that the cross head does not twist this connection on the pin, next that it is well lubricated, and that the oil or lubricant is strong enough to stand the work. After going through the whole of these and finding all right, then we look to see if it be of proper size, and this, I opine, is and always will be determined by experiment, for engines of equal indicated horse power will need different sized pins.

We have one engine running made by George H. Corliss, with cylinder 18×30 inches, shaft $8\frac{1}{2}$ inches diameter, crank pin $4\frac{1}{4}$ inches diameter, and 7 inches long. This runs, with steam at 125 lbs. at 100 revolutions per minute and comes to full stroke probably 500 times per day, then off to nothing, passing many strokes without steam at all. After two years, use, there is no appreciable wear and no heating. We are making another like it, thus using the last part of Mr. Skeels formula and not infringing his rights by using the first.

Syracuse, N. Y. W. A. SWEET.

NEAR Delaware Water Gap, Pa., there is a cave in the face of Mount Minsi, opposite the river, whence issues constantly, with considerable force, a current of cold air. A small stream of water issues from the cave. It has been ascertained that the water trickles down from the roof of the cave, and the cooling of the air is supposed to be due to contact with the wet surface of the roof.

AN advertisement in the special sixty thousand edition of this paper, soon to be published, will reach a class of persons not accessible through the ordinary channels of newspaper advertising. See announcement on another page.

The Great Oil Wells of the United States.

The committee sent by the prophet Moses to enquire into the resources of Canaan, reported that it was a land flowing with milk and honey. But even if that ancient country had been veritably blessed with natural deposits of the substances mentioned, it is questionable whether its richness could have equaled the wealth which this country enjoys in her natural oil wells.

The total oil product is now 34,560 barrels of 42 gallons each, every day.

The number of producing wells in the entire oil region of Pennsylvania is about 5,000, and the average daily product per well is 7 barrels.

A correspondent of the New York *Tribune* gives the following interesting information:

BOUNDARIES OF THE OIL DIGGINGS.

The northern extremity or rather the two northern extremities of the oil producing region are in the vicinity of Titusville and Tidioute, Pa., from which points it extends in a southwesterly direction along the Allegheny River, though not following its course strictly, down to Greece City and Millerstown, a distance in a straight line of about eighty miles. The "Old District" begins at the north, as given above, and ends at Parker's Landing, on the Allegheny River, and comprises most of the old famous wells, including those of Pithole, which have figured so conspicuously in times gone by. The "New District" begins at Parker's Landing and extends down to and includes the new wells of Modoc. The entire district is a rough farming country, and is traversed with lines of hills which, though not remarkable for hight, are of mountainous character. Here and there are towns which, though of moderate size, are "cities," those of Titusville and Franklin being the finest.

THEORY OF THE OIL ROCKS.

The present accepted theory in regard to oil-producing rocks is that they lie in series of belts, the general trend of which is from twenty-two to twenty-three degrees east of north and west of south. But there are minor belts that seem to run across the great belts, and even the most experienced oil men are not very certain of the accuracy of their theories. One who has never visited this country is apt to fall into the error of supposing that the number of wells that have been sunk is quite limited; but the fact is that they may be numbered by thousands. They are seen everywhere, on hill and mountain, in valley, in mid river, in town and in country. And as most of these wells have gone to decay, and but very few are yielding enough oil to pay, and as it cost originally from $5,000 to $10,000 to drill each of them, some estimate may be arrived at of the amount of capital that has been dissipated.

HOW OIL WELLS ARE SUNK.

The business of drilling wells has now fallen almost entirely into the hands of professional drillers. When a man or a company has decided upon a well, and selected its site, the first step taken is to put up a derrick, or, as it is termed here, a "carpenter's rig." This is a framework, made mostly of plank, from 65 to 75 feet high, about 14 feet square at the bottom, and running nearly to a point at the top. The cost of a derrick is about $800. The tools used in drilling are the bit, which is like any ordinary rock drill, but larger, being about three feet in length; above that is the auger stem; then two chain links called the "jars," and above that the "sinker bar." This is attached at the upper end to the rope which passes over a pulley at the top of the derrick, and thence down to a large windlass outside of the derrick. The drilling is done by a steam engine with a crank movement, which keeps the drill at work day and night, a man standing by in the derrick to give the tools more rope at proper intervals, and to turn the drill while it is operating. After the drill has reduced a certain quantity of rock to sand, it is drawn from the well up into the derrick, and the sand pump is lowered and the sand is brought out, when the drill is again inserted. The rope used must be of the very best quality, and in digging deep wells it requires two ropes, as the sand very soon cuts them out. The expense is a very considerable one, being $400 for each rope. The tools for drilling that are now used weigh 1,800 pounds, those that were first used weighing only 90 pounds. A good set of drillers will put a well down in about 65 working days, provided they have good luck and no accidents; but it oftentimes takes six months to reach the oil sand.

ENORMOUS DEPTH OF THE NEW WELLS.

The rock in which the oil is found has a very decided dip from the north to the south, it being about sixteen feet to the mile. In the old or northern part, it is found at a depth of from four to seven hundred feet, whereas the new wells at Modoc are from fourteen to seventeen hundred feet deep, the expense of drilling one of the new wells being nearly double that of one of the old ones. The drillers generally know where they are by the kind of sand that they bring out.

CHARACTER OF THE SEVERAL ROCKS.

At Modoc, at a depth of about five hundred feet, they strike what is called the mountain sand rock, down to which they bore an eight inch hole. Here they know that they are below all fresh water, and they put in a casing, down to and resting on that rock, with an inside diameter of $5\frac{5}{8}$ inches. From there they bore, through the casing, the remainder of the well with a diameter of $5\frac{1}{2}$ inches, depending upon this shoulder of rock at the bottom of the casing to shut off the salt water, which is sometimes found in large quantities. The next sand rock of importance that is found is called the second sand, which lies at a depth of a little over twelve hundred feet and sometimes produces oil. This, however, is not considered a good sign, and makes future drilling operations on the same well rather gloomy work, as a first class well cannot be expected. The fifty foot sand rock comes next; the next is the bowlder; then comes the corn meal sand, so called because of its resemblance to corn meal. From that you get five to ten feet of slate, and then you strike the oil sand, which is a sort of pebbly rock; and if the well is going to amount to anything, oil appears the moment you penetrate or even scratch this rock. Between these strata that I have mentioned, the space is filled up mostly with shells, slate, soap rock, sand, etc., the drilling being very easy. But in the sand rocks above enumerated, slow time is made by the drillers; and the mountain sand is so hard that it wears the drill, and the particles of steel from the bit are very perceptible among the grains of sand.

THE NEW WELLS AT MODOC.

The stream of oil from a flowing well is not continuous, but comes in pulsations, with occasional intermissions of entire stoppage of greater or less length. A good flowing well runs at first with great force, and the yield of oil is accordingly great, but it gradually decreases in production until it ceases to flow at all, and thus it must be pumped, after which the supply goes on decreasing until its yield will not pay the expense of pumping, and then it is shut down. It therefore requires ordinarily the constant drilling of 400 wells to hold the production up to the level of the demand. But at the present time all drilling must stop except in the neighborhood of Modoc, because nothing less than a 200 barrel well will pay back to the owner the first cost, $8,000 to $10,000, with oil at the present prices, 80 cents per barrel at the wells. Wells that will yield 200 barrels a day are found only at long intervals, Modoc being at present the exception to this rule, and the richest oil deposit yet discovered in Pennsylvania.

The first well that was sunk at Modoc was the Troutman well, which was struck last March. At first it averaged about 950 barrels a day, and it turned the attention of oil men in that direction. It, however, stood alone for over four months before any other wells were finished. Its present yield is about 300 barrels a day, and it is considered as holding out remarkably well. In July a number of other wells were struck, among which two of the richest were the Walt Thompson and the Dean & Taylor wells. Their yield is now estimated at 650 barrels each per day. There are at this place 16 wells, all lying within a square mile, which now average 500 barrels each every twenty-four hours. The reports that the new oil wells of Modoc are materially falling off are not correct. It is the opinion of good experts that the yield of oil is even greater than it is reported to be by the producers themselves. I saw wells that were said to be giving 500 or 600 barrels a day which had every appearance of yielding 1,000 barrels a day. As a large number of new wells are being drilled in this deposit, the producers, being anxious to keep the price of oil as high as they can, are evidently underestimating the capacity of their wells.

PRODUCTS OF THE VARIOUS DISTRICTS.

Of the 34,560 barrels of oil now daily obtained, the First District, which is the latest development and includes all the big wells, furnishes 18,560 barrels, the Second District 2,500 barrels, the Third District 4,500 barrels, and all the other districts, containing the wells that furnished all the oil previous to 1870, 9,000 barrels, making a total as above stated of 34,560.

THE PIPE COMPANIES.

As is well known, all the oil is delivered from the wells to the delivery tanks on the railroads through pipes. These pipes are laid generally upon the surface, and they run through valley and over mountain, and under rivers, the oil being forced through them by steam power. The longest pipe now in use is about 15 miles in length.

The Bridgeport Shirt Factory.---The Howe Sewing Machine Works.

A correspondent in the *Commercial Advertiser* gives the following interesting account of his visit to some of the extensive manufacturing establishments in Bridgeport, Conn:

Burlock & Co., large shirt manufacturers, the writer states, employ about six hundred hands, and make one hundred dozen shirts per day, consuming three thousand yards of muslin and seven hundred of linen each day, and $9,000 worth of thread every year. One hundred sewing machines are constantly running, from seven o'clock in the morning until eight in the evening. These machines are worked by steam and managed by young girls, the majority of whom are skilled performers; some of these experienced hands earn as high as $75 per month. Every part of a shirt is manipulated by different hands; each piece is finished in a room designed for the kind of work. It takes sixty women to make all the parts of a shirt, and yet it only requires two minutes to make this all important garment. From the time the cloth is first brought into the cutting room, there is no rest for the fabric; it is tossed about with lighting speed; the changes made from one to another are really marvelous, and, before you get over your surprise, the shirt is ready for the laundry, where it again flies about without stopping until it reaches the inspecting room, where it is allowed to rest a few minutes, when it is carefully looked over, and, if there is the slightest flaw found anywhere in its manipulation, back it goes to the department where the defect was made. We remained some time in the ironing room, and were much amused to see the way the women ironed the bosoms, collars, and cuffs. The irons are heated almost to a red heat; they are passed over the linen with very great rapidity, which is no sooner dried, than the ironer again wets the linen and takes another red hot iron. This drying and wetting process is repeated several times before the linen presents the desired glossy appearance. We asked Mr. Perkins what the secret was of putting on this much admired polish. The gentleman smiled, and said: "It is nothing but elbow grease."

After seeing how much labor and scientific work it takes to make a shirt, we drove over to East Bridgeport, and were escorted through Howe's sewing machine factory. This building has a front of 1,256 feet; it is five stories high, and employs 1,500 workmen. They make 500 hundred machines per day. Every part of a sewing machine is a branch of work by itself, and is manipulated in a separate room under the charge of a foreman. We were very much interested in the needle department, which is under the charge of Mr. Thompson, a very pleasant and affable gentleman, who kindly gave us many points of information. Twenty thousand needles are manufactured in one day. One hundred and eighty men and woman are employed in this department. From the wire steel coil up to the time when the needle is ready for use, it passes through fifty different hands.

LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 16.

PARIS, September, 1873.

Since the date of the previous letter, we have made an excursion into South France, visiting the immense iron works of Le Creusot, and the great and busy city of Lyons. Our trip has occupied only four days, but we have seen and learned a great deal and have experienced much pleasure in that short period.

During the year 1872, the total quantity of cast iron produced in France is reported as 1,181,262 tuns, of which more than one million tuns has been produced by the 113 blast furnaces which use coke fuel, and 178,571 tuns were the product of 115 furnaces using charcoal. The production of steel is given as about 140,000 tuns during the same year, the amount having doubled in the short space of three and a half years, and nearly trebled in about four years. This production is the result of the united labor of many establishments; but a single one, that of Le Creusot, is sending into market one third of the whole, and we should hardly have been justified in leaving France without visiting this place, even had it compelled far greater expenditure of time, money, and physical energy than it has demanded. We were also bound by our acceptance of the courteous invitation of its hospitable proprietor, M. Schneider, whom we had met as a colleague at Vienna.

The day before leaving Paris on this expedition, we visited the locomotive engine building establishment of

CAIL & CO.

on the Quai de Grenelle, near the Champ de Mars. We found there a fine collection of shops, employing between three and four thousand men in the manufacture of locomotives and of general work. We were received here with the utmost kindness and courtesy, as we have been at all of the great manufactories that we have desired to visit, with the single marked exception of that of Krupp, at Essen. The workshops of Cail & Co. cover an immense extent of ground just outside the city of Paris. They are all of one story in hight, the roofs are supported by iron columns and girders, and the interior is generally well lighted and ventilated by windows in the roof.

The transportation of material from one part to another of the works is effected by cars upon a railroad track leading to all the workshops, the traction power being obtained from several light locomotives. In the setting-up shops, traveling cranes are well placed, and are in constant use. The work is generally very good, although some pieces were hardly as well finished as was the average of that which had passed inspection, and it would not have been passed as satisfactory in our own leading shops. The boiler work was quite good. We noticed one riveting machine here, but it would not compare favorably with those that we have seen elsewhere. In the forge shop the work was good. The heaviest steam hammer was said to have a drop weighing 800 kilogrammes—1,760 pounds. Judging from the fact that there were a hundred draftsmen employed, we should conclude that work is not as well systematized as it should be in such a place, or as it is in our own establishments of this kind, and that alteration of designs must absorb a heavy percentage of the profits. It is possible that the variety of work done by Cail & Co., which includes sugar mill work and every variety of machinery, may be good cause for the employment of so much profit-consuming labor. We were pleased to find here a neat chemical laboratory, an auxiliary too seldom appreciated by iron works proprietors.

Taking the 11 A. M. train from Paris, an express running through to Marseilles, we enjoyed a very pleasant ride through the heart of France, arriving at Le Creusot at 9:30 P. M. Our route, almost from Paris to the end of our journey, lay through the beautiful and rich wine-growing districts, of which the produce is sent to all parts of the world. From Verrey to Dijon and Chagny, we were delighted with the beautiful scenery of the

CÔTES D'OR,

where are raised the finest wines of Burgundy, and which district is given its name from the exceptional value of the product of its vineyards. The common table wine of this country, which would, with us, be considered a good wine, sells for about twenty sous a bottle, while the price of the finer brands of the *Côtes d'Or* is ten francs here, and probably nearly as many dollars in New York, if it is possible to obtain them at all in all their native purity and strength. Both red and white wines are raised, but the red are generally most liked and are best known abroad. Their delicate and delicious flavor and their exquisite bouquet are considered, by connoisseurs, to be beyond rivalry.

The level lands of the valley through which the line of railroad passes, and the beautiful sunny hillsides on either hand, are covered, apparently, by one immense vineyard. This whole district, with an area of 250,000 acres, is devoted to wine culture, and the annual production has an estimated value of fifty or sixty millions of francs—ten or twelve millions of dollars.

We dined at Dijon, the name of which town is familiar to all as one of the places which obtained some celebrity during the late war. Here we met a veteran who had been partially disabled in a skirmish with the Prussians in 1871, and a bright young French student with whom we enjoyed a pleasant and instructive conversation until our change to the branch line leading to

LE CREUSOT.

Long before reaching the latter city, we could see, away across the country, great masses of smoke rising slowly from the valley and floating across the hills, like heavy thunder clouds, obscuring large tracts of the country which was elsewhere beautifully illuminated by the bright light of the moon, then just past the full. As we finally skirted the town and rushed toward the station, a sight burst into view such as we had never before witnessed, and to which no verbal description can do justice. The vast clouds of smoke which we had been watching, miles away, were issuing from the tops of myriads of chimneys and from the midst of numbers of great blast furnaces, which rose, like so many towers of Babel, far above the surrounding building The long structures, covering the rolling mills and the forges, were plainly seen through the gloom, lighted up by a ruddy glow from great masses of hot metal passing through the rolls, or by the brighter glare of scores of forge fires; and on the hill above and behind the works, barely revealed by the light of the partly obscured moon, we could see the populous town which has grown up here, founded and supported by this marvelous example of recent industrial progress. A dull intermitted roar of escaping steam, the loud clatter of gearing from the rolling mills, and the rumble of the rolls, with the unceasing concussions of many steam hammers, the sound of loud voices now and then rising above the noise of machinery, and the barking of the numerous dogs in the city beyond, mingled and produced almost as novel and exciting an impression upon the ear as did the strange and interesting scene upon the eye.

A frugal and truly French repast of bread and delicious native wine was furnished at the humble inn at which we stopped for the night; and we retired early, sleeping soundly in beds as clean and comfortable as we ever found at an English country tavern, or in our own New England. Before we had finished our breakfast, our kind friend, the proprietor of this wonderful establishment, who had already been informed of our arrival, called to take us in charge, and we spent the day in its exploration.

A century ago, this busy valley was a deserted and sparsely inhabited spot, forming part of one of the least productive estates in France. The discovery of its mineral wealth at that period was the commencement of its development, by the erection of an ironworks, in 1782, which was supplied with coal from the beds beneath it and with iron ore from the neighborhood. The machinery was driven by one of Watt's earliest engines, which is still preserved at Creusot as an interesting relic. The early prosperity of Creusot, then called Charbonnières, was seriously checked by the French revolution, and by the subsequent uncertainty in political matters; but, recovering, acquired such extent, when purchased in 1837 by MM. Schneider, that its value was fixed at 2,700,000 francs, and its production was stated at 40,000 tuns of coal and 6,000 tuns of iron. The number of workmen was not more than 1,200 to 1,500, and the population of Creusot was not much above 3,000. To-day we find 15,500 people employed in the mines and mills, two thirds of whom are engaged in the latter. The establishment produces 50,000 tuns of steel rails annually, and the new works, the construction of which is already begun, will, in a few months, largely increase this figure. Of iron rails, 20,000 tuns are turned out this year. A hundred locomotives and an immense quantity of other machinery are also included in the annual out-put of Creusot.

There are twelve blast furnaces making ordinary and Bessemer pig metal. The later furnaces are 20 meters—65 feet—high, while some of the older ones are 25 meters. The maximum efficiency seems to have been found at an altitude which has been found best also in some portions of our own country.

The Whitwell and the Cowper hot blast stoves have both been used here, and the new furnaces have a stove which M. Schneider calls a hybrid "Whitwell Cowper." The temperature of blast is carried at about 600° Centigrade=1,080° Fah. The fuel is coke, from native coal raised on the premises or at St. Etienne, where are mines which have the same ownership. The ores of the neighborhood make very good iron, but, for the Bessemer process, iron is made from ores imported from Africa. These ores are as pure and rich as the English Cumberland, and our best Missouri or Lake Superior ores.

Here we saw, for the first time, the molten iron tapped from the blast furnace into ladles, which were drawn at once to the converters and the iron converted into steel without intermediate casting, cooling, and reheating. The economy thus effected is an important item in these days of close competition, and, in part, accounts for the success of these inland ironworks in competing with English makers of steel and in exporting the rails produced here to the United States. It is a matter of wonder that this coöperation of the furnace with the converter is not oftener met with, since there is no difficulty in making the arrangement, as a matter of engineering, and there must be many localities where the requisite capital may be obtained to take advantage of the natural facilities existing for such an economical combination.

The steel rails made here contain four tenths per cent of carbon, and are as strong and tough, and as resilient, as any made in Europe. They are of Bessemer metal. Where a softer steel is required, the Siemens-Martin process is adopted. I think that it was at Le Creusot that this method was first made successful.

In the magnificent Creusot exhibit at Vienna were some fine samples of the product of this process, but we found the finest specimens here that we had ever seen. Such wonderfully ductile metal is precisely what is wanted to take the place of the weaker and less homogeneous metal, iron, for thousands of purposes. These samples were said to contain one fourth of one per cent carbon.

Eight new Siemens furnaces are in course of construction. The rolling mills are very large and are unusually well arranged. The buildings are neat and substantial and the machinery strong and well proportioned. The driving engines are not what we should, in the United States, consider the best possible design, but are well built and are strong and serviceable. The workshops contain much old machinery and some that is new and exceedingly creditable. The forge contains steam hammers of all sizes up to fifteen tuns weight of drop; and here, as well as in every other department, we saw evidence of good management and of intelligent supervision.

We visited the offices and drawing rooms, and found them well constructed, pleasant, and comfortable, with every possible facility for doing work and for communication with the various departments of the works. The telegraph is used very extensively for correspondence. Before leaving, we looked into the houses where the locomotives, used by the works for their own transportation, were kept. There are sixteen now in use, and they are not fully equal to the work. They are plain, powerful machines of the common continental type of freight engine, and exhibit no specially noticeable peculiarities.

The working people here seem to have a more efficient character and more industrious habits than is usual with French workmen, and impress the visitor very favorably by the contrast which they present to the sluggish, inactive, workmen generally seen in Europe.

After a very thorough examination of this greatest of all the French ironworks, after enjoying the generous hospitality of our host, and after a stroll about his pleasant grounds, we took the evening train for

LYONS.

We have not space in which to describe this fine city, or to give even the merest abstract of the memoranda gathered here in the great center of the silk manufactures, where 70,000 looms, in 10,000 establishments, support 140,000 persons, and produce a value of $60,000,000 per year. The permanent Industrial Exhibition, which was visited with the expectation of learning much that would prove of interest, is a sad failure, although it opened so short a time ago under such encouraging auspices. We saw there some fine castings, in Siemens-Martin steel, from the "*Société Anonyme de Charente*," and a six inch armor plate from Marvel Frères, doubled up without crack, as stated, *cold*. Chevalier & Grénier exhibit a compound portable engine and boiler with removable tubes and firebox, as at Vienna. The engine governor was of the parabolic class, and the whole was a good piece of work. The immense buildings look barnlike and empty, and we came away disappointed.

Before taking the train back to Paris, we visited the observatory on the hights of Fourvières, and spent an hour or more enjoying a splendid panorama embracing many miles of the valleys of the Rhone and the Saône, which have their confluence at Lyons, and, a hundred miles away, over the eastern hills, taking in the hazy outlines of Mont Blanc. Then, after an uneventful all night ride, we were back in Paris, ready to leave the continent and to spend a few days in Great Britain.

R. H. T.

THE ATLANTIC CABLES.—The attempt of the Great Eastern steamer to lift and repair the Atlantic ocean cable of 1868 has failed, owing to stormy weather, and the great ship has returned to England. The work is postponed until next year. The fault has been located at a point not far eastward of the banks of Newfoundland. The cable was successfully grappled and lifted several times. A portion of the original cable, that of 1858, was brought up during the grappling operation and found to be in a fair state of preservation.

THE Preece block system of electric railway signaling is worked on the principle that the trains are to be kept a certain unvarying distance apart. No train can advance until the signal is given that the line for the specific distance ahead is absolutely clear.

THE passengers carried by the railways of Great Britian in 1872 reached the enormous total of 423,000,000. The total number carried in 1850 was only 78,854,422. The increases is mainly owing to the construction of underground and other suburban lines leading out of the large cities.

AUTOMATIC CAR COUPLING.

The invention illustrated in our engravings is a new form of car coupling, which, while it connects the cars automatically as they are brought together, allows of the uncoupling of the vehicles from either their tops or sides. The device is claimed to operate perfectly on the sharpest curves and steepest grades, and to bring the cars as closely together as the ordinary drawheads now used. It is attached to the carriages in the usual manner, with perhaps somewhat more up-and-down and sideways play.

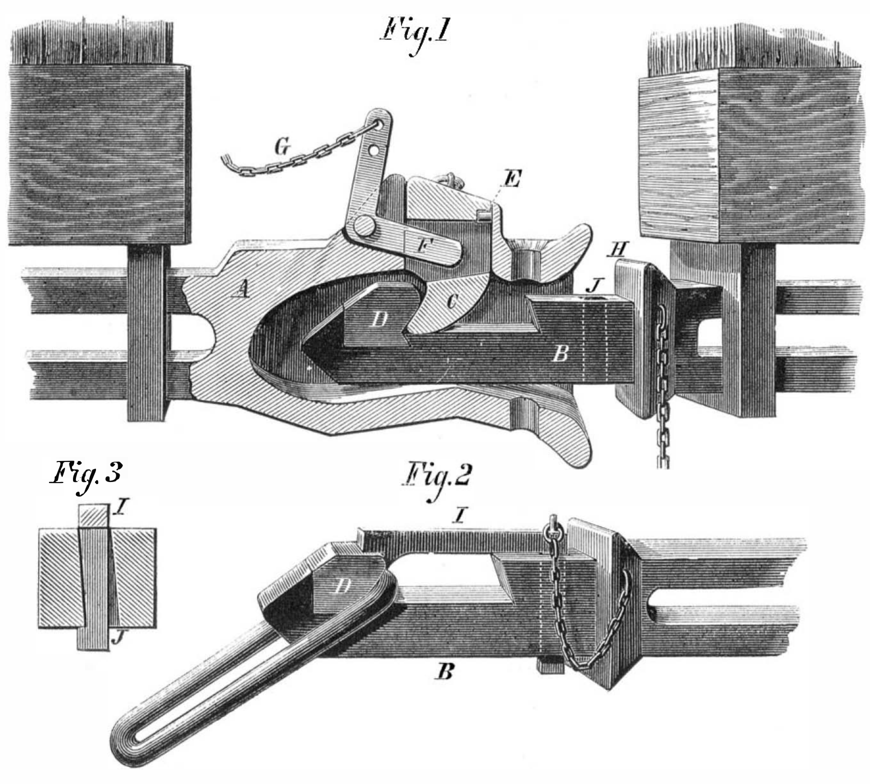
From Fig. 1 the construction will be readily perceived. A is the drawhead of one car, made with a cavity of sufficient size to receive the connecting drawhead, B. Fitting into a recess in A, so that its lower and hook shaped end may project down into the hollow portion, is a steel coupling block, C, which engages with another steel block, D, dovetailed and bolted to the drawhead, B. The block, C, is provided with a ring or handle at its upper portion to admit of its being readily lifted out by hand, when it is so desired, to uncouple the cars, while its movement is limited by a pin or screw, E, working in a suitable groove on its surface. When raised, the coupling block, C, may be held up by a pin placed in a hole therein and above the drawhead.

Pivoted in a slot in the upper part of the latter is a bent lever, F, of which the forward arm enters a slot in the coupling block, so that, by suitably operating the lever, said coupling block may be easily lifted up, and the cars thus uncoupled. This is effected by a chain, G, attached to the upright arm which, passing over suitable rollers, connects with one lever near the top of the car and with two other levers attached to the sides of the vehicle.

The draw bar, B, has a collar, H, to prevent its being forced too far into the opposite drawhead when the cars are brought together.

A point claimed as of considerable advantage in the invention is the facility with which it may be adapted to connect with and in the same manner as the common form of drawhead. In the forward part of the bumber, A, is a hole for a coupling pin which secures one end of the link. The other extremity of the latter slips over the coupling block, D, where it is held in place by a square angle bar, I. One portion of this bar drops into a square though somewhat inclined hole in the drawhead, B, at J, and its lower extremity, being notched, locks itself in. This will be more clearly understood from the section shown in Fig. 3. The horizontal portion of the bar, I, simply rests along the top of the drawhead, B, and terminates in an end angled to fit the corner of the block, D, thus securely confining the link.

Patented through the Scientific American Patent Agency, September 2, 1873. For further particulars regarding purchase of interest in the patent, etc., address the inventor, Mr. Franklin E. Howard, Geneseo, Livingston county, N. Y.



HOWARD'S AUTOMATIC CAR COUPLING.

CUMMINGS' IMPROVED MILL PICK.

The invention herewith illustrated is a small pick, designed for both furrowing and cracking, or for light and heavy stone dressing. The principal advantages are the firmness with which the blades are held, the manner of letting the same down, to compensate for wear, and also the facility with which they may be changed. The latter is an important feature, as it is often necessary to remove blades for sharpening as many as one or two hundred times in dressing a mill or a run of stones. Two sizes of the implement are made, one for furrowing and the other for cracking.

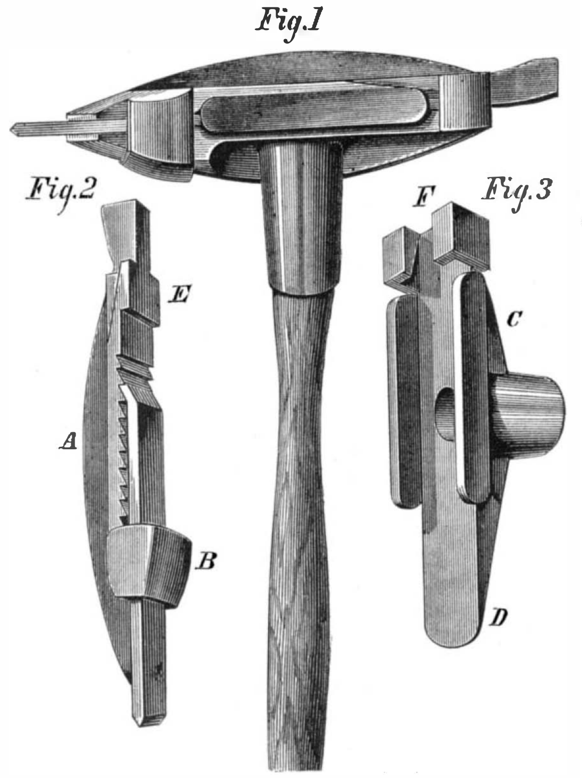


Fig. 1 represents the entire pick ready for use. Fig. 2 is a stationary stock bearing the handle, and Fig. 3 is a detachable clamp plate. The latter is a thin metal plate, having a ratchet on its inner surface, a convex rib, A, on its rear side, and a loop or socket, B. The pick or blade is a thin steel plate of even thickness, with its upper end bent to fit the notches in the clamp plate.

In adjusting for use, the blade is placed upon the clamp plate, its sloping end entering one of the notches, when both are applied to the stack, C. The lower wedge-shaped end, D, of the stock, enters the loop or socket, B, of the clamp plate, and the wedge-shaped lips, B, of the clamp plate fit into corresponding channels formed in the ears, F, of the stock. It will be seen that a blow upon the cutting edge of the blade will force the clamp plate and blade upward, and cause them to embrace the stock with great power. The more powerful the blows upon the stone, the more firmly, it is claimed, is the blade confined in its place. To remove the blade the implement is reversed, and the opposite end of the clamp plate struck on any solid substance, when both clamp plate and blade will be instantly released.

As the blades are abraded by use, they can be let down in the ratchet until worn out. They are tempered along the entire length, and only require grinding to sharpen.

Patented June 24, 1873, by Mr. Jotham Cummings, of West Charleston, Vt., by addressing whom further particulars regarding sale of rights, etc., may be obtained.

The Effects of Worry.

That the effects of worry are more to be dreaded than those of simple hard work is evident from noting the classes of persons who suffer most from the effects of mental overstrain. The casebook of the physician shows that it is the speculator, the betting man, the railway manager, the great merchant, the superintendent of large manufacturing or commercial works, who most frequently exhibits the symptoms of cerebral exhaustion. Mental cares accompanied with suppressed emotion, occupations liable to great vicissitudes of fortune, and those which involve the bearing on the mind of a multiplicity of intricate details, eventually break down the lives of the strongest. In estimating what may be called the staying powers of different minds under hard work, it is always necessary to take early training into account. A young man, cast suddenly into a position involving great care and responsibility, will break down in circumstances in which, had he been gradually habituated to the position, he would have performed its duties without difficulty. It is probably for this reason that the professional classes generally suffer less from the effects of overstrain than others. They have a long course of preliminary training, and their work comes on them by degrees; therefore when it does come in excessive quantity, it finds them prepared for it. Those, on the other hand, who suddenly vault into a position requiring severe mental toil, generally die before their time.—*Chambers' Journal.*

HAMILTON'S CONTINUOUS SELF-FEEDING PERMEATOR.

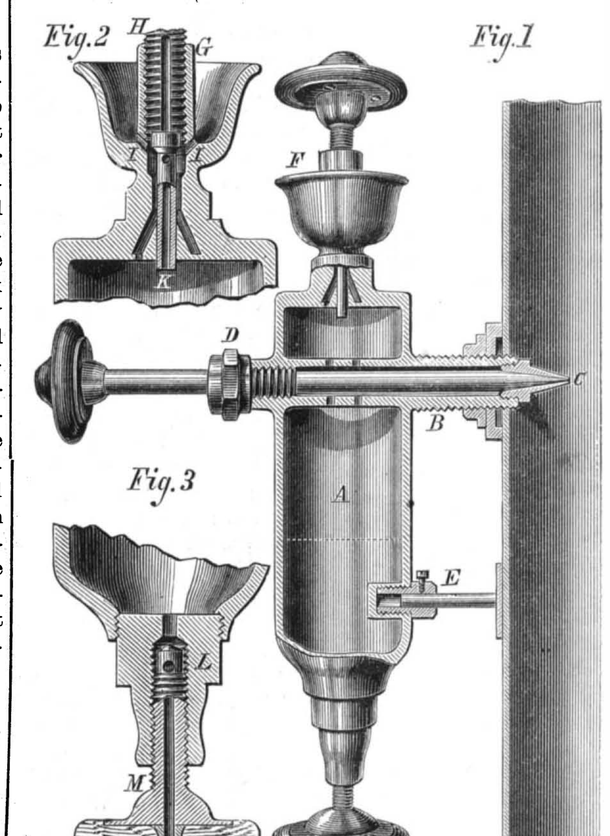
The object of the device herewith illustrated is to inject tallow, oil, or similar material, into the steam in an engine cylinder, and thus, by thoroughly permeating, to lubricate the vapor and, consequently, the machinery with which the same comes in contact. The invention is an ingenious application of the needle principle, the supply orifice being not over one thousandth of an inch in diameter, so that the lubricant is driven in, in the shape of fine mist or spray. Probably the most important advantage claimed is that the apparatus will continue to supply oil even after steam is shut off, as in cases of locomotives on down grades, etc. How this is effected will be noted as we progress, in the description which follows:

The chamber, A, and distributing bolt, B, Fig. 1, are cast in a single piece of any suitable metal. In the bolt are orifices through its wall, leading to the channels formed by the intermediate space between the needle, C, and its interior. At the end of the bolt is arranged a conical discharge orifice, in which is the steel pointed valve spindle or needle. The relative diameters of the needle and opening are such that, when the former is screwed down so as to shut off all further flow of the lubricant, its point projects beyond the hole and into the cylinder, so that the orifice is, by this means always kept free from incrustation. The needle spindle passes through a stuffing box, at D, and is rotated by the hand wheel shown. At E is a socket bearing, to which is secured, by means of a screw, a bearing plate for retaining the cup in proper position beside the steam chest or cylinder.

The oil is poured into the cone-shaped vessel, F, in the center of which is cast a vertical tube, E, shown in section in Fig. 2. The interior of the latter is threaded to receive the screw, H. In the bottom of the receptacle are made annular supply channels, I, and along said screw, H, is cut a groove, as shown, to serve as an air passage. The screw, H, forms a screw plug valve, and terminates in a hollow spindle, K. The surface of the female thread in tube, G, extends below the discharge orifices, I, of the supply chamber, and also below the inlet or escape openings of the air passages, so that each can be opened and closed at pleasure by simply turning the plug valve. The tube, L, of the sediment cock (Fig. 3) is screwed into an opening at the base of the chamber, and is formed, with a female thread, within a small valve chamber into which the oil flows through the short passage shown. The valve plug, M, is conical at its end, and has a passage, throughout its length, opening by branches into the valve chamber.

The apparatus being secured to the cylinder or steam chest, oil or other lubricant, is poured into the cup, the valve plug, H, being elevated to such a position as to leave the lower orifices of the channels, I, and air passages open. The air then will escape as the liquid flows in, a point of advantage, as it is claimed to give the engineer control over the cup, whether the engine is in motion or not, and with no risk of his getting scalded with boiling oil or tallow.

When the chamber, A, is filled, the plug, H, is screwed down, thus cutting off the supply. The needle spindle, C, in bolt, B, is then caused to open the orifice leading into the cylinder. The lubricant passes into the bolt, B, through the orifices in its walls, and is discharged, as before stated, in spray-like form. The steam also enters the chamber, A, through the same orifices, but, becoming condensed, falls to the bottom, and lifting the lighter lubricant, keeps the latter in condition readily to flow to the tubular section of the bolt, B. It is stated that when the cup is emptied the amount of oil drawn off is just equal to the capacity of the chamber, and that the lubricant must, consequently, be always above the bolt and in condition to be fed through the openings. The mere action of the valves, therefore, when steam is shut off from the cylinder, it is claimed, is sufficient to bring the oil away, so that the lubricant is supplied just when the facings become dry and cutting begins.



To draw off the contents, it is only necessary to turn the valve plug, M, and thus allow the sediment, etc., to escape through the opening through its center.

Patented June 24, 1873, to Mr. William Hamilton. For further information address William Hamilton & Co., Box 379, Erie Pa.

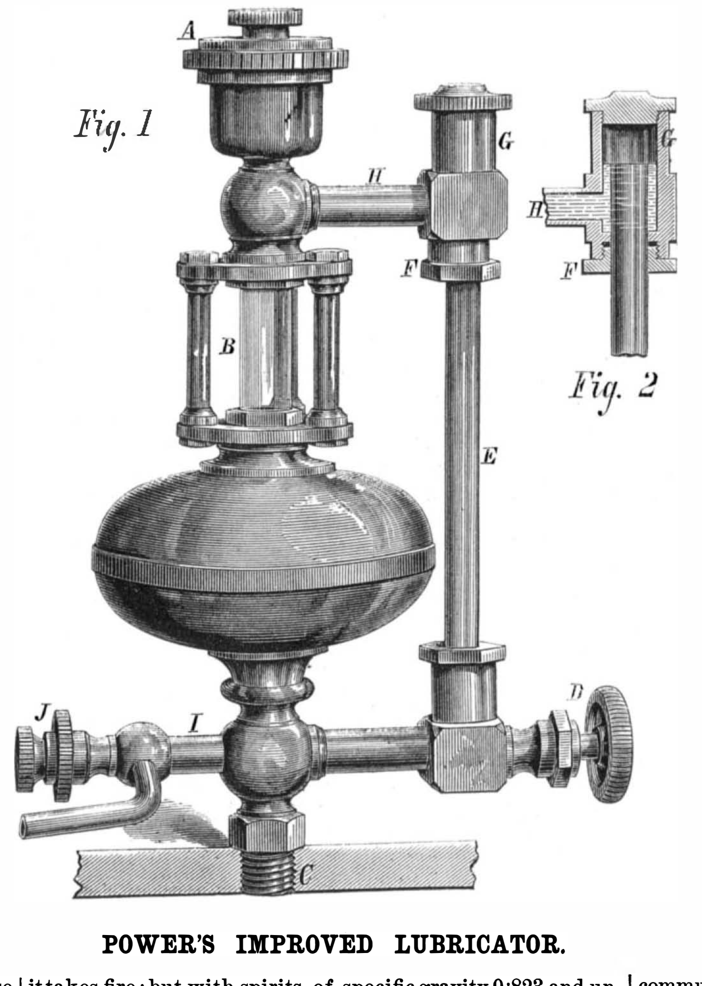
IMPROVED LUBRICATOR.

We illustrate in the accompanying engraving a new lubricating device, claimed to ensure a continuous and economical flow of oil or similar lubricating material into the cylinders of steam engines, and, besides, to possess many improvements and advantages in general construction.

The oil is poured into the cup, A, Fig. 1, and descends by the glass tube, B, into the circular receptacle shown. At C, the apparatus is attached to the cylinder, the steam from which, when the valve, D, is opened, passes up the tube, E. This tube is movable in the direction of its length and is held tightly in stuffing boxes, as indicated in the sectional view of its upper portion, Fig. 2. G is the condensing surface, so that the steam, emerging from the end of tube E, fills the intermediate space between said tube and the inner periphery of G with water. It is clear that, by moving tube E up or down so as to bring its upper end nearer or further from the cover of G, the condensing surface will be decreased or augmented so that less or more water will pass by pipe H, and mingle with the oil in the reservoir. The effect of this addition of water is to displace the oil, raising the latter back through glass tube B and pipe H into G, and thence down tube E into the cylinder at C. The glass tube, B, affords a convenient means for the engineer to perceive the amount of oil in the apparatus, and also to know when the water entirely displaces the lubricating material in the reservoir, a fact indicated by its appearance at the bottom of the tube. There is an opening in the lower part of the reservoir which communicates through pipe I and valve J with the bent conduit shown, thus allowing the contents to be drawn off at will. The valves at J and at A are provided with screw thread collars, which secure them in place and through which their stems freely work. This is designed to obviate the difficulty, which arises when the thread is on the valve stem, in screwing the plug down on its seat in case of any foreign material stopping the way. With the present arrangement, the collar is the securing portion, while the stem may be turned around so as to grind the valve into its seat.

The inventor informs us that he has had this device in use for some time past and has experienced uniform success. The flow is constant and unobstructed, while the expenditure of oil is reduced to a minimum. The construction is strong and durable, and the apparatus generally appears to us as showing considerable ingenuity as well as being well adapted for its purpose.

Patented through the Scientific American Patent Agency, January 7, 1873. For further particulars address the inventor, Mr. James McL. Power, Port Townsend, Washington Territory, or at Warren, Trumbull county, Ohio.



POWER'S IMPROVED LUBRICATOR.

Testing Alcohol.

It is customary to obtain the percentage of absolute alcohol and water in mixtures of alcohol by taking the specific gravity with a hydrometer especially adapted to the purpose and called an alcoholometer. When a liquor contains sirups and extractive matters, the specific gravity fails to indicate the amount of alcohol present. In such cases it has been necessary to distil off the alcohol and then measure it.

In these cases, and also where no alcoholometer is at hand, or the quantity of the liquid is too small to float one, Vogel's method may be employed. He found that, when dry starch paper was dipped into a solution of iodine in alcohol of 66·8 per cent or over, the starch was not turned blue. If the spirits contained less than 66·8 per cent absolute alcohol, the paper is immediately blued. To apply the test to weaker alcohols, it is only necessary to add absolute alcohol until the reaction no longer takes place. From the quantity added it is easy to calculate the percentage. If the spirit tested is above 66·8, water is added from a graduated measure until the starch paper turns blue, and the percentage calculated from the quantity of water added. If potassium be thrown upon alcohol of specific gravity 0·830. it takes fire; but with spirits of specific gravity 0·823 and under, it will not take fire.

THE JAPANESE DEPARTMENT AT VIENNA.

Among the most interesting displays of Oriental productions at the Vienna Exposition is the Japanese department. Here are exhibited the choicest articles of workmanship, embracing those forms of art which, for ages, have satisfied the popular tastes of Japan, but which, under the rapidly improving ideas of her people, will soon for ever disappear. Remarkable sea monsters of grotesque form, birds, vases, globes, etc., having the appearance of solid materials, elaborately adorned, but in reality composed of paper, stretched and supported on bamboos, surprise and interest the visitor on every side. The display of Japanese trappings for horses, vehicles, saddles, bridles, and equestrian equipments is quite extensive and includes many peculiar forms. For example, instead of a stirrup like ours, the Japanese use a piece of wood bent at a sharp angle, to one end of which the stirrup strap is attached, while the foot rests on the portion below, which hangs horizontally. The stirrup is beautifully decorated. The wealthy Japanese, when they ride, present a gorgeous appearance, the animal being covered with gold-plated straps, bridles, and fringes, while the dress of the rider is adorned with golden emblems, and his belt filled with costly swords.

The show of Japanese arms is very fine, especially the collection of swords. These are of curious forms and elaborate workmanship, great pains being taken in the ornamentation of the hilts. The steel is of splendid quality.

In their mental power and readiness to appreciate the ideas and appliances of modern nations, the Japanese are decidedly in advance of other Eastern peoples; and now that the government is so fully committed to the re-education of the people, on the basis of Western civilization, the nation will soon take a high rank. Large numbers of Japanese young men, from the prominent families of the Empire, are now being educated in Europe and this country. At the Vienna Exposition a special delegation of Japanese students and officials are employed to copy and procure information about everything which they consider to be useful for introduction into Japan.

THE JAPANESE DEPARTMENT AT THE VIENNA SHOW.

POTATO BLIGHT AND ROT.

Dr. Thomas Taylor, of Washington, D. C., communicates to *The Lens* the result of experiments upon potatoes, for the examination into the chemical and structural theories of Dr. Lyon Playfair and the fungoid views of several leading mycologists. Among other tubers, one half of a potato brought from Santa Fé, New Mexico, was placed in water with a diseased specimen and the other half in water to which sugar had been added. An Ohio potato was similarly arranged, and the effect of allowing it thus to remain for a considerable period noted. On the twentieth day, the Ohio specimen had entirely dissolved, while the Santa Fé potato was uninjured. Comparing the portions in the sugared water, the Ohio tuber appeared a mass of infusorial life, mycelium, and budding spores, with a strong odor, no starch cells being discernible.

The New Mexican specimen showed few infusoria, and the starch granules arranged in cellulose, between which bundles of mycelium and budding spores appeared in profusion. No liberated granules were visible. Since these experiments, other northern and eastern varieties have been tested by fungoid solutions in contrast with some of the New Mexican varieties, giving like results, clearly demonstrating the superiority of the Santa Fé potatoes, over all others thus far examined, in respect to their powers of resisting fungoid and infusorial action.

We note that the government is about to test, by samples of every variety of potato from the above mentioned locality, their anti-fungoid qualities in the open field and in contrast with the usual varieties grown in that section of the country.

THE NEW EXPLORATION OF THE AMAZON RIVER, BY PROFESSOR ORTON.---UP THE AMAZONS.

No. 3.

A THOUSAND MILES ON THE GREAT RIVER.—SCENERY.

A voyage on the Amazons is excessively monotonous. A vast volume of smooth, yellow water, floating trees and grass, low, linear-shaped islets, a dark, even forest, the shore of a boundless sea of verdure, and a cloudless sky with occasional flocks of screaming parrots, these are the general features. No busy towns are seen along the banks; only here and there a palm hut or Indian village, half buried in the wilderness. No mountains break the horizon, only a half a dozen table-topped hills; and while many bluffs of red and yellow clay are visible, they are exceptional, the usual border being low alluvial deposits, magnificently wooded, but half the year covered with water. The real grandeur, however, of a great river like this is derived from reflecting upon its prospective commercial importance and immense drainage. A lover of Nature, moreover, can never tire of gazing at the picturesque grouping and variety of trees with their mantles of creeping plants; the wild, unconquered race of vegetable giants; the "reckless energy of vegetation," compared with which the richest woods on the Hudson are a desert; the dense canopy of green, supported by crowded columns, branchless for fifty or eighty feet; the parasites and undergrowth struggling for life; the broad-leaved bananas and gigantic grasses; the colossal nut and pod-bearing trees; and above all the hundreds of species of palms, each vying with the other in beauty and grace. Through such a densely packed forest flows the Amazons with all the grandeur of an ocean current.

In giving our voyage up the great river to its source among the Andes, we shall touch only at representative points, and confine ourselves mainly to such commercial and industrial facts as will be likely to interest the practical man. From Pará to Santarém, the first town of importance, is 543 miles. The passage can be made by steamer once a week, sometimes oftener; fare, $25; time, four days. Twenty hours after leaving the capital, the steamer stops at the little village of Breves on the southwest corner of the great island of Marajó. Rubber is the chief article of export. Here begins a labyrinth of narrow channels connecting the Amazons with the Pará; and as the forest is usually luxuriant, the sail through to the Great River is the most memorable part of the whole voyage. Here the palms are seen in all their glory; the slender assaí and jupatí with their long, plume-like leaves, the míritî with enormous fan-like leaves, and the bussú with stiff, entire leaves, some thirty feet long. The banks are frequently bordered with heart-shaped arums and waving arrow grass, or with plantations of the cacao tree and mandioca shrub.

The first view of the Amazons is disappointing, as it is nearly filled up with islands, but where the Xingú comes in, it shows its greatness, being ten miles wide. At the mouth of this tributary is situated the pretty village of Porto de Mos, now numbering but 800 souls, but destined to be an important center in the rubber trade, while the country up the Xingú is admirably adapted for coffee. Passing the singular hills of Almeyrém and the rightly named village of Monte Alégre, famous for its cattle, we reach

SANTAREM

at the mouth of the Tapajós. This ambitious but, to an American, sleepy looking city is the half-way station between Pará and Manáos, and is now aspiring to become the capital of a new province, to be called Baixo-Amazonas, extending from Obydos to Gurupá. It is not thriving, however, barely maintaining its old number of 2,500 souls. Of these about 2,000 are Indians, Negros, and mixed, including two hundred slaves. The situation is beautiful, lying on a green slope facing the clear Tapajós, with undulating campos and flat-topped hills in the rear. Three or four long rows of low, whitewashed, tiled houses, with less than half a dozen two-storied buildings and one Jesuit church, make up the city. There is a "Collegio" for boys and girls, the former department having fifty students varying in age from eight to sixteen, and a course of four years for the study of grammar, arithmetic, geography, history, French, Latin, algebra, and geometry. Just now there is a conflict between the Jesuits and the Masonic order, the government siding with the latter. The priest declared from the pulpit he should obey Rome rather than Rio. The climate of Santarém is delightful, the trade winds tempering the heat (which is seldom above 83°) and driving away all insect pests. The chief diseases are syphilis and fevers. Dr. Stroope, an immigrant from Arkansas, is the sole physician. The soil in the immediate neighborhood is sandy and poor; but inland, especially, where the

AMERICAN COLONISTS

have located, it is exceedingly fertile, rice, for example, having a yield of seventy-five bushels to the acre, and tobacco, one thousand pounds. The great want is a laboring class; there are too many shopkeepers and too few workers. Yet such as are willing to work can be hired for fifty cents a day. One paper, a foot square, is published weekly. The following prices will give some idea of living at Santarém: Wheat flour (mostly from Harper's Ferry, U. S.) costs $16 a barrel; and New York goods generally sell at three times their original value, the chief addition being made at the custom house at Pará. Agricultural implements are at double their price. Butter (all from England and the United States), 80 cents a pound; Holland cheese, 75 cents; Newfoundland codfish, 20 cents a pound; Lowell domestics, from 25 to 40 cents a meter; sawn lumber, $20 a hundred. Of home productions, cacao sells in the city from $2.10 to $2.20 an arroba (32 lbs.); coffee from 16 to 24 cents a pound; sirup (no sugar is made), 40 cents a frasca (5 pints); maize, $2 a bushel; cachaça rum, 50 cents a gallon: peanuts, $2 a bushel; Brazil nuts, $1.50 a bushel; farina, $5 a bushel; tobacco, $1 to $1.25 a pound; lime, $3 a barrel; pork, 35 to 40 cents a pound; beef, 7 to 9 cents a pound; hides, at the ranchos, 5 cents a pound, at Santarém, 7 cents a pound, at Pará, 12 to 14; cattle, at the ranchos, $15 to $20, at Santarém, $25 to $28, at Pará, $35 to $50; horses, at the ranchos, $35 to $40, at Santarém, $40 to $50, at Pará, $50 to $100.

The best paying business at Santarém would be in the manufacture of brick, leather, and lumber. The only articles manufactured are cajú wine, cachaça, soap, and lime. Nearly all the following exports, given in the order of their valuation, come down the Tapajós: Rubber (about 7,000 arrobas annually), cacao, hides, dried beef, fish, farina, salsaparilla, tobacco, guaraná, copaiba oil, Brazil nuts, tallow, cattle, horses, and lime. Coffee, sugar, and rice are imported from below, although hardly any part of the Amazons valley would produce more. Rubber gathering has not only killed agriculture, but drained the district of 2,000 inhabitants.

Santarém is of interest to the American reader as it was selected for colonization by emigrants from the Southern States. Most of the colonists have left, only six families remaining; but these contain nearly all the enterprise and intelligence of the motley party that left Mobile in 1867. These have chosen their plantations on the slopes of the hills, six miles south of the city, and are astonishing the Brazilians with the results of their industry. The land is rated at 22 cents an acre; but practically the colonists enjoy "squatter sovereignty," pre-empting a square mile, and paying no taxes except on exports. They can sell their improvements, but not the land. The soil is black and very fertile. It beats South Carolina, yielding, without culture, 30 bushels of rice per acre. Sugar cane grows eight feet high, or twice the length of Louisiana cane, and fully as sweet. Sweet potatoes grow naturally; indeed it is impossible to exterminate the plant. Broom corn and cotton grow luxuriantly. Indian corn does not mature well; turnips grow finely, but do not come to seed; grapes do well, but the ants devour them. The following

VALUABLE VEGETABLE PRODUCTS

abound at the American settlement: abio, ata, pine apple, pikiá, papaw, aracá, ingá, abacati, bread fruit, orange, banana, cocoa nut, peach palm, cupuassú, cajú, cará (or yam, four or five kinds), three kinds of mandioca, tomato, pepper, ginger, Brazil nuts, tonka bean, sugar cane, sweet potato, squash, Lima bean, rice, tobacco, indigo, and pita; while in the dense forest we find the following trees, many of them unknown to commerce, but furnishing the richest cabinet woods or timber: itaúba (often 60 feet high and 4 feet through), cedar (specimens of which occur 100 feet high and 7 feet in diameter), jutahí (a very hard, dark wood, used for sugar mill rollers, etc.,) sapucaya (resembling hickory, the clear trunk of which is often 50 feet high), loira (the pine of the country), moira-pushúva (similar to black walnut), cumarú, sapupéra, macacaúba (very close grained), acariúba (very durable), javána, rosewood, pracuúba (very hard), pao-mulatto, pao-prito, pao-d'arco, and andiróba. With Nature so generous, with a healthy location at the outlet of the rich Tapajós, and, though 500 miles from the sea, accessible to Atlantic vessels of heavy tunnage, Santarèm is sure of a brighter future. From Santarém to

MANAOS,

the capital of the upper province of Amazonas and the second city in magnitude on the river, is 460 miles. Three villages of importance are passed in this voyage: Obydos (seated beside a bluff on the "narrows," where the river, contracting to a strait not a mile wide, has a depth of forty fathoms and a current of 2·4 feet per second) exports considerable cacao and Brazil nuts. Villa Bella, insignificant in itself, is the outlet of a large and rich inland district, exporting cacao, guaraná (from Manés), piracacú fish, bast, Brazil nuts, tonka beans, tobacco, coffee, caferána, copaiba oil, hides, and beef, but importing almost every necessary of life. And Serpa, built on a high bank of variegated clay, nearly opposite the entrance of the Madeira, has a deep water frontage, where vessels might easily dispense with lighters, montarias, etc. But wharves and piers are yet to be on the Amazons. The excuse for not building them is that the great difference between high and low water (50 feet) precludes their construction. We think any experienced mechanic from the North could easily show that piers on the river are among the possibles, and at the same time reap a fortune for himself. One is greatly needed at Manáos, where sometimes twenty-five steamers unload every month.

On the left bank of the dark Rio Negro. ten miles from its junction with the Amazons, stands the St. Louis of Brazil, the city of Manáos. The site is admirably located for either residence or commerce. It is uneven and rocky, twenty feet above high water mark. The river in front is deep enough for the Great Eastern, and its banks for hundreds of miles are packed with a luxuriant forest of valuable trees. The soil is fertile in the tropical sense; and the climate is Neapolitan, Nature having left little to be desired in this respect. We did not see the mercury rise above 93° at midday, and the nights are invariably cool, with but few mosquitos. The country around is quite romantic for the valley, being undulating and covered with picturesque vegetation; while the *igarapés* or canoe paths winding through the forest are among the most beautiful features in the Amazonian landscape.

The city, for a long time stagnant, is now rapidly improving. As we saw it in 1867, it was meanly built, without a show of enterprise, without a hotel, and not 3,000 inhabitants. It now numbers 5,000 souls, with 17,000 in the district, a mixture of Brazilians, Portuguese, Negros, Indians, Italians, Jews, Germans, and English; it has a fine cathedral, to cost, when completed, $200,000, and a President's palace in process of construction; two hotels and a market, beside many elegant private houses. The city is lighted with 500 kerosene lamps, has day and night schools, with an *Episcopal Seminario*, three newspapers, one daily; and one two horse carriage, which is advertised "to let, rain or shine." But there is neither bank nor book store.

Agriculture, as everywhere on the Amazons, is dead; even farina, the bread of the land, is imported from Pará, although this is the mandioca country. In fact, there is a constant lack of food in the city.

PRICE OF LABOR AND PRODUCTIONS.

The only productive industry worth mentioning is seen in one steam saw mill, one brick and tile establishment, and one soap factory. Masons and carpenters get from $2.50 to $5.00 a day; pilots $100 a month; and physicians $5 a visit. The daily "Commercio de Amazonas" costs $10.00 a year. Hotels, $2 per day. The following prices, current the present month (August), will serve to illustrate life a thousand miles up the Amazons: Cacao, $2.20 an arroba; tonka beans, 20 cents per kilogramme; puxurí (nutmegs), 90 cents per kilogramme; guaraná, 68 cents per kilogramme; Brazil nuts, 5 cents per kilogramme; copaiba oil, 70 cents per kilogramme; fish glue, 90 cents per kilogramme; dried meat, 21 cents per kilogramme; dried pirarucú fish, 23 cents per kilogramme; vanilla, 45 cents per kilogramme; indigo, $2 per kilogramme: salsaparilla in bundle, 80 cents per kilogramme; tucum thread, $1.00 per kilogramme; tallow, refined, 90 cents per kilogramme; rubber, from 56 cents to 85 cents per kilogramme; rubber, in liquid, $2.53 per kilogramme; aguardente (cane rum), from 15 to 20 cents a liter: tapioca, 20 cents a liter; piassaba in the rough, 12 cents per kilogramme; piassaba cord, 50 cents a centimeter; piassaba brooms, $1.60 a dozen; estopa or bast, 9 cents per kilogramme; hides, 26 cents per kilogramme; cotton hammocks, from $5 to $14 each; tucum hammocks, feathered, $45; cedar logs, $1 per meter; cedar or itaúba boards, sixteen feet long, eight inches wide, unplaned, $18 a dozen; cabinet wood in boards, 45 cents a meter; steamer fuel, $20 a thousand sticks, each weighing on the average fifteen pounds*; native brick (8×6 ×2 inches) and tiles, from $50 to $75 a hundred, at Pará $35; the ordinary red sandstone rock, which abounds in the vicinity, unworked, 75 cents a cubic foot.

DUTIES AND FREIGHTS.

The provincial duty on liquors is 25 per cent; on rubber, 12 per cent; on fish, 5 per cent; on all other articles, 10 per cent. If exported, 5 per cent extra is collected at Pará, besides fees. Rubber collected in Peru and Bolivia pays no duty. Steamer freight between Manáos and Pará, on rubber, 25 cents an arroba; on coffee and cacao, 24 cents an arroba; on Brazil nuts, 35 cents a bushel; on brick, $20 a thousand; cotton, 30 cents an arroba; hides, 20 cents each; crude piassaba, 25 cents an arroba; salsaparilla, 30 cents an arroba; tobacco, 25 cents an arroba; boards, $3.30 per dozen; beeves, $7.50 each; horses and mules, $10 each. Freights between Manáos and San Antonio on the Madeira; on rubber and salsaparilla, 40 cents an arroba; cacao, coffee, dried beef and tallow, 32 cents an arroba; Brazil nuts in sacks, 35 cents a bushel; hides 25 cents each. To Hyutanahan on the Purús, the tariff is about the same.

The produce of the Rio Negro and Solimoens does not stop at Manáos, but goes directly to Pará, and must be purchased there. This is owing to the fact that Pará merchants have put the producers under obligation, so that producers up the river cannot sell at an intermediate place. But Manaos is determined to become independent of Pará; and the project of a through line of steamers from Manáos to Europe is on foot. With a healthy climate and fertile soil, a situation near the mouths of four great rivers, the Maderia, Negro, Purús and Juruá, and having water communication with two thirds of the continent, this city has commercial advantages unsurpassed. What it wants is an even and generous legislation and an industrial class. JAMES ORTON.

*Cutting wood for the steamers is very lucrative. Many will soon go into the business with steam or horse power and make fortunes. The forest is free to all. The great difficulty in ascending high up certain tributaries is not so much the lack of water as the lack of fuel, there being no one to cut it.

Honors to Operatives and Foremen.

The Society of Arts and Manufactures, Vienna, has issued 134 silver medals, with diplomas, to operatives and foremen, recommended for the honor by employers who were exhibitors at the Exposition.

The distribution is as follows:

United States of America	5
Great Britain	10
France	18
Germany	13
Italy	9
Switzerland	5
Belgium	5
Holland	4
Portugal	5
Denmark	4
Sweden	7
Russia	5
Greece	3

Trial of Steam Canal Boats on the Erie Canal, in Competition for the State Reward of One Hundred Thousand Dollars.

The trial of steam canal boats on the Erie canal, in competition for the $100,000 prize, came off between Syracuse and Utica, N. Y., on October 15 and 16.

The members of the State Commission present at the trial were Van R. Richmond, George Geddes, John D. Fay, E. S. Prosser, Daniel Crouse, W. S. Nelson, and George W. Chapman; also D. M. Greene, engineer in charge, and H. A. Petrie, Secretary of the Commission.

The boats were required to be able to carry 200 tuns of cargo, besides their motive power, and to make an average of three miles an hour. But none of the boats made this time, and none can claim the reward.

The following is a brief description of the five competing boats, their machinery, etc.

THE WILLIAM BAXTER

was built especially to compete for the prize. She is 96 feet long and 17 feet beam, and has much sharper lines than the ordinary canal boats. Her bottom is perfectly flat, and her sides, stem, and stern, vertical. The outlines of the immersed portions of her bow and stern are the same. She has an overhanging deck at the stern to protect her propellers, and with 200 tuns of cargo she draws 5½ feet water. Her machinery consists of a Baxter upright boiler, and a pair of Baxter compound condensing engines, 7x12 and 12x12. Her boiler is 6 feet high, 46 inches diameter, and has 152 two inch flues, and a grate surface of 7 feet. She is propelled by 2 three bladed twin screws, of 4½ feet diameter and 4 feet pitch. The amount of coal consumed in running from Syracuse to Utica, a distance of 56 miles, was 830 lbs.

THE PORT BYRON.

This is a full sized canal boat of the ordinary outlines, but with a recess or trunk, extending along the center of the bottom of the boat and terminating in an opening, cut in the stern for the reception of the paddle wheel. This paddle wheel is 10 feet in diameter and has eight feathering paddles made of boiler iron. The wheel is driven by two 12x24 horizontal non-condensing engines, which are set on the quarter. The amount of coal consumed from Syracuse to Utica was 4,450 lbs.

THE CENTRAL CITY.

This boat is built somewhat sharper at the bow than the ordinary boats. She is 96 feet long and 17 feet 4 inches wide; and she is driven by two common paddle wheels, placed in recesses cut in the stern. These wheels are of 9 feet diameter, and are driven by a 10x17 horizontal engine. The boiler is 16 feet long and 4 feet diameter. The peculiarity of this boat consists in an arrangement for raising and lowering the paddle wheels and machinery, so as to obtain an uniform immersion of paddles without regard to the draft of water. This adjustment is accomplished by means of four vertical screws, on which the entire machinery, engine, and boiler, rest. The amount of coal consumed from Syracuse to Utica was 7,280 lbs.

THE C. C. POPE

is a regular canal boat of the largest size, to which the screw propeller and machinery are attached without any cutting away of the hull of the boat. A common screw is placed on the outside of the stern in a triangular frame, and an upright shaft and gearing connect this with the engine. The propeller wheel is raised and lowered by means of a screw to suit variable depths of water. The engine is 10x12, and, with the boiler, occupies but 12 feet of the length of the boat, at the stern. This boat has a steam windlass attached, which is used in hoisting cargo and pulling the boat in and out of locks. The amount of coal consumed from Syracuse to Utica was 3,454 lbs.

THE WILLIAM NEWMAN

is on about the same model as last year, but has a Hubbard hydraulic propeller in place of her old screw. She has an horizontal tubular boiler, 8 feet long and 44 inches in diameter, and a grate surface of 13 feet; and she is driven by a single 12x12 upright engine. The propeller is 4 feet 8 inches in diameter and 3 feet long. The amount of coal consumed from Syracuse to Utica was 4,500 pounds.

The boats left Syracuse, October 15, as follows:

William Baxter	6:23 A. M.
Port Byron	9:15 "
Central City	10:16 "
C. C. Pope	11:00 "
William Newman	11:19 "

They arrived at Rome as follows:

William Baxter	9:26 P. M.,	October 15.
C. C. Pope	5:30 A. M.,	" 16.
Port Byron	6:09 "	" "
Central City	6:55 "	" "
William Newman	8:53 "	" "

The boats left Rome as follows:

William Baxter	9:45 P. M.,	October 15.
C. C. Pope	8:40 A. M.,	" 16.
Port Byron	9:00 "	" "
Central City	9:10 "	" "
William Newman	9:50 "	" "

The boats arrived at Utica dock, October 16:

William Baxter	2:30 A. M.
C. C. Pope	1:22 P. M.
Port Byron	2:15 "
Central City	2:18 "
William Newman	2:31 "

The detentions of the various boats along the way were very great, the total detentions of the Newman alone being about five hours.

The Syracuse *Journal* gives the following conclusions, drawn from remarks made by several of the commissioners:

1. That it is quite impossible to invent any machinery that will propel a boat carrying two hundred tuns at a less cost than when moved by horse power, with the present dimensions of the canal.

2. That boats, as now constructed, are too large for the capacity of the canal, their progress being retarded by natural and well known laws relating to space for the displacement of water.

3. That as the law requires that inventions shall be of a character making them practical for superseding horse power, an award is not likely to follow the test.

4. The law requires a speed of at least three miles an hour; and as none of the boats made that time, an award cannot be legally made.

SEE announcement on another page for a special edition of the SCIENTIFIC AMERICAN. Sixty thousand copies to be mailed gratuitously, postage prepaid, to manufacturers, machinists, contractors, and others engaged in industrial, scientific, and mechanical pursuits. Parties having machinery or new inventions to sell will find this an unusual medium to advertise their cases.

ERRATUM.—The address of Mr. Dittenhaver, the inventor of the wood filling described on page 186 of our current volume, is Napoleon, Ohio, and not Chapalear, Ohio.

Recent American and Foreign Patents.

Improved Check Runner.

John Haggerty, Corry, Pa.—This invention consists in providing the base portion of the loop or runner with projections, to prevent the same turning on its axis, and in combining therewith a screw and disk (or washer) which are applied to the opposite side of the strap or head piece of the bridle.

Improved Car Coupling.

William F. Senior, Ripley, Ohio.—Two arms are placed in the cavity of the hopper-shaped coupling box. The forward ends of the arms are rounded off, and rest against concave shoulders formed in the forward parts of the sides of the box, where they are securely pivoted to said box, the said shoulders projecting inward sufficiently to prevent the forward ends of the arms from being struck by the entering coupling bar. Springs are placed between the rear ends of the arms and the sides of the box, and are designed to hold the rear ends of the said arms pressed inward or toward each other. The ends of the coupling bar are rounded off, and have shoulders formed upon their sides, so as, when pushed in, to force the inner ends of the arms apart. As the shoulders of the end of the coupling bar pass the ends of the arms, the springs force the arms inward, so that the shoulders of the said coupling bar may rest against the ends of the arms, which thus sustain the draft. In the cavity of the box is formed a recess to receive the coupling bar and center it, so that it may bear equally upon the arms. Upon the inner ends of the arms are formed projections, between which is placed a block, so that the arms may be forced apart to release the coupling bar, by turning the said block, which is thus protected from being struck by the entering coupling bar. The block is attached to the end of a crank which passes up the platform of the car, so that the arms may be forced apart to release the coupling bar by turning the same. When the crank is released, a spring brings the block parallel with the projections of the arms. With this construction, when the cars are being run together, should the end of the coupling bar drop too low, it may be raised and held in proper position by the attendant from the platform of the car by means of a rod having a hook formed upon its end, or from the top of the car, by using a longer rod. The cars may thus be coupled without danger. By suitable construction, the cars can be readily uncoupled when under headway.

Improved Nut Lock.

Homard C. Lowe, Northeast, Md., assignor to himself and John B. Haley, of same place.—This invention is an improvement in the class of nut locks in which a metal plate is placed in a recess of the washer of the nut, and its ends bent up against the sides of the latter. The improvement relates to the combination of a washer provided with projections on its under side, and two straight grooves in its face (the same crossing each other at right angles), and a sheet metal locking plate, whose form is that of a Latin cross, to adapt it to fit in said grooves, and thus form a double lock for the nut.

Improved Stamp Mill for Ores.

Giles S. Olin, Deer Lodge, Montana Ter.—The object of this invention is to improve the machines now in use for crushing quartz in the process of mining. The cam shafts are supported in boxes on the uprights. There are rubber springs on the stamp stems, which are compressed by the cam as the stamps rise and react to give the stamp a quick downward movement. The stamps are placed on the hypotenuse of the triangular bed, and the coarse quartz is fed through a hopper under the most elevated stamp, which has the coarsest screen. After undergoing the stamping process within this screen, the quartz is spouted under the next stamp, whose screen is finer, and from this it is spouted under the last stamp, and when it passes from the last and finest screen it has been reduced to powder. The quartz falls by its own gravity from one stamp to another through the spout. This is what is called spouting the quartz from one stamp to the other. The screens not only increase in fineness as the quartz descends, but also in speed, and are reduced in lift from the first to the last stamp. By reducing the lift and increasing the speed of the lower stamps, the latter are made to work nearer the dies.

Improved Head Band.

Daniel McKinnon, Wappinger's Falls, N. Y., assignor to Elias Brown, of same place.—The band is made in one piece, in the form of a bow, of horn, rubber, or any other suitable material, and its extremities are provided with hooks the office of which is to hook into the hair of the wearer, so as to bind and ornament the same.

Improved Chandelier Center.

Joseph Kintz, West Meriden, Conn., assignor to himself and P. J. Clark, of same place.—The first feature of the invention consists in a construction of the center in such manner that the lower part can be readily lowered away from the upper part, and the center thereby opened to allow the arms to be put in without entirely removing the lower part, although the lower knob, which, together with the rod and upper knob, secures the parts together, be removed. The second part consists of the arrangement of the hooks on the inner ends of the arms by which they are secured to the center. The third part consists of openings in the lower part of the middle portion of the center, in connection with the contrivances for securing the hooks of the arms to facilitate the connection of them, and securely hold them when connected. The fourth part consists of a bearing flange projecting from the under side of the top part of the center to secure the upper hooks of the arms: and the fifth part consists of a connection of the suspending rod to the center, so as to prevent it from turning when screwing the knobs.

Improved Can for Paint, etc.

Oliver E. Walker, Cincinnati, Ohio, assignor to himself and Charles F. Stites, of same place.—This invention consists of a paint can composed of a metal cylinder with wooden heads at each end, secured, by a flange of the cylinder end turned over the outside and a bead raised on the inside of the cylinder against the inside of the head, by impressing a groove in the outside of the cylinder. One of the heads has a large opening through it to allow of putting in and removing the paint, and a plug is used to close the hole.

Improved Revolving Fire Arm.

William H. Philip, Brooklyn, N. Y.—This invention relates to the combination of a sliding pawl bar and a series of pawls with a series of revolving cartridge cylinders arranged on the same axis, and provided with spiral and and straight grooves to enable them to be turned in succession, whereby, when one cylinder is exhausted, it sets the next one in motion, and ceases itself to rotate. The invention also consists in connecting the pawl bar and series of pawls with the hammer.

Improved Spring Rocking Chair.

Franklin Chichester, Milwaukee, Wis.—This invention relates to the construction of that class of rocking chairs which have the stationary legs or stands, with which the seat is connected, by springs, which allow it to have a rocking motion; and consists in the peculiar mode of applying a plate spring to the front of seat at the rear, and to the middle of back.

Improved Reel for Skeining Silk.

Robert Simon, New York city.—For crossing the threads of "greges, thrown, raw, and soft silks, and other threads or yarns, in skeining them, to prevent the threads from mixing and knotting together, and thus save much loss of time and waste of material in winding from the skeins upon bobbins, in consequence of the breaking and snarling common to the ordinary mode of skeining, it is proposed to have a wide reel with, say, six arms and as many longitudinal bars, in the outer sides of which are small transverse grooves. In combination with said reel there are one or more traversing guides to lay the thread on the reel, the guide being operated so that it will cross the threads at intervals between some of the bars—say, every second pair—and lay them parallel, or nearly so, between the others, and at the same time shift at each revolution of the wheel by a slow forward and backward motion, independent of the crossing motion, so as to lay the threads parallel and not directly upon each other, and thus construct flat skeins with crossed threads.

Improved Centering Chuck.

George H. Miller, Binghamton, N. Y.—This is an improved chuck for centering shafting and other work to be turned in a lathe, and consists in a frame formed of arms crossing each other, and provided with slots to receive the clamping dogs, a crank and pinion and ratchet mechanism for moving the dogs toward or from each other and holding them at any point and of a central tube and a punch working through the same.

Improved Cotton Press.

Paul Williams and Robert A. Williams, Winona, Miss.—This invention consists of joints in the screws which work the follower, whereby the latter can be swung conveniently away from over the case, to allow of filling the case with the cotton or other material to be pressed.

Improved Cock for Drawing Beer.

John Moffet, New York city.—The drawing cock is fitted into the head from the inside, and a plug is fitted in the inside extension. The outside extension is shorter than the chine of the barrel. The ventilating cock is fitted in the side of the barrel directly over the drawing cock, with its plug also inside of the barrel. There is a vent passage through the cock, and a corresponding passage through the plug, also an extension of the plug out through the cock, for the application of a wrench for turning the plugs. A rod connects the two plugs, for turning one by the other. Said rod is capable of a slight endwise motion in the plug, and a spring is arranged with it and said plug to keep both plugs tight on their seats. By turning the plu one way to open the drawing cock, the ventilating passages will be bro into line, so as to admit the air; but by turning them the other way the s passages will remain closed while the drawing cock is opened, so that ventilating passages may be opened or not, at will.

Improved Water Cooler.

Thomas Smith, Brooklyn, N. Y.—The object of this invention is to so improve the water cooler in common use that pure water or other liquids may be cooled and drawn off for use without the admixture of ice water and its impurities. It consists in arranging the receptacle for the liquids as a casing around the ice chamber of the cooler, providing it with an inclined bottom and a faucet at the lowest point thereof. A feed opening or funnel at the top admits the liquid.

Improved Griddle.

Samuel Kennedy, Allegheny City, Pa.—This invention consists of a griddle for baking pancakes having a hoop or flange projecting downward from the edge of the lower side, to elevate the griddle above the stove top and inclose a hot air space for equalizing the heat throughout the whole area of the griddle. The invention also consists of a damper, in combination with this elevated griddle and hoop or flange, for regulating the heat within the flange by opening or closing passages through it.

Improved Wheel for Vehicles.

Charles W. Spayd, Wilkesbarre, Pa.—This invention consists in the combined spoke socket and felly clip of a wheel, having one end of the socket circular, but gradually changed in shape to an oval toward the felly to allow the spoke to be wedged.

Improved Brush Washboard and Roller.

Isaac Hussey, Ironton, Ohio.—This invention relates to the application of bristle brushes in the operation of washing. A roller is employed that is made both to rotate and reciprocate over the clothes, which are themselves spread upon a stationary subjacent brush. In using the machine, the article is spread upon the brush, and the roller brush moved gently up and down upon it, said brush being immersed in the suds between each downward and upward movement.

Improved Washing Machine.

James H. Hill, Boone, Iowa.—This invention consists of a rectangular tub with corrugated or ribbed bottom and sides, mounted on trunnions at the sides on a suitable stand, so as to oscillate in its longitudinal plane, with several loose balls of wood placed in it on the clothes to act in conjunction with the water to effect the washing of the clothes. The tub is oscillated or swung on its trunnions by the attendant to cause the necessary motion of the water, balls, and clothes.

Improved Sewing Machine Power.

Alfred W. Cochran, Eufaula, Ala.—This invention consists of a sewing machine mounted on the operator's rocking chair, and having its pitman connected to the wall or other stationary object, so that, by rocking the chair, the pitman gives rotary motion to the driving wheel of the machine. The sewing machine table, divested of the stand ordinarily used, is mounted on the arms of the chair in front of the operator, and swings forward and backward in unison with him, so that no inconvenience in managing the work arises from the rocking motion. The pitman is, by preference, attached to the stationary support on the horizontal plane of the crank shaft; but it may vary from it either way to some extent without material effect. The crank shaft is arranged at the front of the chair and parallel with it.

Improved Means of Adjusting Paddle Floats.

Juan B. Baptista, New York city.—The novelty of this frame and arrangement of the paddles consists of the upper and lower parallel cross bars for supporting the paddles vertically between them, and the fastening of the paddles in them by keys, or other equivalent devices, driven or screwed in holes in the paddles above and below the cross bars, the paddles having several holes at different hights. By simply taking out the keys or bolts, shifting the paddles up or down, and putting said key or bolts in again, the paddles may be readily shifted to any required condition. Thus the paddles are adapted to be changed with special facility, as often as may be required, in the navigation of rivers, bays, and other water courses having numerous sand bars and other shallow places.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From September 22 to September 27, 1873, inclusive.

BOOT HEEL STIFFENER.—J. W. Hatch, Rochester, N. Y.
CAR WHEEL, ETC.—J. K. Sax, Pittston, Pa.
PEAT FUEL.—W. S. Tisdale, New York city.
PURIFYING SUGAR, ETC.—J. M. O. Tamin, New York city.
ROLLING STEEL AND IRON.—D. J. Morrell, Johnstown, Pa.
SILVERING MICA.— W. M. Marshall, Philadelphia, Pa.
SWITCH, ETC.—W. Wharton, Jr., Philadelphia, Pa.

Answers to Correspondents

S. R. should paint his iron fence according to the directions on p. 295, vol. 28.—R. R. R. should correspond with a boat builder.—A. D. B. will find the manufacture of collodion described on p. 171, vol. 28.—C. C. D. & Co. should write to the inventor, whose address we gave on p. 407, vol. 26.

I. N. P. asks: What does the word *bacteria* mean, and what is its origin? Answer: Bacteria are vegetable forms of life of the lowest order. They are mere points of organized matter, liable to appear in any solid or fluid substance containing vitalized matter. The Greek *bacteria* means a staff or support, but the etymology of the word as applied to organic life is unknown to us.

E. N. M. asks: 1. What meaning have the small capital letters placed on the four corners of the postage stamp of Great Britain? 2. How many volumes were there in your old series? 3. What is the difference between a sulphide and sulphate? Answers: 1. They are merely for the guidance of the engravers of the plates. 2. Fourteen. 3. A sulphate is a compound of sulphuric acid with a base: a sulphide is one of hydrosulphuric acid with a base.

C. H. G. asks: How can I make an elastic clear varnish? Can India rubber be dissolved in alcohol, and how? Answer: India rubber cannot be dissolved in alcohol. Its proper solvents are, ether, chloroform, or, better, bisulphide of carbon. An elastic varnish can be made by dissolving 1½ ozs. india rubber, cut as small as possible, in 1 pint of bisulphide of carbon.

S. P. & Co. ask: How can we deposit bright copper on unpolished cast iron by dipping? Answer: Use a solution of sulphate of copper 3½ ozs., sulphuric acid 3½ ozs., and water from 1 to 2 gallons. Small articles can be conveniently coated by jerking them about in sawdust or bran soaked in the above described solution.

P. S. asks: 1. How can I get hazel nut stains out of a linen shirt bosom? 2. Is there such a thing as a miner's compass? Answers: 1. Soak the spots with a strong solution of oxalic acid, and then throw the acid away, as it is a poison. 2. You can get a miner's compass at any optician's store. Very small samples of any substance can be sent by mail.

A. R. G. says: We are having some trouble in taking the oxide off sheet iron. We are working now with a lead tank, ¼ inch thick, placed in a wooden tank; but it continually leaks. We use the oil of vitriol and water heated by a jet of steam; but when we solder the cracks, it eats the solder off. Is there any other material that will do to make boxes? We have tried wooden boxes, but cannot keep them tight. What is the best process to take the oxide off sheet iron, so that it will answer for tinning and galvanizing? Answers: You are using a good material and process for removing the oxide from the surface of the iron. The trouble with the lead lined tank can be removed by burning or melting the edges of the sheet lead together by the blowpipe, instead of soldering. This is done in the erection of sulphuric acid chambers by men called "lead burners," with some one of whom you should communicate. There is consequently no necessity for casting so expensive a contrivance when ordinary sheet lead, enclosed in wood, can be made to answer.

N. O. A. asks: How can I tell gold from other metals? How can I ascertain the fineness of gold? Answers: Metallic gold can be almost invariably distinguished by an experienced eye by its rich yellow color. Touch it with a drop of strong nitric acid and notice whether any oxidation, effervescence, etc., takes place. If no effect is produced, the article may be considered as gold on the outside. This test is, of course, only a very partial one, as the gilded sham jewelry may withstand it. To ascertain the fineness of gold, that is, how much real gold there may be in or on a gilded metal or alloy, the specimen must be analyzed by a chemist. This can be done by dissolving the gold material in *aqua regia*, and afterwards precipitating the gold by a solution of protosulphate of iron (copperas). The precipitate (washed, dried and gently heated) is weighed as pure gold.

B. F. D. asks: Is there anything that will take the stain of nitrate of silver from the hands as well as cyanuret of potassa, and be less poisonous? Answer: Try a solution of the hyposulphite of lime, potash, or soda.

J. W. asks: How can I get rid of the unpleasant odor arising from new feathers? They have been thoroughly washed in hot water, sun aired, and well dried. Answer: Wash the feathers with a weak solution of carbonate of soda, or water to which a little solution of chloride of lime has been added, then rinse in clean water and dry thoroughly.

B. asks: Can you inform me what liquid Professor Tyndall used (in his lectures last winter) to blow his large soap bubbles with, and (2) how hydrogen soap bubbles are blown? Answers: 1. As far as we know, he used a very strong solution of hard soap. 2. Hydrogen bubbles are blown in the same way as air bubbles, hydrogen gas being delivered into the bowl of the pipe instead of air. Hydrogen is easily made by pouring dilute sulphuric acid upon scraps of zinc.

J. D. B. asks: How are transfer pictures put on, and what are the ingredients? Answer: Dissolve 2 ozs. glue, ½ lb. starch, 4 table spoonfuls glycerin in ½ gallon water. Put two coats of this on the paper to be printed, and then print in colors. Transfer the picture by damping the print, and then placing it on the object to be ornamented, the surface of which should be previously varnished.

R. B. B. asks: How can I dissolve isinglass? Answer: If you mean isinglass, a species of fine glue, it is soluble in water. If you mean mica, the transparent mineral used in stove doors, and which some people call isinglass, it is insoluble.

D. P. W. asks: Will discharging the exhaust steam into the chimney injure the same? Answer: Yes; eventually it will soften and disintegrate the bricks and mortar.

B. C. M. C. says: Please give best process for annealing small steel forgings, from ½ lb. to 10 lbs. in weight? Answer: Heat them in a muffle or sand, and allow them to cool slowly.

J. E. E. says: In your issue of October 11, page 225, under the heading of "Scientific and Practical Information," there is an account of the instantaneous lighting of the Jewish synagogue on Lexington avenue, New York city. Was the light produced by a preconceived plan? If so, please explain the *modus operandi*. Or was it involuntarily produced by the electrical influence upon the audience? Answer: It was produced by electrical influence upon small bits of platinum wire placed over the orifices of each gas burner. Series of these bits of platinum were connected by ordinary copper wires with a galvanic battery. On closing the circuit, the electricity passed through the wire and through the platinums, which, being very small, offered so much resistance to the passage of the electricity as to become heated white hot; and the gas, being at the same moment turned on, was instantly ignited.

W. A. says: It is a well known fact among practical men that no rule for width of belts is reliable, as no two rules give the same results. The greater the width of the belt, the greater is the error. If a 1 inch belt at a velocity of 750 feet per minute is right for a horse power, why do we not use a belt 50 inches wide to transmit 50 horse power? It seems that the experiments upon which the formulas have been obtained have been from small belts of single thickness. Practical results show that the power of a belt to transmit force is more nearly as the square of the breadth. "I will cite a few cases as examples, the pressure being taken in the cylinders: 1. Engine 8 x 12, pressure 70 lbs., 80 revolutions, with 5 feet driving pulley to 24 inch one on line shaft; belt 9 inches wide, of double thickness, and 41 feet long.

$$\frac{50{\cdot}26 \times 70 \times 160 \text{ feet} = 562912 \text{ foot pounds}}{\text{speed of belt } 15{\cdot}70 \times 80 = 1256 \text{ feet per minute}} = 448{\cdot}17 =$$

49·77 lbs. per inch of belt. 2. Engine 13 x 30, pressure 60 lbs., 62 revolutions, with 5 feet driving pulley and a heavy fly wheel, 15 inch double belt driving on to a 32 inch pulley on line shaft; distance between centers of pulleys, 17 feet.

$$\frac{132{\cdot}73 \times 60 \times 310 = 2468778 \text{ foot pounds}}{\text{speed of belt } 15{\cdot}70 \times 62 = 973{\cdot}40 \text{ feet per minute}} = 2536{\cdot}24$$

=169·08 lbs. per inch. 3. Results from an elevator strap 2½ inches wide, single belt, driving pulley 18 inches diameter, 124 revolutions; driving on to a 14 inch pulley without slipping; between centers of pulleys, 10 feet. Effect, 1000 lbs. raised 31 feet per minute. $\frac{31000 \text{ foot pounds}}{\text{speed of belt } 4{\cdot}712 \times 124} =$ 53·05=21·42 lbs. per inch. This weight was the utmost capacity of the belt, and more would cause it to run off. Many cases to the contrary, where bad judgment had made the results quite insignificant through the slipping of the belts, might be cited. Answer: In case proper constants are obtained by experiments with small belts, there seems to be no good reason that they should not apply to large ones. The driving power of a belt depends upon the friction between it and the surface of the pulley, which is proportional to the pressure or tension of the belt, and independent of the width. Hence, if we could make a belt one inch wide strong enough, it might transmit as much power as another belt 20 inches wide. The last example cited by our correspondent is a reliable one, giving observed results; and it is experiments of this kind which we would desire our readers to forward to us. The other examples, in which the power is calculated, do not seem to be so reliable. The calculations take no account of the back pressure in the cylinder, of the loss of pressure between the cylinder and boiler, of the expansion and cushion, if any, and of the friction of the moving parts. The judges at the Fair of the American Institute may have an opportunity to make tests of the value of pulley coverings in comparison with the ordinary method of transmitting power on smooth pulleys; and we hope that if they do investigate the matter, they will determine some rules that will be of value to the engineering community.

H. B. says: I commenced ferrotyping, but I get nothing but more or less foggy pictures. I am sure the fault lays in the nitrate bath. Whenever I make the bath, as soon as the silver dissolves in the water, it gets a milky appearance and gradually comes to a chestnut brown. If I leave it to stand for 24 hours it gets clear, and a brown precipitate forms. I use common well water, filtered through paper. Can you tell me what causes this brown precipitate in the nitrate silver solution? Answer: Your trouble is due to bad water. You should always use distilled water for a photo bath. You can easily make distilled water by placing a tin funnel over a water pot and boiling the water. The inner edge of the funnel should be turned up so as to form a ledge to catch the condensed water, and there should be a spout to lead off the drip. The steam that rises is condensed by contact with the funnel, runs down into the ledge and out at the spout. A common iron pot, used in the kitchen on the stove, will do.

J. G. asks: 1. What would be the best way to stop a leak in a gas pipe, where there is great expense incurred in getting at the leak? Is there any chemical composition that I can pump through the pipes to rust the leak up without injury to the pipes, as the leak is small but very troublesome? 2. Why does lightning sometimes tear and splinter trees from the ground upwards, and at other times downwards? Answers: 1. You might coat the interior of the pipe with hot coal tar, and then you could inject some rusting composition which would be drawn to the hole; after it had set, the remainder could be washed out. 2. It may be that in one case the tree is struck directly, and that in the other the stroke is communicated from the ground.

C. H. H. asks: Is there anything with which I can produce a white color on iron or brass, except by painting with ordinary white paint? Answer: You can apply a white enamel, such as you see in some iron pots. See page 149, volume XXVIII.

A. A. F. asks: 1. What makes it dangerous to load a cannon without thumbing it? What causes the powder to catch fire? 2. What particular properties have flint and steel, that fire is seen when they are brought together with quick rapid strokes? Answers: 1. The vent is closed to prevent the admission of air. 2. The friction between the two substances raises the particles that are broken off to a red heat.

W. & L. ask: What do you think of petroleum as an agency for the removal of scales from boilers? Would not an agent which is sufficiently powerful to remove or decompose a substance formed upon the flues and plates of the inside of a steam boiler also destroy the iron, as the scale is harder than iron? Petroleum possesses the property of removing the hardest scales in any steam boiler that I have yet seen. It has been brought into general use here in our locality, and more explosions have occurred here than ever before. Engineers are competent, water seemingly good, and our boiler iron has stood a tensile strain of sixty thousand pounds to the square inch. Answer: So far as we know, the petroleum does not injure the iron. It is quite possible that the boiler you speak of may have been much corroded, and that the removal of the scale revealed the defects.

C. H. S. asks: How can I make a dip for cleaning brass rough castings, so that they will look bright and retain their color when exposed to the weather? Answer: Brass, however highly polished, will not retain its bright surface long when exposed to the weather. We would therefore advise you to use a simple lacquer or varnish for the brass after it is well polished. This you can make by dissolving 8 ozs. of shellac in 1 quart of strong alcohol, and using the clear portion, applied by a fine brush on the polished brass. A good polish for brass is rottenstone made into a paste with sweet oil. You can give brass a fine color, by washing with a strong lye of red alum (1 oz. alum to 1 pint water), then rinsing with clean water, and finally finishing with fine tripoli.

J. A. asks: How many horse power have I in a stream of water with a fall of nine feet? Answer: You do not send enough data to enable us to answer this question. Probably if you communicate with water wheel manufacturers, you can obtain such information as you desire. Send them the hight of the water over the bottom of the opening, or the mean velocity with which it flows through the opening.

C. F. B. asks: How can I lay out a small bracket from a large one so as to have them both of the same pattern? Answer: You can do it by means of the pantagraph, described and illustrated on page 99, vol XXVIII.

K. F. asks: Can galena be roasted in the open air by staking, as the ordinary sulphurets are? Answer: We have never heard of the process of roasting galena being practiced. From the fact that galena melts before the blowpipe, owing to the large percentage of lead (85 per cent), if its roasting were attempted in the way indicated it would be apt to fuse and run together, thus defeating the object in view.

A. Q. N. asks: What course shall I pursue in order to become a civil engineer? What amount of education is requisite, and how can I get into the business? Can I teach myself drawing; if so, what are my best aids? Answer: It is possible for any young man with energy and talent, to educate himself, but of course there are many difficulties in the way. A good civil engineer must understand mathematics and the principles of natural philosophy; and there are many other things, which he can only acquire by experience. Try and get some position in the surveying party on a railroad, to make a start. Professor Warren's elementary works on drawing are well suited to those who wish to instruct themselves.

G. W. C. asks: 1. How can I melt brass and copper? 2. What kind of molds should be used? Will wooden ones do? Answers: 1. Use a crucible made of fire clay or black lead. 2. Molds can be made of sand or plaster of Paris. Wood will not answer.

W. asks: 1. Will you please give me a rule for finding the diameter of a wheel when the circumference is known, and *vice versa*? I have two arithmetics, one of which gives 3·14716 or $3\frac{1}{7}$ as the divisor or multiplicand, and the other, 3·1416. Which is right? 2. In making calculations for spur gear wheels, should I draw the circumference to the base of the teeth or calculate from the outer circumference? 3. In a process as that described on page 194, present volume, does the water evaporate or lose its bulk by expansion and condensation when there is no escape by leakage? 4. Will you name some good book that will aid me in making patterns for models? 5. Will you please tell where I can get the book that is to be issued monthly at the Patent Office? Answers: 1. The number 3·14159265 is the approximate value to be used. More commonly, we employ 3·1416, which is sufficiently correct for general operations. 2. Calculate the circumference at the pitch line, between the points mentioned. 3. The water evaporates, and has its bulk increased. The steam is then condensed, thus restoring the original bulk. 4. We do not know of any single work that will give you the desired information. 5. We suppose you refer to the weekly volume. This is not sold to private individuals.

C. C. T. asks: How far will a siphon draw water? Answer: The water will rise in a siphon to a hight due to the pressure of the atmosphere, or nearly to 34 feet.

L. H. asks: How can I construct a force pump? Does it make any difference whether I put the air chamber between the two check valves? I want it to lift water about 2 feet. I tried a ½ inch receiving valve and a ⅜ discharging valve. Answer: We get very little idea from your letter as to what you wish to accomplish. Place the air chamber beyond the delivery valve of the pump.

A. W. F. says: In your issue of August 23, 1873, on the "Manufacture of Oil of Vitriol," by J. F. Gesner, M. A., I find sulphuric acid described as $H_2\,SO_4$ and in another place as $SO_3\,H_2O$, and water as H_2O. My knowledge of chemistry would make the former $H\,SO_4$ or SO_3HO, and the latter HO. Please inform me which is the correct way. Answer: The writer of the article referred to has followed the best and most recent authorities. Chemists differ as to the symbolic notation of water, but whether we write it HO or H_2O, no difference is implied in the relative weights of the combining elements. When water is submitted to electrolysis, it is well known that hydrogen is given off at one pole and oxygen at the other. The relative weights of the gases thus evolved always remain the same, that is 8 parts by weight of oxygen are given off to 1 of hydrogen, 9 parts of water always yielding these proportions. But there are two volumes of hydrogen to one of oxygen, and the question is: Shall we regard these two volumes of hydrogen as 1 equivalent and the volume of oxygen also as 1, and regard water as a binary compound, or shall we call the 2 volumes of hydrogen, 2 equivalents, making equal volumes the equivalents of each element and regard water then as a ternary compound? Under the first supposition water is written HO, and under the second H_2O; but in H_2O, oxygen is regarded as having twice the atomic weight of the oxygen in HO, thus preserving the relative weights. Under this system the atomic weights of several other elements are also doubled, as those of carbon, sulphur, etc., hydrogen being taken as the standard.

H. H. T. asks: Are cast iron sectional boilers as safe as wrought iron boilers? Answer: In regard to sectional boilers a committee of the American Institute Fair, in 1871, made the following remarks: "Your committee feel confident that the introduction of this class of steam boilers, will do much toward the removal of the cause of that universal feeling of distrust that renders the presence of a steam boiler so objectionable in every locality. The difficulties in thoroughly inspecting these boilers, in regulating their action, and other faults of the class, are gradually being overcome, and the committee look forward with confidence to the time when their use will become general, to the exclusion of the older and more dangerous forms of boilers."

H. P. M. asks: 1. In building a chimney 75 feet in hight, which would create the most draft, one started at 2 feet square on the inside at the base, and spreading out to 3½ or 4 feet at the top, or one 2 feet square all the way up? What is the theory? 2. What is the best method of brightening up small castings in a mill? Answers: 1. Probably it would do better if made of the same size all the way up. 2. The castings may be dipped into sulphuric acid, and then placed in a revolving cylinder, or polished on a wheel.

W. S. asks: Which will sustain the greater weight, a solid stick of timber sawn 10 inches square and 30 feet long, with the ends resting upon blocks without any other support, or the same amount of timber in three separate pieces, each of 3⅓ inches in thickness, set up edgewise, side by side? If there is any difference, please give the principle. Answer: If all the sticks are of the same quality, the same amount of weight can be sustained in both cases.

F. E. P. says: In electroplating sewing machine attachments, I find it very difficult to deposit the silver on the solder at the joints. I have tried several dipping compounds, but with poor success. I have tried copper plating; but the copper will not stick firmly enough. Can you give me any information on the subject? Answer: To prepare your articles for plating: first boil them in a solution of caustic potash to free them from grease. Then dip quickly in red nitrous acid to remove any oxide from the surface, and afterwards wash well to remove every trace of acid. Then dip into a solution of mercuric cyanide of potassium (not too long), and afterwards wash in water as before. The amalgamation of the surface effected promotes the adhesion of the film of silver.

M. A. P. asks: What can I use to cement the joints of vitrified pipe for conveying strong acetic acid? Answer: Mix equal parts of pitch, resin, and well dried plaster of Paris. This is used for the masonry of chlorine chambers and vitriol works.

H. F. asks: Are there three rails used on the track of the Rigi railway? Answer: Yes, and the central rail is a rack into which a toothed wheel of the locomotive gears.

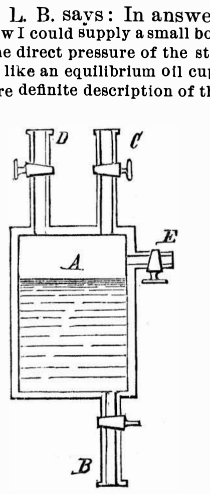
T. H. asks: What is an anemometer? Answer: The usual instrument for measuring the velocity of the wind is formed of two wires crossing at right angles, at each end of which is a cup-shaped vane, placed with its concave side to receive the current. A counter is employed to register the number of its rotations; and it must be nearly free from friction, or its indications will be valueless.

J. H. M. asks: Can you give me a recipe for staining butternut wood in imitation of black walnut? Answer: The following is highly recommended: Water 1 quart, washing soda 1½ ozs., Vandyke brown 2½ ozs., bichromate of potash ¼ oz. Boil for 10 minutes and apply with a brush.

L. C. asks: 1. What book contains the most accurate tables of the number of bricks required for walls and cisterns; the quantity of lime and sand for a certain number of bricks; the day's work for bricklayer; and the cubic yards to be excavated for a cistern, tank or cellar? 2. How is puddling for bottom of water reservoir made, and how thick should it be? Answer: We know of no book that can be relied on to give you this information. Consult a good mason, or builder. 2. Read our article on page 240, current volume.

U. T. K. asks: Can a low pressure single cylinder marine beam engine be worked with one cylinder head broken out? If it can, what course can be taken to form a vacuum in the condenser? Would it be necessary to take any buckets off the wheels? Answer: In King's work on the steam engine, page 98, this matter is referred to as follows: "Disconnect the steam and exhaust valves from the damaged end of the cylinder, if the engine be fitted with poppet valves, and let the atmospheric pressure force the piston in one direction, the steam being used for the opposite direction. Should the engine be fitted with a slide valve, close up the opening into the damaged end of the cylinder by fitting in, steam tight and in a substantial manner, a block of soft wood." In such a case, it would probably be necessary to remove some of the paddle floats, or to reef them.

T. L. B. says: In answer to my inquiry as to how I could supply a small boiler with water, you say: By the direct pressure of the steam, using an arrangement like an equilibrium oil cup. Will you please give a more definite description of the article? Answer: The appended sketch will probably enable you to understand the arrangement.



A is a vessel of suitable size, connected by a pipe, B, to the check valve of the boiler, by C to the steam space, and by D to the water supply—each of these pipes having a cock or valve, so that it can be closed at pleasure. E is an escape pipe and valve, opening into the air. The operation is as follows: Close valves in pipes B and C, and open those in pipes D and E. The water will then run into the vessel A. When it is full, close valves in pipes D and E, and open valves in pipes B and C. The vessel A being above the boiler, the water will run into the boiler, as the steam pressure on top of the water in A is the same as the pressure on top of the water in the boiler.

H. C. P. asks: What weight will a flat bottomed boat, with perpendicular sides, 16 feet long x 3 feet wide x 14 inches, carry? The weight of the boat is 200 lbs. How much weight will it carry when drawing 6, 8 and 10 inches of water respectively? Can you give me a formula for it? Answer: You do not send enough dimensions to enable us to make the calculations, but we will give you the method and you can apply it. Find the area of the bottom of the boat, in square feet. Suppose that it is A square feet. Then the boat, when drawing 6, 8 and 10 inches of water, respectively, will carry the following loads: When drawing 6 inches, $A\times\frac{6}{12}\times 62\cdot5-200$. When drawing 8 inches, $A\times\frac{8}{12}\times 62\cdot5-200$. When drawing 10 inches, $A\times\frac{10}{12}\times 62\cdot5-200$.

G. S. T. asks: Will sulphur water affect a boiler injuriously, and to what extent? Is there any way of counteracting its effect, or of purifying the water? Answer; We do not think the sulphur water will injure your boiler; and we do not know of any method you can employ, to purify the water, that is sufficiently practicable for general use.

A. B. asks: How can I dissolve rubber so as to mold it into any required form? Answer: Immerse the rubber in a mixture of bisulphuret of carbon 95 parts, and rectified spirit 5 parts, until it swells into a pasty mass. It may then be molded into any desired form.

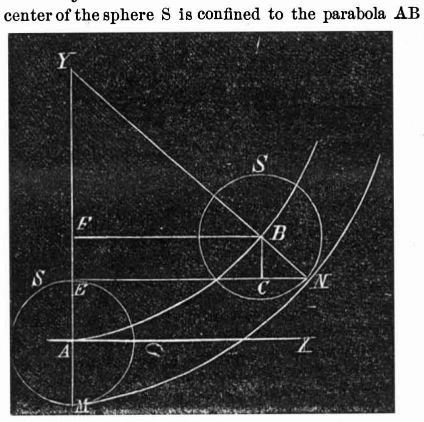
H. J. W. says: 1. Are the fumes from hot aniline dyes injurious? 2. Where can I find some account of the manner of preparing aniline colors? 3. I want small steel wire in the coil, cut into lengths of three inches; what is an ordinary and cheap process for straightening the latter? Answers: 1. We think not. 2. Reimann's work on "Aniline and its Derivatives," will give you the desired information. 3 Draw the pieces through an opening in which they bear at three points. Such an arrangement can readily be made with three nails.

E. A. P. asks: 1. Is there any known law by which to determine the amount of pressure per square inch required to compress common atmosphere to any desired volume: that is, to reduce two volumes to one, three to one, etc.? Answer: Mariottes law is: The temperature remaining the same, the volume of a given quantity of gas is inversely as the pressure which it bears. Therefore a pressure of two atmospheres will reduce the volume to one half, of three to one third, etc.

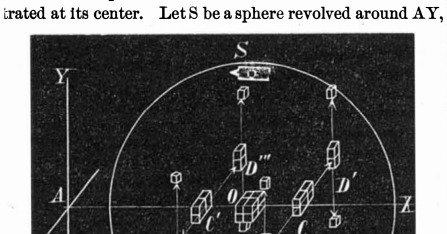
J. M. B. says, in reply to R. A. C., page 27, current volume: "I have made an entire destruction of willow swamps by chopping the trees around at any convenient hight, and stripping the bark to the ground and letting it remain; when the sap is in flow, in July or August, is as good time as any. Do not chop them down for a year or two. 4. A certain cure for nose bleeding is to extend the arm perpendicularly against a wall or post or any convenient object for a support. The arm on the side from which the blood proceeds is the one to elevate."

C. A. D. says: C. M. N. can precipitate nitrate of silver and sal ammoniac by adding to a solution of the former salt a solution of chloride of sodium or hydrochloric acid, which immediately precipitates the silver as a white flocculent precipitate, the new compound being, in the language of the chemist, Ag Cl (chloride of silver). Sal ammoniac can be precipitated by bichloride of platinum; the precipitate is of a light yellow color. These are also characteristic tests for the above named salts.

J. B. W. says: C. H. A. (page 87 of your current volume) can find the solution of his problem in Smith's "Mechanics." Of course the surface of the revolved fluid may be replaced by a rigid paraboloid, and a material particle without friction will remain at rest upon any part of the surface. The case of a ball rolling on a surface is, however, different. I will assume (and afterward prove) that the centrifugal force generated by a revolving ball is the same as if the mass were concentrated at the center of the ball. This true, the ball will be at rest when its center is confined to a parabola, whose equation, referred to the axis of revolution and a tangent at the vertex, as the axis of x and y, is $x^2=\frac{2g}{w^2}y$, where g = force of gravity = 32′ +, w = no. of feet per second passed over by a point one foot from the axis, x = the abscissa and y the ordinate of the curve: *Proposition:* If the center of the sphere S is confined to the parabola AB

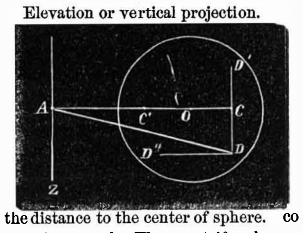


by means of the curve MN, on which the sphere rolls, the curve M N is not a parabola. Let F be the focus of the parabola and draw F B its semi-principal parameter. Draw also NBY, a normal. From the nature of the parabola, we shall there have: FB = 2FA and angle NYM = 45°. When the sphere has its center at B, the resultant pressure of the centrifugal force and gravity is in the direction BN; BN is therefore a normal not only to the parabola but also to the curve MN. But the curve at N being perpendicular to the normal, it makes an angle of 45° with YM, ∴ if it is a parabola, NE, perpendicular to YM, must be its semi-principal parameter, and E, its focus; and we must have EN=2EM. But $EN = EC + CN = EC + \frac{1}{2}\sqrt{2}\,BN = FB + \frac{1}{2}\sqrt{2}\,AM$, and $2\,EM = 2(FA - FE + AM) = 2(FA - \frac{1}{2}\sqrt{2}\,AM + AM) = 2FA + 2AM - \sqrt{2}\,AM$ ∴ $FB + \frac{1}{2}\sqrt{2}\,AM = 2FA + 2AM - \sqrt{2}\,AM$. But FB = 2FA. Substituting, $\frac{1}{2}\sqrt{2}\,AM = 2AM - \sqrt{2}\,AM$. Dividing by $\sqrt{2}\,AM$, we have $\frac{1}{2} = \sqrt{2} - 1$, or $1\frac{1}{2} = \sqrt{2}$, which is not true. ∴ MN is not a parabola. *Proposition:* The centrifugal pressure of a revolved sphere is the same as if its mass were concentrated at its center. Let S be a sphere revolved around AY,



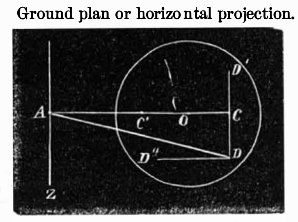
and consider 8 particles at its center. Let OA be the distance to the axis. Remove 4 of the particles to C and 4 to C′, so that AC – AO=AO – AC′. Then place 2 each at D D′ D″ D‴, equally distant in front and behind AX. Finally separate each pair by raising one particle and lowering the other a certain distance. We have now taken the 8 particles from the center and placed them in correct position in the sphere, and as this figure is symmetrical with respect to a line parallel to A Y through its center, all the particles, supposed to be concentrated at the center, may be removed by 8s and placed in position to make a homogeneous sphere. We will now show that such a change produces no change in the centrifugal pressure. Let a be the weight of a particle,

Elevation or vertical projection.



cle, ao=b, the distance to the center of sphere. co = c′o = c, the distance of removal. Then centrifugal pressure of 8 particles at the center will be $8w^2b\frac{a}{g}$, of 4 at c it will be $4w^2(b+c)\frac{a}{g}$, and of 4 at c′ it will be $4w^2(b-c)\frac{a}{g}$. Adding these, we have, for the 8 particles after removal Centrifugal pressure $= P_c = 4w^2\frac{a}{g}(b+c+b-c) = 8w^2b\frac{a}{g}$, the same as when they were at the center. Taking now a ground plan and letting cd = cd′ = d, also ad = e, we have,

Ground plan or horizontal projection.



for the centrifugal pressure of 2 particles at d: $P'_c = 2w^2e\frac{a}{g}$, but this pressure is in the direction ad, and we must resolve it into 2 parts, one in the direction cd, which will be destroyed by the opposite component of the pressure produced by the 2 particles at d′, and the other in the direction d″d, which, combined with the corresponding component of d′, will result in a pressure in the direction ac, the same as if the particles were at c. Resolving, we have for the pressure in d″d: $p''_c = 2w^2e\frac{a}{g}\cos. cad = 2w^2e\frac{a}{g}\frac{b+c}{e} = 2w^2(b+c)\frac{a}{g}$; and as there are 2 pairs of particles the whole pressure is $P'''_c = 4a^2(p+c)\frac{a}{g}$, the same as if the 4 particles were at c. Lastly, it is evident that there can be no change of centrifugal pressure produced by moving the particles parallel to the axis, and therefore the pairs may be separated in this manner. Therefore the particles being moved from the center of the sphere into position in its body, no change is produced in centrifugal pressure.

P. K. D. says, in answer to C. C.'s query as to press power: I would suggest that to give the amount of pressure exerted against W, it will be necessary to know the distance from B to the center of track roller. If the power was applied at the center of the track roller, then the amount would be obtained thus: Divide the length of lever E (measuring from center) by the distance from center of track roller c to a perpendicular line drawn from the point of lever attachment (to W) to the track. Multiply this by 8 (the power obtained by the line) and the result thus obtained by the 1600 lbs. This will give about 75024 lbs. Now to solve the problem given: Diminish this result in proportion to the distance that B is moved up the lever from center of track roller.

F. A. W. says, in reply to P. T.'s query as to the consumption of water by engines in cold as compared with that in hot weather: A few years ago three boilers were situated on the higher floor of a building, and were heated by gas that would otherwise escape. This gas was admitted to the boilers and regulated by means of sliding gates. The speed of the blowing cylinders was governed of course by the velocity of the engine, and the latter by an ordinary governor; but this not being sufficiently accurate, it was necessary to throttle the engine to drive it at the required number of revolutions per minute. Much practice enabled us to admit just sufficient gas to the boilers to maintain a pressure of 60 lbs. with hardly the variation of a pound in a week, and sometimes in a longer period. Nearly a year of such experience showed us that, in cold, damp weather, it was necessary to admit more gas, and in warm, pleasant weather to admit less. Of course, difference in charging would make a change in the quantity and quality of the gas, and perhaps augment the resistance of the air that was being forced into the furnace; but a long continued series of experiments, such as we were obliged to make, eventually established the fact. The boilers were supplied with a constant stream of water, regulated arbitrarily by a cock, and so accurately as not to require moving sometimes for days together. "I do not apprehend that the cold damp weather had any appreciable effect in requiring the admission of more heat to the boilers, except by the increased condensation of steam, which was not more than in ordinary engines. This same condensation will undoubtedly account for the difference, if there is any, between the effect of steam and air in a locomotive."

D. M. says, in answer to the question proposed by C. H. A. (page 187, vol. XXIX): Let there be a system of rectangular axes, having c for their origin, b c being the axis of X. Since the number of revolutions of the ball a is constant, a line equal to its distance from the axis of X and perpendicular to the same axis, may be taken to represent the centrifugal force, the force of gravitation being represented by a constant line parallel to the axis of Y, and which I denominate by g. Therefore at any point, x′ y′, of the curve, the resultant of the two forces will pass through the point, x′y′, and also through a point whose equations are x=x′ –g, and y=2y′. Therefore the equation to the resultant is $y-y'=-\frac{y'}{g}(x-x')$ which is evidently the equation to the normal of a parabola having 2g for its parameter. (See Davies' "Analytical Geometry.")

G. W. says, in reply to H. H. J., who asked as to making a combined reaper and thresher: It cannot be done. At the time grain ought to be cut, it is not dry enough to thresh; and if left standing until it is dry enough to thresh, it will shell out so as to lose half the crop, especially if the grain be oats. It was this which made useless a harvester in the western states. It cut the heads off and left the straw standing; the heads were to be stored in cribs or bins, like corn. But the heads proved to contain so much moisture as to cause mold and rot.

W. W. H. says, in answer to T. M. Jr., who asks how to preserve grapes in the bunch, fresh as when taken from the vines: When the grapes are fully ripe, clip the bunches from the vines carefully, and get a water tight keg or box. Place in the bottom of the box a layer of dried grape leaves, half an inch thick, then layers of grapes and leaves alternately until the vessel is filled; nail a board on top, and bury the vessel in the ground, where water will not stand, out of reach of frost. Grapes put up in this way will keep fresh and sound until April.

J. W. H. says, in reply to C. P. T., who wants a heavy foam on a tonic beer: Use the whites of a dozen or more eggs in a 10 gallon keg.

J. M. B. says: "I think the blistering of varnished cement tiles, which D. U. B. complains of on page 171, current volume, is caused by the expansion of the moisture contained in them when varnished. A remedy would be to drive the moisture out."

COMMUNICATIONS RECEIVED.

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

On the Million Dollar Telescope. By W.M.R.
On Canal Navigation. By T. K.
On Hatching Eggs. By B. F. S.
On Spectroscopic Manipulation. By C. A. D
On Perpetual Motion Seekers. By F.
On Financial Science. By J. E. E.

Also enquiries from the following:
H. C. B.—C. G. T.—M. W. K.—A. V. L.—J. N. P.—G. M.—J. W. S.—W. H. B.

Correspondents in different parts of the country ask Where can I get a cross-cut saw for getting out trunks of large trees? Where can I obtain cotton seed oil machinery? Who makes shoe peg machinery, and what does it cost? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

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September 30, 1873,

AND EACH BEARING THAT DATE.

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APPLICATIONS FOR EXTENSIONS.

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

26,674.—Clothes Dryer.—B. B. Hawse. Dec. 17.
26,689.—Pivot Bearing.—F. C. Lowthrop. Dec. 17.
26,785.—Waste Cock.—G. W. Robertson. Dec. 24.
26,803.—Boots, etc.—F. D. Ballou. Dec. 24.
27,455.—Spring Covering Machine.—J. T. Loft. Feb. 25.

EXTENSIONS GRANTED.

25,640.—Steam Boiler.—J. Harrison, Jr.
25,662.—Construction of Prisons.—E. May.
25,673.—Lasting Boots, etc.—J. Purinton, Jr.
25,683.—Hydrant.—C. L. Stacy.
25,692.—Sewing Machine.—K. Vogel.
25,701.—Skeleton Skirt.—J. Draper.

DISCLAIMER.

25,693.—Lasting Boots, etc.—J. Purinton, Jr.

DESIGNS PATENTED.

6,895.—Call Bell.—C. S. Barnard *et al.*, W. Meriden, Conn.
6,896.—Boot Jack.—O. F. Fogelstrand, Kensington, Conn.
6,897.—Lamp Shade.—W. Maevers, New York city.
6,898.—Tea Pot Base.—E. B. Manning, Middletown, Ct.
6,899.—Lamp Foot.—N. L. Bradley, West Meriden, Conn.

TRADE MARKS REGISTERED

1,473.—Windmill.—Atwood *et al.*, San Francisco, Cal.
1,474.—Packed Oysters, etc.—Barnes & Co., Balt., Md.
1,475 & 1,476.—Fertilizers.—G. Dugdale & Co., Balt., Md.
1,477.—Ague Cure.—H. Van Kiper *et al.*, New York city.
1,478.—Prepared Fish.—Dodd & Co., Gloucester, Mass.
1,479.—Brandies.—M. Doherty & Co., Boston, Mass.
1,480.—Cheese.—Webb & Co., New York city.

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VALUE OF PATENTS

And How to Obtain Them.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

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HOW TO OBTAIN *Patents*

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them: they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to Munn & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to Munn & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

To Make an Application for a Patent,

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of Munn & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000, and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, when business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address Munn & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

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On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

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

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

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

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Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing Munn & Co. 37 Park Row, New York.

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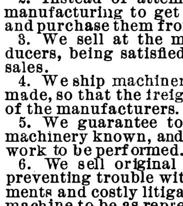

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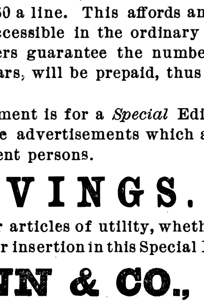

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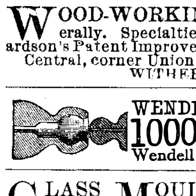

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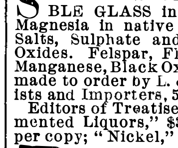

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