SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXIII.—No. 18. (NEW SERIES.) | NEW YORK, OCTOBER 30 1875. | $3.20 per Annum. (POSTAGE PREPAID.)

MODERN BRITISH LOCOMOTIVES.

Although railway gages are no wider than they were, and consequently the space at the disposal of locomotive builders is limited, there is a continual progress being made in the efficiency of the locomotive engine. The machine itself is so complicated that the proper proportions of many of its parts are still matters of experiment; and many engines have been built especially to attain a maximum result, only to reveal on trial that the weight is improperly distributed on the wheels, or that the springs are ineffective on heavy grades or around sharp curves.

In England, the progress of locomotive building is noticeable on several grounds. The Great Western Railway, Brunel's masterpiece, with its 7 foot gage, for many years has possessed engines which no narrow (4 feet 8½ inches) gage railway could hope to rival. In their boilers, nearly 2,000 square feet of heating surface gave a tremendous steam-making capacity; and the admirable proportions of the whole engine, and the concentration of the heavier parts around and above the center of gravity, made them remarkable for steadiness, even at a speed of 60 miles an hour, the usual rate of travel on Great Western express trains, and their economy in fuel and repairs has yet to be surpassed. But the numerous connections with narrow gage lines have at last made the broad gage a serious disadvantage to this line; and its conversion into one of the ordinary dimensions will before long be completed.

In the meantime, the narrow gage engine is being improved till it seems fairly in the way to become as big and as powerful as the width of the track will let it. The London and Brighton Railway, a line with a very heavy passenger traffic, has made much advance in this direction, under the guidance of Mr. W. Stroudley, the company's locomotive engineer, and we give herewith an engraving, showing in section his latest work; it is an engine named the Grosvenor, which possesses many points of interest, and which has already performed some notable feats.

The first thing in the representation of this engine that strikes the critical observer is the large heating surface. The firebox is of unusual dimensions, the outside shell being 72½ inches by 46, and the inside 66 by 40½ by 71. The diameter of the boiler is 53 inches, and the tubes are 206 in number, and of 1¾ inches outside diameter. The tubes are distributed nearly all over the cross section of the boiler, giving a high water level; and dryness of steam is insured by use of a steam dome. The cylinders are inside, giving the engine the additional steadiness imparted by concentrating the weight; their dimensions are 17 by 24 inches, and they are supplied by ample steam pipes, 3 inches in diameter. The slide valves travel 4 inches, and give ⅛ inch lead with a maximum travel, the outside lap under the same circumstances being ⅞ inch. The driving wheels are 6 feet 9 inches in diameter, and the leading and trailing wheels, 4 feet 6 inches. The two latter pairs of wheels have leaf springs, 3 feet 6 inches by 5 inches wide; while the driving wheels have volute springs, as shown, which are, perhaps, the one feature in the design which is open to criticism. The weight on these springs is no less than 14 tuns, and this pressure must tell on the springs, rendering them very liable to set under so heavy a load; and the excellent devices for tightening them up can only defer the time when they will go to the scrap heap. The total weight of the engine is 33 tuns.

The tender is of unusual dimensions, to allow of long runs without stopping for water; it will hold 2,520 gallons, and has a warming apparatus of 153 square feet of heating surface, so that cold water need never be pumped into the boiler. The tender runs on 3 pairs of wheels, and weighs 15 tuns 6 cwt.

It will be predicted that this engine has a great power of making steam, and of keeping up the supply; and this surmise has been verified by feats actually performed. The Grosvenor recently took a special train from Portsmouth to London, 87 miles, in 1 hour 50 minutes, the average speed being 48 miles an hour. But a still greater proof of the staying power—to borrow a term from the race course—of the engine was a run from London to Brighton, 50½ miles, in 1 hour 10 minutes, with 22 railway carriages in the train. This last will be regarded as an extraordinary speed with such a load, especially when it is remembered that the railway is troubled with many long and heavy grades.

An invention of Mr. Stroudley's calls for special mention. It is a speed indicator, consisting of a fan with straight arms, revolving in a brass casing and sending water up a copper pipe which terminates in a glass gage tube. The hight at which the water stands shows the speed at which the engine is traveling. It certainly is a convenient appliance, and is said to be exceedingly accurate.

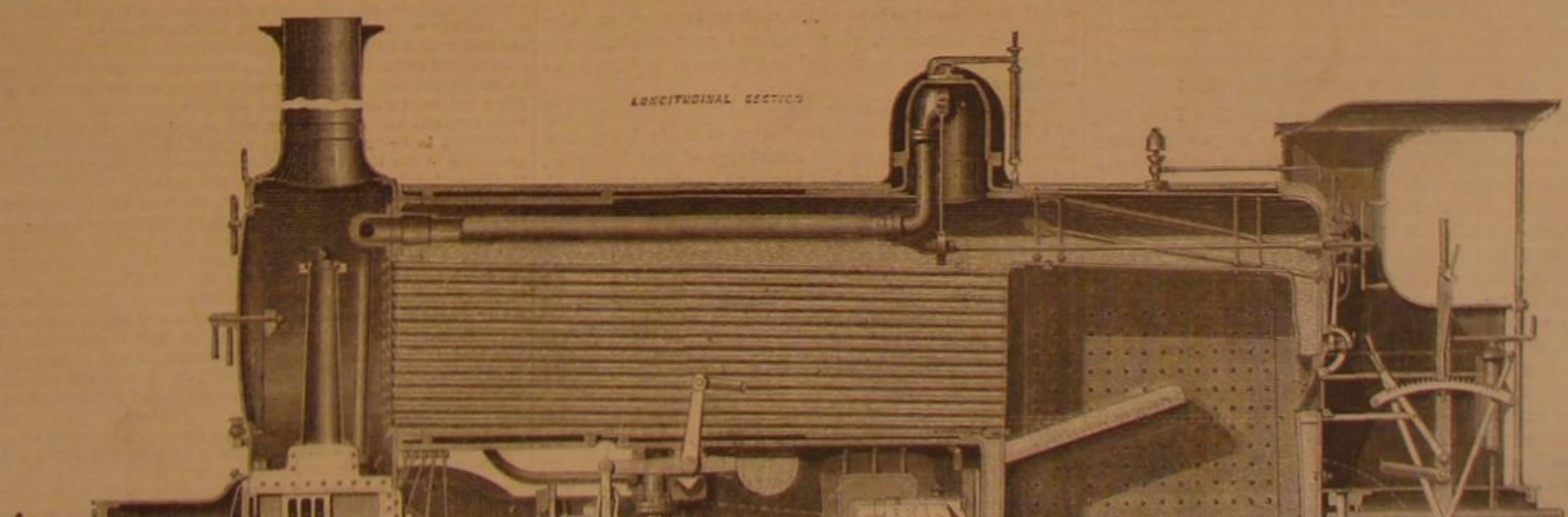
The National Tube Works Company has just been awarded a gold medal by the Mechanics' Institute Fair, San Francisco, Cal., for the merits of their patent enamel water pipe. Their address can be found in our advertising columns.

A Skillfully Executed Job.

A new and interesting experiment in house-moving was performed in this city, not long ago, at No. 116 West Twenty-fourth street, in the presence of a number of prominent builders and inspectors. About a month ago the Society St. Crescent de Paul determined to build on the vacant lots in rear of their Twenty-third street building. A survey of the land being made, it was discovered that the wall of the five-story brick livery stable adjoining, occupied by S. C. Mott, encroached eighteen inches on their property. The owner was notified to remove the wall to the eastward, and Weeks and Brothers, builders, were authorized to tear it down and rebuild. Mr. Weeks did not like to pull down the wall, and hit upon a plan for moving it bodily.

Ten yellow pine timbers, 12 by 12 inches, planed on the upper surface, were let in horizontally under the wall, at equal distance, just above the foundation, and at right angles to its face. "Needles," builders call them. The upper surface of each needle was profusely greased, and a smaller needle, planed surface down, inserted along each larger one. Spur braces fixed at the foot in these upper timbers held the wall plumb. The jack screws, working horizontally, were set at the ends, on one side of the ten upper needles. This being done, an eighteen inch slit was taken off vertically from the stable building just inside the wall. At 7 o'clock in the morning, says the New York *World*, a man at each jack screw began to work it, and the wall moved an inch safely. "Go on!" said the boss, with some little excitement, and this time one of the ten men did not work his rack as much as the rest. The overseers were a little nervous at this, but the wall carried the lazy needle along with the rest. By 10 o'clock the 4,900 square feet of wall were pushed up tight against the open side of the stable, and the whole was perfectly plumb and unshaken. The men in the stable pursued their usual avocations during this performance, which attracted a crowd of interested spectators.

According to Dr. Schuller of London, the bad effects of chloroform on the *pia mater* are neutralized by nitrate of amyl. This substance, it is stated, even in cases of complete anæsthesia, arrests suffocation, reëstablishes normal respiration, and allows the pulse to regain its vigor. This, if demonstrated beyond doubt by further necessary investigations, will be an important discovery, since it tends to neutralize the serious danger which now in many instances attends the use of chloroform.



A MODERN BRITISH LOCOMOTIVE.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year, postage included.......................$3 20

One copy, six months, postage included..................... 1 60

Club Rates.

Ten copies, one year, each $2 70, postage included..........$27 00

Over ten copies, same rate each, postage included........... 2 70

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VOLUME XXXIII., No. 18. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, OCTOBER 30, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

IS OUR TORPEDO SYSTEM USELESS?

An editorial has recently appeared in the New York *Sun*, advocating the abolition of the engineer corps of the army on the ground that that arm of the service is no longer useful. Referring more particularly to the Government torpedo station at Willett's Point, on the Narrows of Long Island Sound, where a school of instruction in the manufacture and use of torpedoes for the army engineers has been for some time past established, the *Sun* considers that the same is of no value to the country, mainly on account of the defects known to exist in fixed submarine torpedoes, which class of weapon the *Sun* seems to believe is the only one made the object of military study. Our contemporary fortifies its arguments, which are directed against the entire torpedo system, by extracts from a report of Admiral Porter, in which that officer suggests several points in which he deems the submarine mine to be deficient.

It is well known, to all who have watched the remarkable progress which, during the last few years, has been made in torpedo science, that of all types the planted torpedo is probably the weakest. Unless a vessel comes within a destructive range, which experiment has proved to be quite contracted, no injury would result; and there are besides the other disadvantages of the concussion of one submarine mine blowing up the others, and of possible deterioration of the explosive material through long immersion. These facts are set forth by Admiral Porter, and are true enough; but on other hand it should be remembered that in themselves they constitute problems capable of solution, and because they exist now is the strongest possible reason why the engineers should continue the experiments already begun with that object. Again, the *Sun* and the Admiral place much stress on the failure of submarine torpedoes during the war. It should be remembered, however, that such torpedoes (with the exception of a few attempts made by the Russians during the Crimean war) were the first ever employed, and were of the crudest imaginable construction. Nitro-glycerin never entered into their composition, and seldom gun cotton; and very frequently they were merely tin cans or kegs of powder rigged with a percussion fuse to blow up on impact with the vessel, or some equally imperfect arrangement, to be fired by a friction tube attached to a cord from the land, and which, if left under water for months, might easily become harmless. They are certainly not to be compared for an instant with such submarine torpedoes as were used in the recent Oberon experiments in England, to explode which electrically worked devices were employed, which not only enabled the operator to blow up the sunken mine, but also exactly indicated when a vessel had arrived within the destructive area of the torpedo.

We think, therefore, that, even if the engineers devoted themselves to nothing but submarine mines, which is not the case, the continued existence of the corps would be an advantage to the country. The fact is, however, that the engineers study not only the system of fixed but that of movable torpedoes; and that the latter constitute the vastly more effective branch, the *Sun* fails to consider. To every one inventor who is giving his attention to the fixed torpedo, a dozen are devoting their energies to the movable types, and the movable torpedoes are those which will play the prominent part in future conflicts. We have already noted the remarkable success which has attended the experiments upon the Lay and Ericsson boats, which can be directed into the midst of an enemy's fleet when the latter is miles away from shore, and be made to blow up the strongest vessels without those on board having the slightest indication of their presence. There are the spar torpedo launches, now built in England, of steel, and capable of steaming at the rate of 18 knots per hour. Half a dozen of these swift craft, each provided with a heavy torpedo, could on a foggy night run in among a fleet of vessels, and each sink or shatter its victim before the crews could get to their guns. The heaviest cannon would be of little use against rapidly moving objects which could noiselessly steam inside of point blank range before fairly discovered by the lookouts.

Our readers are sufficiently posted in the progress made in torpedo science not to require any review of what has been accomplished at Newport, the work at which station is well supplemented by that at Willett's Point. Both schools have acquired a high reputation abroad, and the abolition of either would be, we think, a loss which the country can ill afford to incur.

THE COLLEGES AND THE HARD TIMES.

No one will deny that money is "tight" at the present time. Nine men out of every ten we meet exclaim: "Oh, I can't get any money." At this time it would be well to remember the principle embraced in the famous reply of that sturdy old New Englander, who said that, among the rocks where they could raise nothing else, they built schoolhouses to raise men. When you cannot find work for the hands, set your brains at work. If you cannot labor, study. If the counting houses, the woolen mills, the machine shops, even the railways, will not open their doors to your sons, there are plenty of educational mills where they will be thrice welcome. Every trade seems overstocked with men just now; but he who lays a sound foundation at any technical or scientific school during his enforced vacation will be the better prepared to profit by the revival of trade and manufacture when it does come, as come it must and will in due time. The machinist who has mastered the higher mathematics, or acquired skill and facility in the use of his pencil, is prepared to take a high rank as inventor, superintendent, or proprietor, when time and practice shall have rendered him equally skillful in the use of tools and the working of metals.

We met a gentleman recently who had taken up the study of a foreign tongue in order the better to study his profession. To-day, he tells us, the knowledge of that language, taken up only as a means, has become a source of profit almost equal to that which had been his main object of study. Many are the cases we have met where some subject, pursued at odd times as recreation, has become a source of honor, if not of glory. Dr. Priestly, the discoverer of oxygen gas, was a theologian, and chemistry was his pastime; but chemists honor his memory and celebrate his achievements, while his name has long since passed from the notice of the theologians, or is mentioned only with disrespect and disgust.

It is a gratifying fact to notice that the attendance at all our principal institutions of learning is larger this year than ever before; new colleges are being opened, old ones are generally full; salaries and appropriations are raised, new chairs are endowed, and general educational prospects are bright and encouraging.

THE LOCOMOTIVE SEMI-CENTENNIAL.

On the 27th of September, 1825, the first railroad for conveying passengers was opened in England between the towns of Darlington and Stockton. The occasion brought together a throng of witnesses, some doubtful, more scornful, and all perhaps better prepared to scoff at the failure, which it was confidently predicted awaited the bold inventor in his daring attempt to make vehicles travel at the unprecedented rate of fifteen miles an hour, than to congratulate him upon the triumph which upset their theories and left them questioning the reliability of their senses. It is suggestive to contrast this unbelieving assemblage with the gigantic gathering which has enthusiastically celebrated the day which marks the lapse of the half century since that victory over prejudice and ignorance was gained. Sooty Darlington, opportunely washed by recent heavy rains, donned her gayest garb. Flags and banners flaunted from every building, triumphal arches spanned the streets, processions paraded, the railway magnates and notabilities congregated at a great banquet, and a peer of the realm unveiled a statue of Joseph Pease, the philanthropist and capitalist, in whose open purse George Stephenson found the staunch material support which enabled him to prosecute his labors to their successful end. On the following day, the festivities were continued in adjacent towns, and so, for forty-eight hours, the jubilee existed.

In Darlington, the locomotive which drew the first passenger train was exhibited actually at work. It was propped up so as to be just clear of the rails; and being held in a stationary position, its wheels revolved at their utmost speed, which would have carried the engine along at its old maximum rate of eight miles per hour. The weight of the machine is but six tuns, twenty-five tuns less than that of the magnificent engines which English workshops now produce. The contrast between the two (of which next week, when we publish the engravings of both, our readers will have an opportunity to judge) is as proportionally great as that between the knot of unbelievers of 1825 and the cheering crowds of the recent festival.

Stephenson, it may be remembered, was born at Wylam-on-Tyne, and it was there in 1813 that a locomotive called the "Puffing Billy" was built, under William Headley's patent, for Christopher Blackett, Esq., the then proprietor of the collieries. The machine was used to drag coal long before Stephenson constructed his railway engines. Probably it was from this crude old apparatus (which, after working at Wylam continuously from the year above mentioned up to 1862, was removed to its present resting place in the Patent Office Museum in London) that Stephenson gained some of the ideas which he subsequently developed. Puffing Billy has, however, another and greater claim upon popular notice, one especially interesting in these later days, when railroad litigation has become so vast and extended that a new code of laws has sprung up for its government, and that is that it was the subject of the first legal controversy engendered by the railway. The question of nuisance, on which the difficulty was based, became afterwards the ground for many of the most absurd objections to Stephenson's proposed use of the locomotive for passenger transportation. "The smoke and dirt will annoy everybody on the line," "the noise of the machine will scare cows so badly that their lacteal functions will be arrested," "if cows get on the track, how will the engine get out of the way?" are specimens of this cavilling, familiar to every one who has perused Stephenson's eventful biography. The smoke nuisance seems to be the trouble in this earliest dispute, and the opinion of the counsel learned in the law, who was appealed to in the matter, we give below. It is a curious contribution to the history of the railroad, and we are indebted for it to a London correspondent, who copied it from the original manuscript now hanging framed beside the old engine.

9th July, 1814.

CASE RESPECTING THE USE OF A STEAM ENGINE FOR CONVEYING COAL.

FEE FOR MR. WILLIAMSON'S OPINION, 1 GUINEA.

BAINBRIDGE:

CASE.

Mr. Blackett is Proprietor of a coal mine at Wylam in Northumberland and for the purpose of sending his coal to Lemington he took Wayleaves on various Estates between there and Wylam, especially over the estates of A, for a term of years not yet expired whereby a demise of a sufficient and convenient Wayleave Liberty and Passage to and for Mr. Blackett his Executors Administrators and assigns and his and their Agents Servants and Workmen from time to time and at all times during the continuance of said demise to take leave and carry away with horses carts waggons or any other carriages whatever all and every or any of the coals to be won, wrought and gotten forth and out of the said colliery and coal mines in through over and along the lands and closes of A, according to the line of way therein described under the yearly certain and contingent rents therein mentioned.

When the Wayleave was granted Mr. Blackett led his coal by the ordinary coal waggons drawn by horses; but his agent has recently discovered an Invention to them by a Steam Engine instead of horses and for that purpose he obtained his Majesty's Letters Patent as a reward for his ingenuity and the Steam Engine is now actually at work. In the operation a little noise and Smoke is certainly made, which A. considers a nuisance and has requested Mr. Blackett to suspend the use of it. Mr. Blackett is extremely anxious of being on good terms with his Landlord and is inclined to yield to his wishes so far he consistently can, but in the first place he is desirous of having the Question of right and wrong established between them.

The Patent in Question is granted for the express purpose of enabling the Patentee to carry the waggon by means of a Steam Engine instead of Horses, and it is rather improbable that Government would License a thing the use whereof could be deemed a nuisance; and in a Mining Country like this Every Encouragement should be given to the Ingenuity of Mankind in all things that tend to decrease the Expence of Labor.

In consequence of the Waggon way being made, the county road has in many places been lain close to and contiguous with the Waggon way and it is alleged that the Steam and Smoke will frighten the Horses passing and repassing and render traveling unsafe. However in many places the road has been removed to the Waggon way, and not the Waggon way to the road.

You will be so good as peruse the case and give your opinion on the following Queries:

Whether under all the circumstances stated in the case Mr. Blackett has a right by virtue of the above recited Leave to carry his coal Waggon by means of a Steam Engine which is placed upon a Frame resembling that of a Coal Waggon over the lands of A.

Whether the use and exercise of the Steam Engine upon the Waggon way and for the purpose above suggested can under all the circumstances of the case be deemed a nuisance.

It does not appear to me that there is any objection arising from the Leave itself, to Mr. Blackett conveying his coal waggons by means of this Steam Engine. But I think that the use of such an Engine may be deemed a nuisance to A. if the smoke and noise occasioned thereby render his habitation unhealthy or uncomfortable. But this must entirely depend upon the quantity of smoke and noise so occasioned, and the distance of the house of A. from the Waggon Way. RT. HOPPER WILLIAMSON.

If the noise of the engine disturbs the cattle grazing on the lands adjacent to the Waggon Way so as to injure them with regard to their feeding, I think it may be considered a nuisance. RT. H. W.

PROGRESS OF AMERICAN TELEGRAPHY.

According to the recent annual report of the Western Union Telegraph Company, this great corporation has now in operation 72,833 miles of telegraph line, 179,294 miles of operating lines, and 6,565 offices. Its receipts for the past year were nine and a half millions of dollars, expenses six and a half millions, nearly—net profits over three millions. Over seventeen millions of messages were transmitted, the cost of which to the company was 37 cents per message. This is rather cold comfort for new companies that would like to compete with the Western Union by a reduction of the rates. Rather dismal, also, for the advocates of government telegraphy, who propose a uniform charge of 25 cents for each message, being the rate now in vogue in England, where the telegraphs are worked by the government at a great annual loss.

Our British cousins are a little apt to think that what they don't know about telegraphy isn't worth knowing. But the truth is they have not as yet learned the A B C of rapidity in the business. In this respect the American telegraph engineers are in advance of other nations; nor is this very surprising, since both the telegraph works and telegraph experiences of individual nations are diminutive when compared with those of the United States. For example, the length of all the telegraph lines in the United Kingdom is only 23,878 miles, while, as shown above, a single company in this country is now working more than three times that length.

Another reason for the advanced situation of telegraphy in this country is the fact that there are thousands of telegraph operators and electricians here who, under the stimulus of our patent system, are constantly studying how they may improve instruments or make discoveries by which the operation of the line and adjuncts can be improved, quickened, or made more economical. Their success is astonishing, and in one branch is illustrated by the report of the Western Union Company, which shows that, by the employment of the new duplex and quadruplex instruments, they have greatly reduced the expense of transmission, besides increasing the capacity of the lines.

If our telegraphs were in the hands of government officials there would be less striving or competition for excellence, and little encouragement, we fear, would be offered for the discovery of new improvements.

The recent invention of Elisha Gray, heretofore described by us, by which sixteen or more messages may be transmitted each way, at one time, over one wire, promises wonderful results in the future. It indicates that the time is coming when household and private telegraphic lines will become as common as the existing method. It is one of the peculiarities of Mr Gray's remarkable method that, while sixteen different persons may use the wire, none of their messages need interfere with or become known to any of the other users, save the sender and his designated correspondent.

A new organization entitled the National Telegraph Company, with a capital of $25,000,000, has been organized in California, and it is to be hoped that it will meet with success. But this it can only hope to achieve by improving the existing service. If it can send messages as promptly, at no greater prime cost than that now paid by the present companies, it may secure a share of the business. But this will be up-hill work in the face of the admirable management of companies like the Western Union, which are constantly striving to improve every branch of their service, and quick to adopt every practical improvement that inventors present.

FOREIGN PATENTS—REDUCTION OF COSTS.

We would direct special attention to the announcement, published in another column by Messrs. Munn & Co., of an important reduction in the costs of foreign patents.

Throughout all Europe there is a large and increasing demand for American inventions, and those of our ingenious countrymen who neglect to secure foreign patents, if their improvements are good, simply throw away golden opportunities.

Many millions of dollars are already invested in Europe in the manufacture of American inventions, introduced there by enterprising adventurers, who are always on the alert to pick up and patent abroad, for their own benefit, all new American devices of any account, the foreign patents for which have been neglected by the original authors in this country.

American patentees have it entirely within their power to put a stop to this species of piracy. They can always, if they desire, file in their applications for foreign patents in advance of others, because the invention remains unknown abroad until the patent issues here.

Indeed, one of the provisions of the American law is intended for the special convenience of our inventors in securing their foreign patents. After the official examinations have been made here and *the patent allowed*, the inventor then possesses good *prima facie* evidence that his improvement is equally good and patentable in all other countries; and after such allowance, the patent need not be issued under six months, if the patentee so elects, or for such less period as he wishes, thus giving him abundant time to take as many patents in foreign countries as he desires.

Our patentees are not sufficiently alive to the importance and value of this excellent provision of law. It should be their aim, in all cases where the invention is of probable value, to secure European patents promptly, before they are deprived of the privilege by interlopers.

Where the original author is unable to meet the necessary expenses, he can generally, by a little perseverance, find partners to assist him: one of whom, for example, would pay for the English patent, and share in its proceeds; another for the French patent, and so on.

The facilities of business, steam, postal, and telegraphic connections between this country and Europe are now so great that patents may be taken and handled in the chief European States with almost as much ease and promptitude as in this country; and, we repeat, it is a folly for our patentees to overlook the matter.

THE KEELY MOTOR DECEPTION.

By a special invitation of the managers of the Keely motor, Vice Admiral Wellesley, of the great ironclad Bellerophon, and a party of his associate officers and friends, were lately admitted to a private exhibition of this *rara avis*. The admiral was attended by several of the original promoters of the scheme, among whom, according to the Philadelphia *Times*, were Professor B. Howard Rand—who, it will be remembered, certified in effect that, while he did not know actually anything about the wonderful gas, he did know that its nature and generation were totally unknown to Science—by W. H. Rutherford, Chief Engineer U. S. Navy, by the learned counsel of the company, who so adroitly managed to get a hundred thousand dollars in cash out of the New York capitalists, by Keely himself, and several of his best helpers.

Keely went through the juggle in the usual manner. The boiler was suspended by chains from a beam overhead, to satisfy the visitors that there was "no humbug." Water was then run through the boiler, which visitors were allowed to smell and taste, indicating no chemicals present. Keely then blew his breath into her as usual, turned the cocks, and lo! the gage indicated 1,750 lbs. pressure per square inch. This was allowed to escape for half an hour, more or less, through a pipe having the bore of about the size of a horse hair, during which time the gage went down to 500 lbs. One of the British officers suggested that this didn't look like a constant force, or capability of doing actual work. To which Keely made the old reply, originally given three years ago and repeated at every performance, to the effect that the new machine was not quite done, would be ready in about two weeks, and *then*, etc. The sum total of information gained by the British officers, if we may judge from their reported expressions made after the exhibition, was that they saw the gage go up; but how it was done they were not shown, nor was anything of a practically useful nature developed in their presence.

THE FAIR OF THE AMERICAN INSTITUTE.

That telegraph wires in cities will eventually have to be laid underground is a fact which is beginning to force itself upon the popular mind. It is only necessary to recall the wholesale destruction of the aerial wires by the accumulated ice during last winter, and the danger in which the city was placed for the time owing to the consequent rupture of the fire alarm system, to perceive the importance of the change, without considering other reasons which militate in its favor. Inventors consequently are turning their attention to the devising of means for enclosing the subterranean lines, and one new mode of so doing we find among the exhibits at the fair. Copper wires are drawn through glass tubes of a somewhat larger diameter. These tubes are in turn enclosed in iron pipe and held firmly therein by paraffin, which is poured in in a melted state. For lateral connections, as well as for convenience in laying, traps are used, into which the pipe is screwed, the wires passing over non-conducting bridges, so that any wire may be taken out and replaced without interfering with the working of the others. The pipes are made in suitable lengths and are connected by couplings, the joints being faced with paraffin. The inventor states that the device has been tested over considerable distances with success.

THE AQUOMETER

is a new steam pump now in operation in the machinery department. It bears a strong resemblance both in shape and in construction to the similar apparatus known as the pulsometer. There are two working chambers combined with an interposed pressure chamber. Steam enters one chamber or the other according to the position of a steam valve, and presses upon the surface of water in the chamber, forcing the same out. As soon as the live steam reaches the discharge port, its free escape produces a reduction of pressure in the working chamber. The discharge valve then closes, the steam valve cuts off further entrance of steam, and the body of water in the central pressure chamber opens the suction valve and causes an instantaneous condensation of the entire volume of steam within the working chamber, so as to produce a vacuum therein, which causes said chamber to fill with water. The suction valve then ceases, and the momentum acquired by the water flowing up the suction pipe operates to fill the pressure chamber. As the one chamber is thus filling, the steam current operates to force the water out of the opposite chamber, so that a constant flow is produced in the discharge pipe. The steam valve is balanced in its chest, and means are provided to prevent injury by the entrance of grit or dirt.

Any farmer who possesses a manure heap, according to the inventor of

A NEW INCUBATOR

on exhibition, is provided with the essential means of artificially hatching chickens. The idea is to utilize the natural heat of the manure, to produce and maintain the requisite temperature for the incubating process. The apparatus, which is quite simple, consists of a cask or cylinder of wood, near the bottom of which is a door for convenient access to the interior. On the bottom is placed a sieve for the reception of the eggs. In the head is made a kind of chimney covered with an adjustable sliding piece. A bed of horse manure about a foot thick is prepared, and on this the cask is stood. Then manure is heaped about the sides of the latter, flush with the top. A thermometer is placed upon the sieve; and when this shows the interior heat to have reached 104°, the eggs are inserted. Nothing further remains to be done, but to watch the thermometer during the usual hatching period. If the heat exceeds 104°, some of the manure is removed and a portion of the circumference of the cask left exposed; if the mercury falls below the above point, manure fresh from the stable is substituted for the older material. When the chickens appear, the interior of the cask is cleaned, and an artificial mother, composed of a disk covered on its under side with buffalo hair, is inserted and adjusted to a proper hight from the bottom, by means of a threaded rod passing through a nut in the cover of the cask. The manure is still left around the latter, the heat being necessary for the young chickens until they have grown sufficiently to warrant their removal. The chimney on top serves for ventilating purposes. The inventor says that any number of eggs that can be conveniently disposed on two sieves, if need be, can be thus hatched.

The manufacture of

AMERICAN CORDIALS.

is interesting as the starting pointing of a possible new industry. The visitor will find in a small room adjacent to the main hall a large variety of these liqueurs, and will also have an opportunity of witnessing the preliminary operation of their distillation. It is proposed, of course, to compete with the maraschinos, chartreuses, and other cordials of foreign make; and to this end the manufacturers confine themselves, as far as possible, to herbs and other ingredients of American production. The distilling apparatus now in operation is worked by steam. The ingredients, moistened, are placed in a vessel which is contained in a larger receptacle, into which the steam enters. The effect of the heat of the latter is to vaporize the materials, the vapor first passing to a drum above and thence through a high arched pipe to a cooler, which is simply a receptacle enclosed in a cold water bath. The high pipe prevents the passing over of the heavy oils, so that only the fine aromatic essence is condensed, and afterward, in liquid form, drawn off from the cooler. Subsequent distillation is carried on with California brandy or native wine, which supplies the spirituous principle; and the result is a cordial of fine flavor, in many respects equal to that of foreign production.

Mr. L. W. Pond.

The death of Mr. L. W. Pond, the well known machine tool manufacturer of Worcester, Mass., recently occurred in a very sad and unlooked-for manner. He took passage in the night steamer Providence from this city for Boston. The weather was quite stormy, and the vessel had considerable motion, owing to the rough sea. When last seen Mr. Pond had quitted his state room, partially undressed, and probably was suffering from the effects of the rolling of the boat. His apartment in the morning was found empty with the exception of a few articles of clothing, and no traces of its occupant could elsewhere be discovered. From the fact of Mr. Pond being known to have a considerable sum of money about him, together with the circumstance of his having occupied a state room in a very quiet and retired portion of the vessel, a suspicion of foul play was engendered; but this has since given way to the more probable assumption that the unfortunate gentleman, while near the side of the boat, lost his balance, and was thrown over the rail by a heavy lurch.

The terrible death which he thus met, while it will awaken a deep feeling of sympathy among all, cannot add to the sorrow with which those who knew Mr. Pond will regard his loss. He was one of those persevering, enterprising men such as are naturally fitted to be leaders in great industries, and such as the country can least afford to part with, an inventor and a patentee of celebrity and of marked genius and ability, and beyond all he possessed a personal character untinged, through a busy life, with the faintest shadow of reproach.

Rise and Progress of Trademarks.

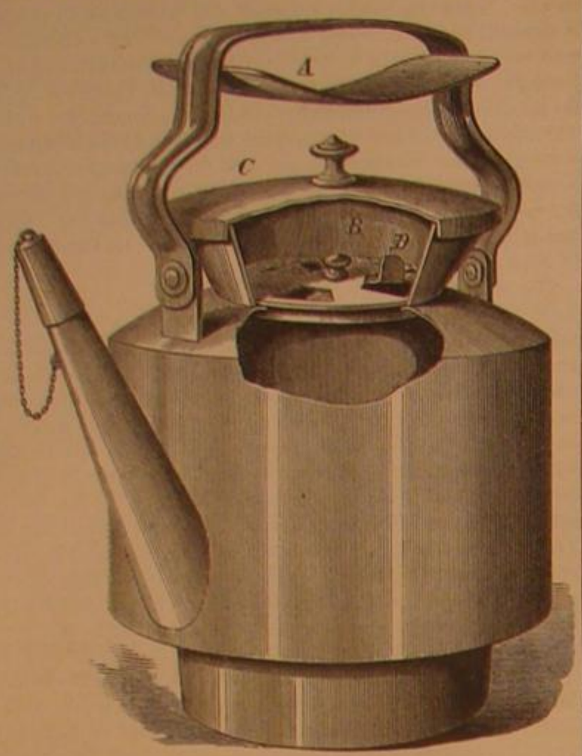
"Examples of the practice of using marks to show the workmanship of various manufactures have been discovered at Herculaneum, such signs having been in vogue among bakers and others. In modern times similar tokens have been adopted in textile and various other fabrics, though the earliest extant are those of paper. After the invention of paper (15th century) from pulp of linen rags, water marks were introduced into the fabric, doubtless to show the manufactory from which the paper was issued. The process has since become general, and the trademark a recognized part of the system of commerce, by which a guarantee is given to the purchaser and a legitimate protection afforded to the manufacturer. The legislation of 1862 is a step in the right direction, and has already done service to trade and morality. It is upon the uniform good quality of manufactured commodities that any foreign trade depends for its continuance, and the obligation of the legislature to secure the purchasing public from fraud, whether the purchaser be a home or foreign consumer, is more and more stringent when the goodness or badness of the object cannot be readily detected by ocular inspection. It is in such cases that the use of trademarks is most useful."

The above, from so good authority as the London *Stationer*, applies with equal force to our manufacturers. There are some things in which the slow Britishers excel the more rapid Yankee. In the matter of securing trademark protection on their products, and the extent of advertising their goods, they are far ahead of our people.—EDS.

IMPROVED TEA KETTLE.

This is an age of utilizations. It is a province of invention to prevent waste—to economize everywhere—facts well exemplified in the device illustrated herewith, the object of which is to usefully employ the steam which issues from the tea kettle, and thus to enhance the value of that indispensable vessel. Incidentally the invention serves to prevent water boiling over upon the stove, and also offers a convenient funnel for filling the kettle.

About the main portion of the kettle and about the handle there is nothing peculiar, save that the latter is provided



with a metal guard, A, to protect the hand from the steam. The opening of the vessel, however, has a funnel-shaped rim, B, the space inside which may be utilized for steaming, cooking, or warming various articles placed therein, and enclosed by the cover, C. The top aperture of the kettle is closed by an interior perforated cover, which has a centrally applied slide piece, D, and button, so that the opening for the escape of the steam into the upper chamber can be increased or diminished at will.

Patented through the Scientific American Patent Agency February 16, 1875. For further information, address the inventor, Mrs. Harriet Gray, lock drawer 5, Marquette, Mich.

COMBINED SCISSORS AND RIPPING KNIFE.

Combination implements are coming more and more into use. Every day brings us new forms of instruments, more or less complicated, designed to reduce the number of tools which an operative must have at hand by placing several tools in one handle. Many of these devices show considerable invention, and save expense in first cost, as well as time and trouble in manipulation.

Mr. C. M. Johnson, of New York city, is the inventor of an ingenious arrangement of a knife blade with a pair of scissors, the object of the knife being to cut or rip seams or perform other operations incidental to the seamstress' labor. One blade of the scissors is made a little thicker than usual, and a longitudinal slot is cut in it, in which the square part of the knife is received. The latter can be pushed out or in, as desired, and is secured in any position by an ordinary clamp screw. The annexed engraving shows the device very clearly.

RECENT HOSPITAL CONSTRUCTION.

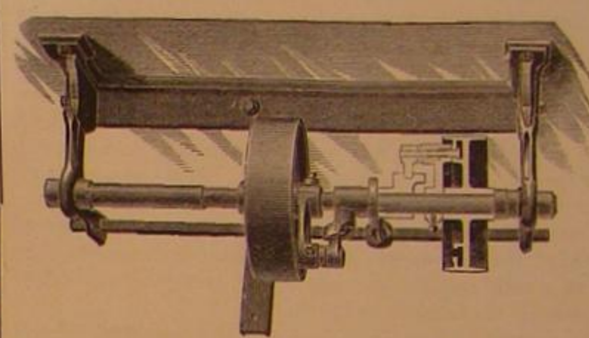
There has recently been erected in London a hospital for children, in the construction of which there are many novel and important features. The building is from a design by Mr. Edward M. Barry, R. A., and it consists of a center block and lateral wings, the former containing the hall, main staircase, chapel, operating theater, and administrative offices, the wings containing the wards, which run longitudinally, being lighted on both sides. The hospital is intended to accommodate 200 in patients, and a dispensary, for the relief of out patients, is located in the basement. The chapel is small, being about 26 feet square; but the *Building News* states that so unique and costly a gem of art, for its size, has seldom been seen. It is the gift of an anonymous donor, and no expense has been spared on its decoration. The richest marbles and alabaster are used in its walls, and the pavement is mosaic.

The wards are about 80 feet long by 23 feet wide, and 13 feet high, and each contains 18 beds; thus each patient has about 1,200 cubic feet space. Five such wards are provided, besides separate apartments for infectious and surgical cases. At the end of each ward are bath rooms and closets, each bath being provided with flexible tubes for filling portable baths for the small children; and each closet is flushed every time a child pushes the door. Slate and glass are used for utensils and for shelving, for cleanliness' sake, and the walls are made double to secure warmth and dryness, the inner surface being of glazed brick, which is easily washed, and is so completely non-absorbent that it gives no foothold for the spread of infection. The floors are of teak, so perfectly laid that they are waterproof; and they are polished so that simply sweeping them insures cleanliness.

The exterior of the building, as shown in our engraving, is of the modern classic order. The ornamental piers, which are striking ornaments, contain the smoke and air flues, while the shafts for admitting the pure air and extracting the foul are in the pyramidal roofs of the end towers. Colored brick and tile are freely used in the work, and serve to show how highly ornamental a structure can be, by the hands of a real artist, constructed of brick.

IMPROVED FRICTION CLUTCH PULLEY.

This engraving represents Bean's patent friction clutch pulley applied to a countershaft, such as is used over engine lathes and other machinery requiring quick and positive change of motion. This countershaft has innumerable



advantages. It runs without noise, and it is strong and durable. It is not complicated in its construction, and is consequently always in working order, the few wearing surfaces being so arranged that they can be very easily and quickly adjusted.

For use on heavy machinery where it is necessary to start and stop gradually, to prevent strain or breakage, and upon line shafting where it is desirable to stop a part or the whole without slackening the speed of the engine, the application of this friction clutch pulley is guaranteed by the manufacturer to give full satisfaction.

One of these countershafts can be seen in operation at the Fair of the American Institute. For circulars and particulars apply to D. Frisbie & Co., New Haven, Conn.

HOSPITAL FOR SICK CHILDREN, GREAT ORMOND STREET, LONDON

THE NEW GIFFARD RAILWAY CARRIAGES.

We recently gave an engraving of the new railway carriage, constructed after the designs of M. H. Giffard, a French engineer, and so built to be free from the oscillating or similar motions common to railway vehicles. While this device excellently answered the objects of its inventor in the respect mentioned, the systems of springs adopted added very materially to the weight of the carriage, thus increasing the labor and expense involved in its traction. To meet this difficulty M. Giffard has devised a new vehicle, which is represented in the annexed illustration, extracted from *La Nature*. The body is entirely separate from the trunk. The springs are of the ordinary leaf pattern. The novel feature consists in the mode of suspending the body from the springs, which is done by connecting the lower ends of the curved iron rods, four of which are fastened on each side of the vehicle, by means of universal joints, to the lower extremities of arms suspended from the ends of the springs. The weight of the carriage is reduced to about one tenth in excess of that of the ordinary car, while all the advantages of immobility and easy riding, described fully in our previous article, are retained.

GIFFARD'S RAILWAY CARRIAGE.

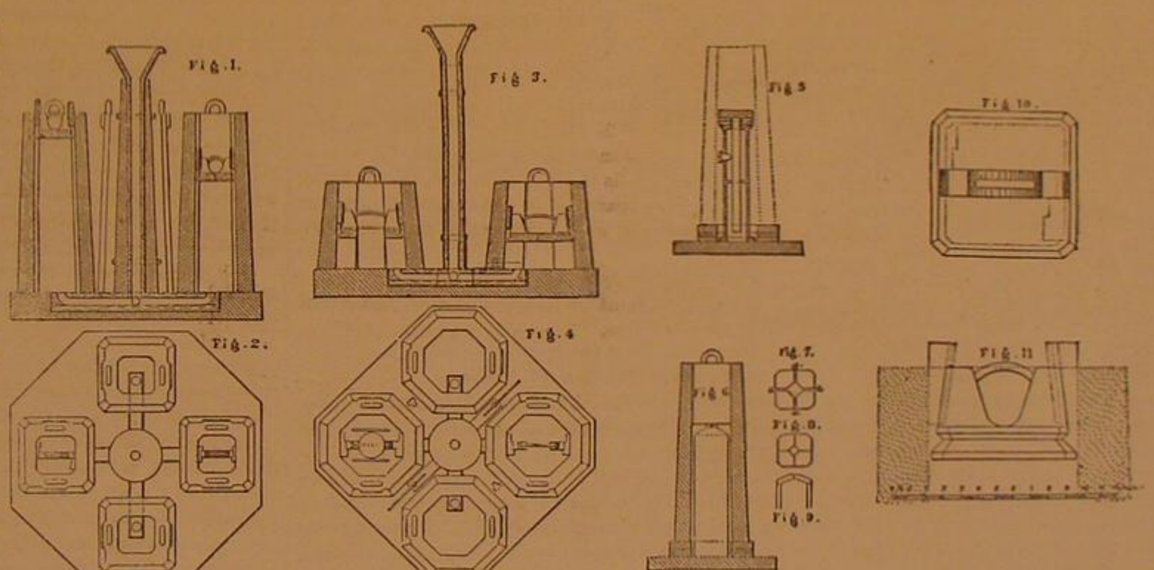
NEW METHOD OF CASTING STEEL INGOTS.

The advantages of casting steel ingots in groups, from below, that is, filling a number of molds at the same time, from one runner, are so obvious and so great that many plans for casting in this way have been brought forward from time to time. The chief practical difficulty in casting in groups has been to find some entirely satisfactory mode of stoppering the ingots, when the molds have been filled to the required hight.

Durfee patented, some years ago, making molds for group-casting closed at the top, with the exception of a small vent hole: a plan that gives a very sound, clean ingot, but necessitates a different mold for each different weight to be cast, and renders it difficult to get out an ingot that may stick in the mold. Ireland uses a plain heavy casting stopper, dropped on the metal after the mold is filled, such as is used in casting ingots of tool steel from crucibles; a stopper of this kind, however, can only be used in parallel molds, made in two parts, bolted or cottered together; and in these parallel molds, even when planed all over, inside and at the joint, the ingots are apt to stick, and the molds, after having been in use for a short time, open at the joints, causing fins on the ingots. Mr. A. L. Holley has patented several modes of stoppering molds, to be filled also from below, but they have not come into general use.

In the plan of stoppering herewith illustrated, the stopper used is a cast iron block, about 2 inches thick, grooved round the edge, as shown in the accompanying sections, and of such a size as just to drop freely into the top of the mold. A small vent hole, about $\frac{3}{16}$ inches in diameter, is drilled through it, and is slightly conical, that the metal may not stick in it. The stopper is fixed in the mold by two cast iron wedges, as shown more clearly in the enlarged plan and section, Figs. 10, 11. To set the stopper in the mold, the latter is dropped over a post of such a hight that, when the stopper is placed in the mold, and on the top of the post, it is exactly at the hight required. A small shovelful of loam, such as is used in lining steel ladles, is then thrown in, and rammed into the joints by a rammer, 2 inches or 3 inches broad, and about ½ inch thick; the wedges are driven in, to fix the stopper in its place, and the mold is then ready for casting. The loam or mixed clay and sand used should be only slightly damped, so that it will just cohere when pressed together in the hand. The post is adjusted to the required hight by putting packing blocks or rings at its foot, to raise the mold, or by packing under its head, which for that purpose may be made loose and fixed by a set screw in the side. In order to prevent the squeezing down of a fin of loam between the post and the inside of the mold, if the loam is rammed in too hard, or if the rammer is thin, the head of the post should be a pretty close fit in the mold at the hight at which the stopper is fixed. For this purpose, several heads should be provided, to fit different molds, or different hights in the same tapered mold; or the top of the post may be made beveled, as shown, Fig. 6, and four small adjustable blocks may be placed on it when it is in position in the mold. These slide down the beveled faces of the post, into the corners of the mold, and close up the spaces through which loam might squeeze down. The only openings still left are those at *a*, *a*, *a*, *a*, Fig. 7, between the blocks; and in arranging the molds for casting ingots, such as those for tires, in which a perfectly smooth top is required, these are closed by laying over them small loose pieces of sheet iron, before dropping the stopper in. Tire ingots may be cast either in the form of solid cheeses, the more usual plan, or with a core, in order to save punching. Stoppers for both these plans of casting are shown in Figs. 2, 3.

The molds when arranged on the base plate are filled through a central runner, with a branch leading into each mold. The central runner is made in two parts, bolted together, or clamped, as shown in the illustration, by rings driven over them; or by rings put on loosely, and tightened up by wedges, in the same way in which the halves of ordinary molds for casting steel tool ingots are put together. The funnel-shaped top of the runner is in a separate piece, put in after the lining is completed. The runners are dried by setting them over holes in a thick cast iron plate, heated below by a fire, or by a gas flame; and in order that the lining may dry readily, they should be perforated all over with ½ inch holes, placed pretty closely together. Where there is plenty of crane power, to handle the runners, they are most conveniently made of cast iron, but where they have to be carried by hand, they may be of light wrought iron. Both these forms of runners are shown in Figs. 1 and 2.



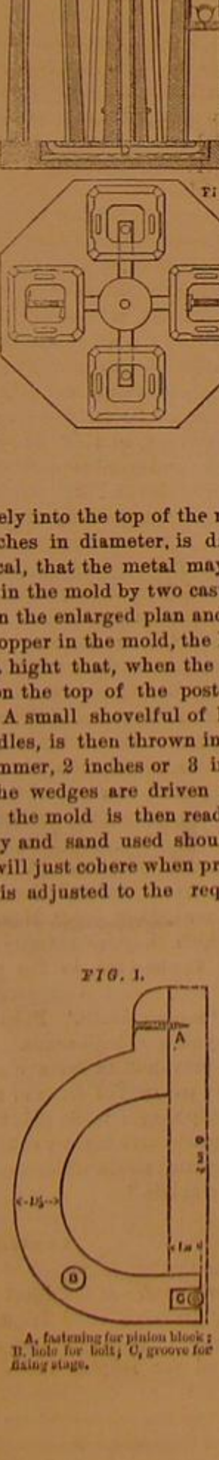
HACKNEY'S METHOD OF CASTING STEEL INGOTS.

A HOME-MADE COMPOUND MICROSCOPE.

A correspondent of the *English Mechanic* sends the following description of a microscope stand, which may be manufactured at a trifling expense by any one having a little mechanical skill: "Of course I suppose him to have odd pieces of sheet brass of different thicknesses, brass tubing, screws, wood, etc., as, if he has to resort to the shop for everything, he will find it make a very different figure to what mine cost.

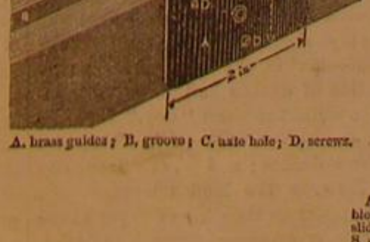
I give average dimensions, which any one can vary to suit himself. To begin, procure a piece of oak, beech, or some other heavy wood, 6½ x 3½ x 1 inch. At each corner of either end and in the center of opposite side, fix a small round knob to enable the stand to be firm in any position. Next draw a line across the center of the board at right angles to the longest side, and on this line at 1 inch from the center make two mortises, ½ inch in diameter, with center bit (the measurement is to center of mortise), for the uprights, the dimensions of which should be 7½ x 1½ x ½ of an inch each, and at the end of each carefully make tenons to fit the mortises. Having rounded off the upper corners, put them in position (none of the parts should be finally fixed until the whole is completed). If properly done, you will now have a space of about 1½ inches between the uprights. Now cut out from board of this thickness a piece of the shape and dimensions in Fig. 1, and in the place indicated in the engraving, and also at about ¾ of an inch from top of the uprights, cut, with a center bit, a hole about ⅜ of an inch in diameter; through these put a bolt the size of the hole, with a round head at one end and a nut at the other. This bolt should be about 3 inches long. By this you will be able to fix the body in any position. Next plane up very truly a piece of wood 1 x 1½ x 6 inches long, and through the middle of the widest face make (lengthways) with a ½ inch plow a groove about ½ or ⅜ of an inch deep, and in another piece of wood, ⅜ x 1½ x 6 inches, make a similar groove, but only $\frac{3}{16}$ of an inch deep; and if you do not intend making a rackwork adjustment, plane a strip of wood so as to move truly in the groove ½ or ⅜ of an inch in width and 6 inches long, which piece glue in the groove formed in the smaller piece of wood; and the pieces of brass on the sides, as afterwards mentioned, must be put on. If you intend making a rack adjustment, a rectangular rod of brass ½ x ½ x 4 inches long must be fixed at the end of the upper groove, which is intended to be nearest the object, and in the remainder of the groove should be inserted a strip of wood of the same size; this will save brass. A clock pinion—that which works the count wheel in old case clocks is the best, and can be procured of almost any dealer in old brass, etc.—must be fitted on an iron axle 3 inches long, in the middle of which is a square arbor to fit the hole in center of pinion. This had better be turned in a lathe, the ends just small enough for the pinion to pass over easily, and a small portion the thickness of the pinion (which must not be wider than the groove) left larger in the middle, to be afterwards filed down to fit the pinion tightly. Sometimes a steel pinion can be had with axle already fixed (having formed in this shape a portion of a clock), when none of this work is of course required. Now comes the most difficult part of the job, to file teeth in the rack to fit the pinion, which must be done very exactly, or it had better be left undone and a sliding adjustment used. My rod was of lead, in which the teeth are more easily cut, and although it has been in constant use for two years it is still in good working order; but of course brass is preferable and would repay the extra trouble. In the larger piece of wood, at a distance of 3½ or 4 inches from the end toward the stage, the groove must be deepened for a short distance to allow room for the pinion, and in the best position, to be ascertained by careful measurement, a round hole (the size of pinion, on the opposite side, and concentric with the other hole) the size of the axle; or it may be made larger, and a metal bearing put in on both sides instead of one. You will now have your pinion in the center of the groove, and an inch of axle projecting on either side, on which to fix the knobs or milled heads with which to turn it; but before putting these on, two pieces of brass (Fig. 2) must be cut out, and about $\frac{1}{16}$ of an inch of the upper edge turned at right angles, and a slit made in the sliding top in which this will work, for which purpose the bent edge should be about $\frac{1}{16}$ of an inch above the upper face of the board on which it is fixed, and care must be taken that it is perfectly parallel. The engraving will show the method of fixing. Now put on a pair of milled heads, or any knobs which

FIG. 1.



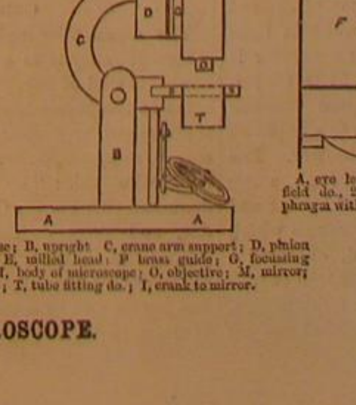
A, fastening for pinion block; B, hole for bolt; C, groove for fixing stage.

FIG. 2



A, brass guides; B, groove; C, axle hole; D, screws.

FIG. 3



A, base; B, upright; C, crane arm support; D, pinion block; E, milled head; F, brass guide; G, focusing slide; H, body of microscope; O, objective; M, mirror; S, stage; T, tube fitting do.; I, crank to mirror.

FIG. 4

A, eye lens, 1in. focus; B field do., 2in. focus; C, diaphragm with aperture.

A HOME-MADE MICROSCOPE.

will enable the pinion to be worked evenly, slide the top in its position, and if everything has been done correctly you will have a rack adjustment which will work as truly as in many of the cheap brass microscopes, in fact better than some. Be careful, in screwing on the brass plates, that the screws do not project into and spoil the groove. The best plan for getting the sliding piece to work smoothly on the other is to work them backwards and forwards on each other, and on no account must the faces in contact be either stained or polished, except naturally, although the exposed portions will be much improved in appearance if stained and polished. As regards wood, any that will not split easily and will take a good smooth surface will do. Now fasten the piece of wood with the pinion on the opposite side to the groove, to the flat face of the curved piece of wood (Fig. 1, A), leaving one inch projecting toward the stage (which is to be fixed at B), and the end to which the pinion is nearest is to be placed uppermost. The tube, which may be of brass, zinc, or even brown paper, according to what is most convenient or procurable, is the next thing to be made, and it should be rather greater in diameter than the amplifying lens if the eyepiece is not constructed, and, if so, of a size that the eyepiece can slide closely into. It may be fastened to the sliding piece by means of strips of brass going round it and screwed into the wood, or, what is far better, by two screws through the middle of the sliding piece (in the groove), one side of the tube, and fastening into two small bits of wood inside; or the heads may be inside the tube, and small nuts used to tighten it. The tube, which should be 8 or 10 inches in length, should reach, when the two sliding pieces coincide, to within ¼ inch of the opposite side of the curved piece of wood. The stage, which should be a piece of wood 2¼ x 3½ x ⅛ of an inch thick, should be let in by one of the shortest sides into the slit, C (Fig. 1), and screwed firmly in that position. Exactly opposite the center of the tube make a dot; and with this as a center and a 1½ inch center bit, cut a hole, into which fit a brass tube 1 inch in length, to fit the apparatus into. Two springs of sheet brass, cupped so as to allow a slide to be slipped in and pressed just sufficiently to hold it in any position, should be fixed at the sides of the stage; or a sliding ledge, on which the slide may rest, may be used instead. Under the stage, in the position indicated in Fig. 3, which represents the completed instrument, a strip of wood, ½ of an inch square and of such a length that when the microscope is placed upright it may touch the base, must be mortised in, on which to fix the mirror, the manner of doing which is shown in Fig. 3, the crank and U-shaped piece being strips of brass screwed so as to be capable of being turned in any direction. The mirror may be either a plain one with two pivots, or, what is better, one of the sixpenny reading glasses, which should be unscrewed out of its handle, the slit soldered to act as one pivot and a piece of wire soldered on the opposite side for the other. Now get two pieces of thin looking glass, and get a glazier to cut them to fit the brass rim of the lens, cement them back to back, and fix them in the rim of the lens, when you will have one side plain and the other equivalent to a concave mirror. You have now only to construct your eyepiece and objective to have the microscope complete. For the eyepiece, procure a plano-convex lens 2 inches focal distance, and another 1 inch; fix them in a brass tube 1½ inches apart—convex sides of both toward objective—and in the focus of the eye lens fix a diaphragm, with a circular aperture about ⅜ of an inch in diameter; and a brass plate with a small hole should be placed between the eye and the eye lens (Fig. 4). The objective, which may consist of a double or plano-convex lens, should have an aperture of about ⅛ of an inch for a 1 inch power, and smaller for higher powers; it must then be fixed at the other end of the tube, and be sure that it is exactly centered, and its axis coincident with that of the tube. If you have carefully followed these directions you will have a really useful microscope, which will afford you hours of instruction and enjoyment."

Lowe's New Process for Gas.

Mr. G. L. Dwight, of Mont Clair, N. J., sends the following description of this process, which is now in practical use in Utica, N. Y.:

In general terms, the product is the result of a decomposition, by heat, of water and crude petroleum, but it is as different, in its character and quality, as the method by which it is produced differs from all others.

The system of retorts or equivalent vessels, heated externally, has been in all other methods in some degree adhered to. In this, however, it has been entirely abandoned, and the materials for decomposition are introduced directly into the fire itself, by which means there is secured the greatest possible economy of heat; while certain constituents, ordinarily wasted, are utilized as fuel, some being burned, which in other processes are carried forward with no advantage to the product. However trivial this difference of principle may appear, it is proven to be radical by the accomplishment of important differences in result. No other residuum than pure ashes is drawn from the generator. This generator is substantially a small cupola furnace of about 3½ feet internal diameter, built of firebrick, with air space between double walls, which is charged with anthracite to a depth of 3½ feet and driven to the proper heat by a blower. The draft is carried into the base of, and upwards through, a second cylindrical chamber, much like the first, but higher and filled with firebrick laid up with interstices, through which the gases of combustion are carried and ignited, evolving a high temperature. When suitable heat is attained (a dull cherry red in the generator, and a white in the superheater, as the second chamber is termed) the base is closed against atmospheric air, the valve passage to smoke stack shut, and dry steam is admitted directly into the incandescent coal, a little above the grate bars, while crude petroleum is dropped from above upon the same. The gases therefore are generated in the same vessel at the same moment, and pass together into the secondary chamber.

It will be remarked that the mass of coal is gradually being cooled by the passage through it of the steam; but as the gases escape from the furnace very hot, they do not greatly diminish the heat of the second chamber, which, by its uniformity and hight of temperature, equalizes and thoroughly fixes the product. Thence it passes, through the washing and condensing apparatus, onward through the lime boxes to the holder.

In practice at Utica, which is the largest place yet lighted by this system, two generators are employed (though four were set up), being used alternately. No. 1 is heated while No. 2 is making gas, and so on, so that continuity of production is ensured. One generator is used for 30 minutes, and then another, this length of time being, on the whole, the most economical, as the fire is not, during that period, so far checked as to involve delay in re-firing. The mass is then stirred slightly with an iron rod, a small quantity of coal added, and the blast re-applied. Each run gives an average of 3,000 cubic feet. The management of the apparatus is stated to be exceedingly simple, requiring no skilled labor beyond a little experience in judging of heat and in the gaging of the oil flow. In the Utica works, two men by day and night, at laborers' wages, make all the gas required by that city, the coal system having been for some months entirely superseded. Continuous daily operation there has clearly demonstrated that 60 lbs. anthracite, costing $6 per tun, and 3 gallons petroleum costing 6 cents per gallon, yield 1,000 cubic feet of gas, which, with the labor and time added, makes a cost, in the holder, not exceeding 50 cents per 1,000 cubic feet, for gas of a quality not less than 20 candles. No difficulty is found in maintaining a uniform standard, and no indication of stratification or of deposition in the pipes is met with. The flame is remarkably white and intense, and its combustion perfect. Extreme experimental tests, or (better still) the practical experience of the past winter, at Phœnixville, Pa., where the thermometer sank to 17° below zero, have shown conclusively that this product is less sensitive than coal gas. Mr. Dwight considers himself justified, by the facts, in claiming for the Lowe process the following advantages over all others:

1. Great simplicity of apparatus, and consequent low first cost.
2. Solidity of mechanical construction, whereby the minimum of wear and tear is secured.
3. Ease of management, which largely reduces the labor.
4. The comparative cheapness of materials employed, and their thorough utilization.
5. The high quality of the product, and, for the above stated reasons, its very low cost.

Vertical Motion of Vessels.

Mr. Thorneycroft, the well known builder of fast steam launches, proves that at high rates of speed the body of a vessel actually rises above its ordinary load water line, and, as the speed increases, continues to rise still higher. The experiments from which these results were deduced were conducted with the steel torpedo launch lately built for the Austrian government, with which a speed of 19·4 knots was attained. The differences of level were determined by means of three plumb bobs hanging from a bowsprit at various distances in front of the bow, from observations with which the altered water surface was measured, and some exceedingly instructive diagrams made therefrom. From these it appeared that, up to a speed of about twelve knots, the vessel sank more deeply in the water; but on being driven to a higher speed, she seemed to make an almost sudden leap up, and continued gradually to rise above the normal water line as the speed increased.

A Buried Forest.

A man living in Essex county, Virginia, in digging a well recently, at a depth of about thirty feet came upon the trunks of large trees several feet in diameter, which were found upon examination to be cypress. Fearing the water would be injured by the wood, he determined to abandon his well, and dug another some distance off. When he had reached about the same depth he again encountered the trees; and a third attempt, at a still greater distance from the first well, again brought him in contact with this subterranean forest, the trees of which are of great size and well preserved.

There are portions of land in New Jersey, near the coast, where buried trees are also found, and considerable business has been done in unearthing them.

Cable Telegraphing.

The ocean telegraph operator taps the key as in a land telegraph, only it is a double key. It has two levers and knobs instead of one. The alphabet used is substantially the same as the Morse alphabet—that is, the different letters are represented by a combination of dashes and dots. For instance, suppose you want to write the word "boy." It would read like this: "— . . . — — — . — — —". B is one dash and three dots; O, three dashes; and Y, one dash, one dot, and three dashes. Now, in the land telegraph, the dashes and the dots would appear on the strip of paper at the other end of the line, which is unwound from a cylinder, and perforated by a pin at the end of the bar or armature. If the operator could read by sound, we would dispense with the strip of paper, and read the message by the click of the armature as it is pulled down and let go by the electric magnet.

The cable operator, however, has neither of these advantages. There is no paper to perforate, no click of the armature, and no armature to click. The message is read by means of a moving flash of light upon a polished scale produced by the deflection of a very small mirror, which is placed within a mirror galvanometer, which is a small brass cylinder two or three inches in diameter, shaped like a spool or bobbin, composed of several hundred turns of small wire, wound with silk to keep the metal from coming in contact. It is wound or coiled exactly like a bundle of new rope, a small hole being left in the middle about the size of a common wooden pencil. In the center of this is suspended a very thin, delicate mirror about as large as a kernel of corn, with a correspondingly small magnet rigidly attached to the back of it. The whole weighs but a little more than a grain, and is suspended by a single fiber of silk, much smaller than a human hair, and almost invisible. A narrow horizontal scale is placed within a darkened box two or three feet in front of the mirror, a narrow slit being cut in the center of the scale to allow a ray of light to shine upon the mirror from a lamp placed behind said scale, the little mirror in turn reflecting the light back upon the scale. This spot of light upon the scale is the index by which all messages are read. The angle through which the ray moves is double that traversed by the mirror itself; and it is, therefore, really equivalent to an index four or six feet in length, without weight.

To the casual observer there is nothing but a thin ray of light, darting to the right and left with irregular rapidity; but to the trained eye of the operator every flash is replete with intelligence. Thus the word boy, already alluded to, would be read in this way: One flash to the right and three to the left is B. Three to the right is O. One to the right, one to the left, and two more to the right is Y, and so on. Long and constant practice makes the operators wonderfully expert in their profession, and enables them to read from the mirror as readily and as accurately as from a newspaper.—*Boston Herald.*

A Suicidal Epidemic.

A recent number of *Chambers' Journal* gives an entertaining article on suicides, from which we copy:

"Sometimes," says the writer, "a person determined to destroy himself will wait months and years for an opportunity of executing the deed in the particular manner he has marked out for himself, and the very inclination to suicide may be removed by withdrawing the particular objects that would awaken the idea. Thus a man who has tried to drown himself will be under no temptation to cut his throat. Example, it is well known, is a powerful cause of excitement to the suicidal act. We were once told by a physician that a hypochondriacal patient used to visit him invariably the day after reading the report of a suicide in the daily papers, possessed by a morbid fear of imitating the act of which he read. Sir Charles Bell, surgeon of Middlesex Hospital, was one day describing, to a barber who was shaving him, a patient's unsuccessful attempt to cut his own throat, and, on the barber's request, pointed out the anatomy of the neck, showing how easily the act might be accomplished. Before shaving operations were completed, the barber had left the shop and cut his own throat according to Sir Charles Bell's exact instructions. Sometimes there is an epidemic of suicides, as at Versailles, in 1793, when out of a small population 1,300 persons destroyed themselves in one year; or as in the Hotel des Invalides in Paris, when six of the inmates hanged themselves on a certain crossbar within a month. Very often the disease is hereditary, and at a certain age the members of one family will all in turn evince the suicidal tendency, while even children of very tender years have been known to end their short lives by their own act, from force of example. Curious, too, are the methods of self-destruction, but they are too painful to bear description. A Frenchman once attempted to ring his own death knell, by tying himself to the clapper of the church bell, which thereupon began to swing, and alarmed the villagers by its unwonted tones. All cases of determined suicides are characteristic of confirmed insanity; whereas, in a case of impulsive insanity, the perpetrator will often regret the act before it is completed and endeavor to save his life, as did Sir Samuel Romilly, thus demonstrating that the very attempt may effect the cure of the disordered brain. The months of March, June, and July are the favorites with men, September, November, and January for women, in which they voluntarily end their lives. In youth men hang themselves, in the prime of life use firearms, and, when old, revert to hanging. Women usually prefer Ophelia's 'muddy death.' Poisoning is a method adopted by the very young of both sexes. We have the consoling reflection that, prevalent as brain disorder is in our country, at least eighty per cent of cases of insanity are curable if treated at an early stage; while it is to be noted that it is not pleasurable, productive brain work that does the mischief, but rather the mental strain which results from the high pressure of our artificial life."

Centennial Notes.

The Centennial Board of Finance have secured more than forty-six acres of fine level grain land at Schenck Station, on the Philadelphia and Trenton Railroad, three miles this side of Bristol, for the purpose of making it an international trial ground for reaping machines, steam plows, harrows, rollers, etc., at the Centennial Exposition. The necessary plowing has already been done under the superintendence of the Centennial Bureau of Agriculture.

PRACTICAL MECHANISM.

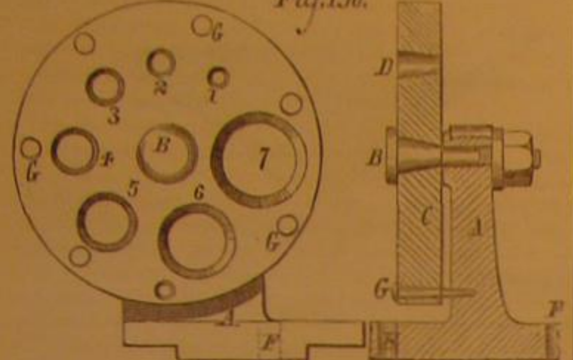
BY JOSHUA ROSE.

NUMBER XXXIV.

CONE PLATE FOR BORING IN THE LATHE.

For chucking shafts and other similar work in the lathe (to bore holes in the ends of the shafts, etc.), the cone plate shown in Fig. 150 is the best appliance known to machinists.

Fig. 150.



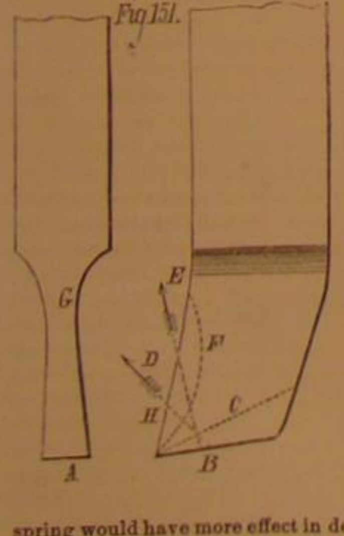
A is a standard, fitting in the shears of the lathe, at E, and holding the circular plate, C, by means of the bolt, B, which should be made to just clamp the plate, C, tightly when the nut is screwed tight. The plate contains a series of conical holes, 1, 2, 3, etc. (shown in section at D). The object of coning the pin, B, where it carries the plate, C, is that the latter shall be made to a good working fit and have no play. The operation is to place the shaft in the lathe, one end being provided with a driver, dog, or carrier, and placed on the running or line center of the lathe; and the other end, to be operated upon, being placed in such one of the conical holes of the plate, C, as is of suitable size, the distance of the standard, A, from the lathe center is to be adjusted so that the work will revolve in the coned hole with about as much friction as it would have were it placed between both the lathe centers. Thus the conical hole will take the place of the dead center of the lathe, leaving the end of the shaft free to be operated on. F F are holes to bolt the standard, A, to the lathe shears or bed; and G G, etc., are taper holes to receive the pin, G, shown in the sectional view. The object of these holes and pin is to adjust the conical holes so that they will stand dead true with the lathe centers; for if they stood otherwise, the holes would not be bored straight in the work. In Fig. 155, hole No. 7 is shown in position to operate, the pin, G, locking the plate, C, in that position. In setting the work, the nut on the pin, B, should be eased back just sufficiently to allow the plate, C, to revolve by hand; the work should then be put into position, and the pin, G, put into place; the standard, A, should then be adjusted to its distance from the live lathe center, and bolted to the lathe bed; and finally, the nut on the pin, B, should be screwed up tight, when the work will be held true, and the cone plate prevented from springing. Care must be taken to supply the conical holes, in which the work revolves, with a liberal quantity of oil, otherwise they will be apt to abrade.

SLOTTING MACHINE TOOLS.

Tools for use in slotting machines are divided into two classes, those used by themselves, for holes in which there is not sufficient room to admit a tool post or bar; and short tools, held in a tool post on the bar, and fastened by a set screw or screws thereon provided.

Referring to the first class, which should never be employed if it can be avoided, Fig. 151 is a tool for cutting out a key seat. The edge, A, is the cutting part, the thickness at G being reduced to make it clear the sides of the key seat. The face, B, receives the force necessary to bend the shaving, which, acting at a right angle to that face, tends (as will be observed) to force the tool deeper into the cut, at the angle shown by the dotted line and arrow, E. Now suppose B to be ground to the angle shown by the dotted line, C; the direction of the force required to bend the shaving would be in the direction of the dotted line and arrow, D; and a comparison of D and F shows that an equal degree of spring would have more effect in deepening the cut of the tool in the case of D than in that of E; and it is this consideration which determines the proper angle of the face, B. It being obvious that the more angle it has, the keener the cutting edge of the tool will be, and the greater the liability to force into the cut; and since the deeper the cut, the greater is the force required to bend the shavings, the tool continues to spring, digging into the work and either bending or breaking itself, or stopping the machine. Hence the face, B, should be made for slight tools, or for tools held far out from the tool post, at about the angle shown above.

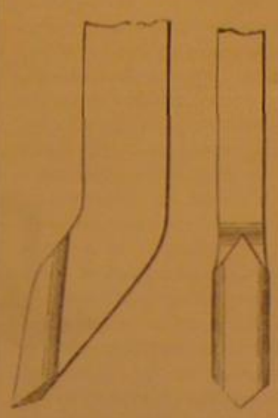
Fig. 151.



The face, H, should, in all cases, be made as shown above, and not hollowed at all in the direction shown by the dotted line, F, which would not only weaken the tool, but would cause the cutting edge to be badly supported by the metal behind it, and hence to break; and these considerations, as to the shape and angle of the faces, B and H, apply to all descriptions of slotting machine cutting tools, and are of more importance in the class of tools above shown than in tools used in any other kind of machine, because of the great distance they have, at times, to stand out from the holding screws or clamps.

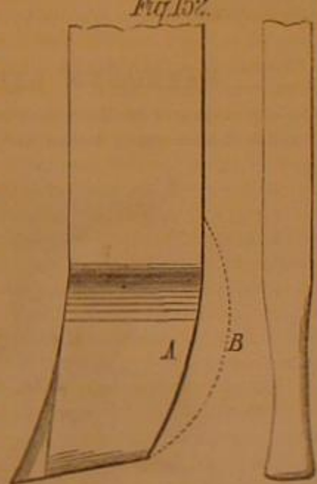
A roughing out tool, held in the tool post without the aid of a bar, should be made as shown in Fig. 151 *a*, concerning which nothing need be said save that it should be hardened right out, if the cutting edge stands close to the holding screws or clamps of the tool post, and tempered to a light straw, if held far out from the same, which will, in the latter case, prevent it from breaking in consequence of any deepening of the cut from the tool springing.

Fig. 151 *a*.



For cutting out a half-round groove, the tool shown in Fig. 152 should be employed. The outline, A, is made as denoted by the dotted line, B, in cases where, from the narrowness of the tool, it is very liable to spring from the pressure of the cut, as, say, when the thickness at C is less than three eighths inch, in which case the cutting edge should be lowered to a straw color; whereas, if thicker, the edge may be hardened right out. It is well here to note that it is advantageous that the tool should have a barely perceptible amount of spring, in the direction of D, in Fig. 151, because otherwise the edge of the tool will rub against the work during the back stroke, and thus become rapidly dulled.

Fig. 152.



Whenever the nature of the work to be done will admit, a holding bar and short tool, such as shown in Fig. 153, should be employed. A represents the bar, which is fastened in the tool post, B the tool, and C a set screw to hold the tool, which set screw may be placed in the end, D, of the bar. By using such a bar, short tools, such as have been already described for use in the lathe or planer, may be employed, their shortness rendering their grinding and forging much easier of accomplishment. Many of these holding bars have small pivoted boxes, similar to that shown in Fig. 154, provided to receive the tool. A is a sectional view of the bar, B is the box, pivoted at C, D is the tool, and E the set screw for holding the same. It will be observed that the set screw, E, screws into the pivoted box, and not into the end of the bar, and that the hole, provided in the end of the bar to admit the set screw, is large enough to permit the set screw to have plenty of play or movement. The object of this and similarly designed devices is to allow the tool to move, in the direction of D, off the pivot, C, and thus to prevent the tool edge from rubbing against the sides of its cut during the up stroke of the bar, the spiral spring shown being made sufficiently strong to support the box, B, in the position shown, but not sufficiently strong to resist much force exerted upon the tool and in the direction of D. For small or even medium sized work, these devices are very efficient; but for large, heavy, outside work, the bars themselves are too slight, and it is usual to employ a similar device (on a large scale) provided in the tool end of the slide itself. Under these conditions, the slotting machine will perform as heavy duty as either the lathe or planing machine. The writer has in his possession a cutting taken off the outside of a crank at the Morgan Iron Works, which cutting measures 2½ inches and is a full ½ of an inch in thickness, the tool employed being a knife tool, ground as shown in Fig. 155.

Fig. 153.

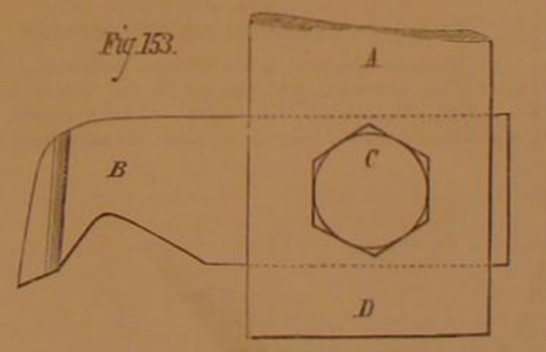


Fig. 154.

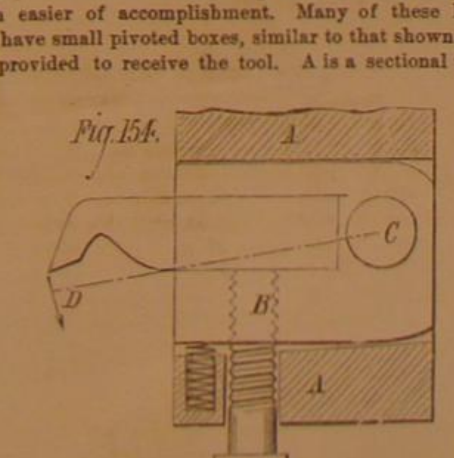
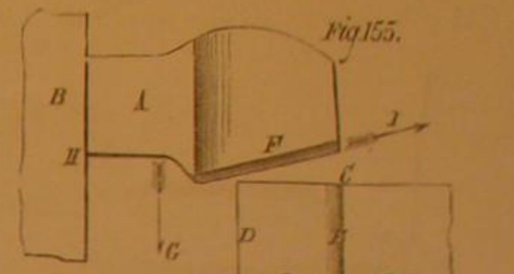


Fig. 155.



B represents the tool end of the slide of the slotting machine, A the knife tool, C the work, and from D to E the depth of the cut.

The face of the tool is ground off at an angle, in the direction of I, so that the point of the tool shall not break off when it strikes the work, and so that the strain upon the tool and working parts of the machine shall not come upon them too suddenly, and cause them to break, as would be the case were the cutting edge of the tool to strike the cut along its whole length simultaneously. As shown in the engraving, the tool would strike the work at F on the edge only, which would for an instant of time exert only enough resistance to bring all the working parts of the machine to a bearing; and as the tool descended, the strain would gradually increase until the point of the tool reached the work. When the tool is near the end of the stroke, and therefore leaves the cut, it will do so at F first, thus leaving the cut gradually, and greatly modifying the jump due to the recoil of the working parts of the machine when relieved of the heavy strain necessary to drive such a deep and thick cut. The enormous strain placed upon the tool would inevitably break it were it left very hard; it is therefore tempered to a purple.

No other tool can well be used for taking such heavy cuts, because grinding off the face, F, of any other tool would not leave the tool edge sufficiently keen to sever the metal without an excessive amount of driving power, and further because the breadth of the face, F, which sustains the force necessary to bend the cutting, is narrower in the knife tool than in any other, and therefore bends the cutting less, experiencing a corresponding decrease of strain. Cuts of such great depth and thickness cannot be well taken in slotting machines whose slides are operated by a connecting rod or link, because the excessive strain would be apt to force the connecting rod along the slot provided to alter the stroke of the machine; the sliding head is therefore provided with a strong rack on each side, operated by pinions, with suitable reversing gearing attached for varying the stroke.

When operating the feed of a slotting machine by hand, the work should be fed to the cut while the tool is reversing its motion at the top of the stroke, and not while the tool is cutting or at the bottom of the stroke, because, in either of the latter cases, the tool edge would grind against the sides of the cut during the up stroke, which would soon impair the cutting qualifications of the tool.

Tool-holding bars of sizes below about 1½ inches in thickness should be made of steel so as to be strong enough to resist the tendency to spring. For sizes above that, they may be made of wrought iron.

Buffalo Bones.

It is stated that many of the settlers in Kansas, in the valley of the Arkansas, have done a profitable business by gathering up buffalo bones. The prairies for forty miles each way from the railroad have been gleaned over till not a relic of the chase can be found. Heads and ribs are worth $5 a ton; these are shipped to Philadelphia and ground up into fertilizers. Shins and shoulder blades are worth $10 a ton, these go to the sugar refineries. The horns are worth $30; the tips are sawn off here and sent to the factories of umbrellas, fans, pipes, etc.; the remainder is used by the chemists. Bits of hide found hanging to the heads are taken off and sent to the glue factories. Every fragment of these animals is made to serve a purpose.

Electrical Exhibition in Paris.

In the Champs Elysées, in July, 1876, will be held an exhibition of the applications of electricity to industrial and domestic purposes. Information will be given on application at the offices of the exhibition, 86 rue de la Victoire, Paris. A special exhibition of the improvements in railway appliances has been proposed to be opened in Paris next year.

A Snake within a Snake.

While some workmen were laboring in a meadow near Saugus, Mass., recently, they discovered a black snake about five feet long. A closer examination revealed the fact that the tail of another snake was protruding from its mouth, and this was found to be a water adder, which measured nearly four feet.

IMPROVED GRINDING MILLS.

Geared mills with vertical spindles, says the inventor of the improved mills illustrated in the annexed engravings, are going out of use.. Their toothed wheels or cogged gears are too rough in running and too expensive, while spindles in a vertical position do not run well, because they cannot be kept thoroughly oiled, and do not lie steadily against their bearings. Almost all the shafting used for driving machinery is now horizontal, with vertical pulleys, and therefore the driving pulleys of grinding mills should obviously also be vertical, in order to be as convenient as possible to set up and put in operation.

Fig. 1

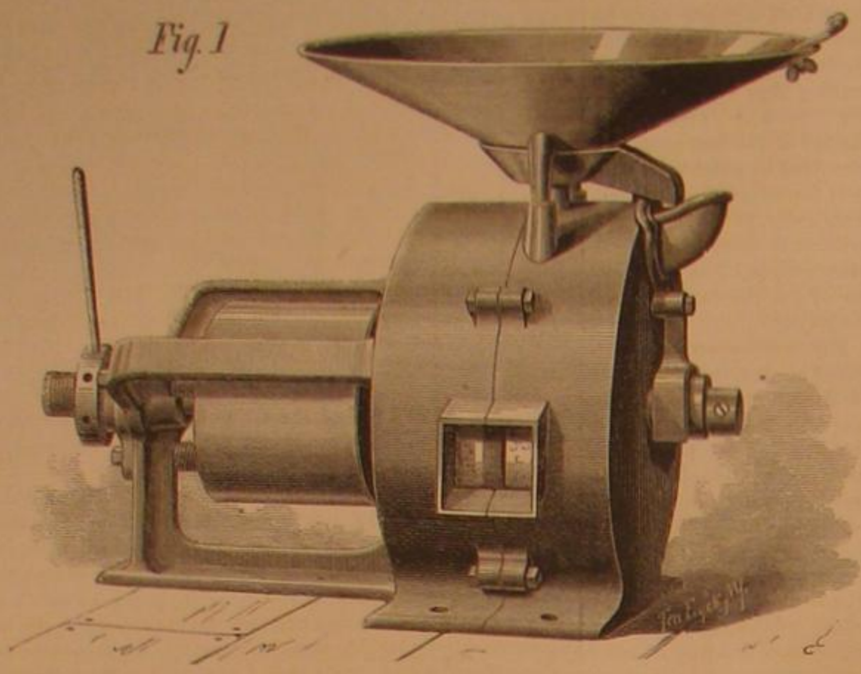
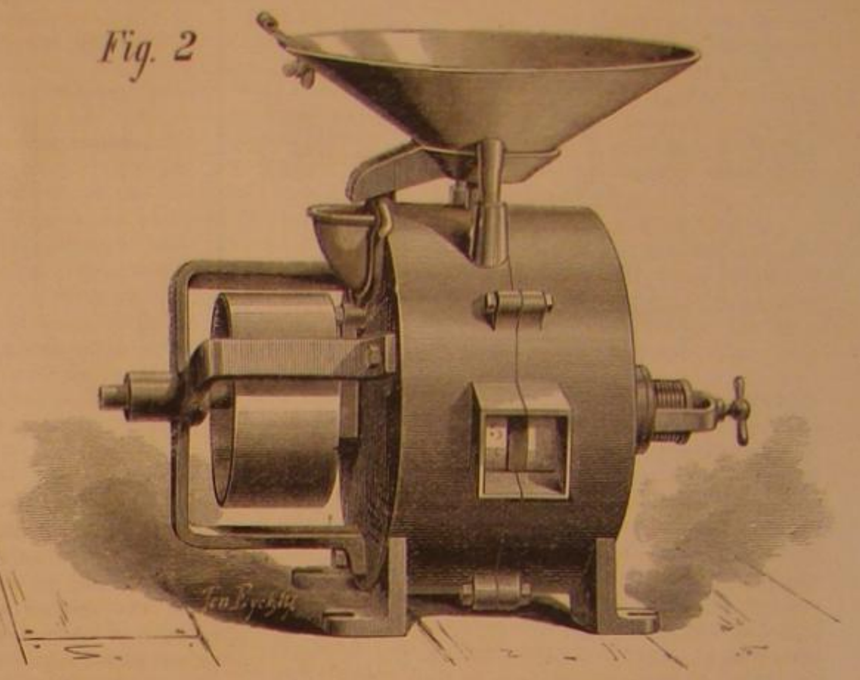


Fig. 2



HARRISON'S GRINDING MILLS.

In constructing the mills represented, the horizontal shaft was the inventor's main object; but subsequent experiment showed him other and superior advantages attaching to the form. The machines became more quiet and light running, but ground more rapidly, while their simplicity evidenced that the extensive repairs required in the use of gearing would be avoided. As now made, the mills are compact and convenient to be driven from portable steam engines or horizontal shafting. The boxes for supporting the spindles are four times longer than are usually made, extending almost through the entire mill; and they carry the runner, which is solidly attached to the spindle, in a true plane with the face of the bedstone.

Millstones and the framework on which they are usually mounted are liable to be broken by hard substances passing through the mills, which in many cases have proved destructive to life and limb. To avoid such accident, the inventor constructs his mills so that they may be readily adjusted to any desired strain; and should nails, slugs, or bolts go through the stones, the latter immediately return to their places with such accuracy that no stoppage of the machine is required, but the working position is kept, and all delay avoided.

It is claimed that anything, however hard or ungrindable, which will pass through the eye of the stone will pass out without injury to the stones or mill. In order to accommodate different articles, which require more or less strain in grinding, and each needs a pressure peculiar to itself, the mills are provided with safety springs, which can be readily adjusted or changed to suit. These are also applicable to change of pressure, needed according to the quantity to be ground, as of course it takes more working pressure to grind 50 bushels than 10 bushels of meal per hour. A common working speed for the 20 inch mill is 1,400 turns per minute, and 1,000 turns for the 30 inch mill. The small portable burrstone mills grind 50 bushels of good meal per hour, as regular work, from day to day, and have averaged as high as 80 bushels. This, the inventor claims, is due to the peculiar mode of mounting and dressing the stones, their facility for receiving grain at the eye, and the ease with which the meal passes out of the new discharge spouts. It is due also to the vertical position of the stones, the extraordinary velocity at which they run, and to such an adaptation of speed to grinding surface that, when the meal is once properly ground, it is thrown out and does not clog the furrows and consume the driving power.

The inventor has submitted to us written certificates as to the above mentioned capabilities of his mill. He further states that over 9,000 machines were sold up to the beginning of the present year

The engravings show three different types of mill, the principal points of difference being the construction and mode of adjusting the spring bearings by means of which the pressure of the stones is automatically controlled. The mills are adapted to all varieties of grinding and for every substance, whether wet or dry, hard or tough, heavy or light, brittle, or fibrous.

The strength and durability, necessary to enable these mills to be run safely at a very high velocity, is secured by the employment of the best materials, metal and stone only being employed in their construction. They are delivered to purchasers ready for use and complete running order.

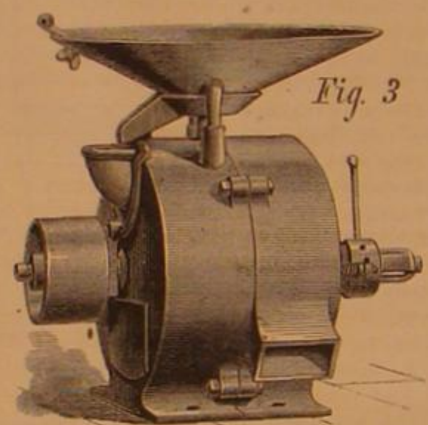
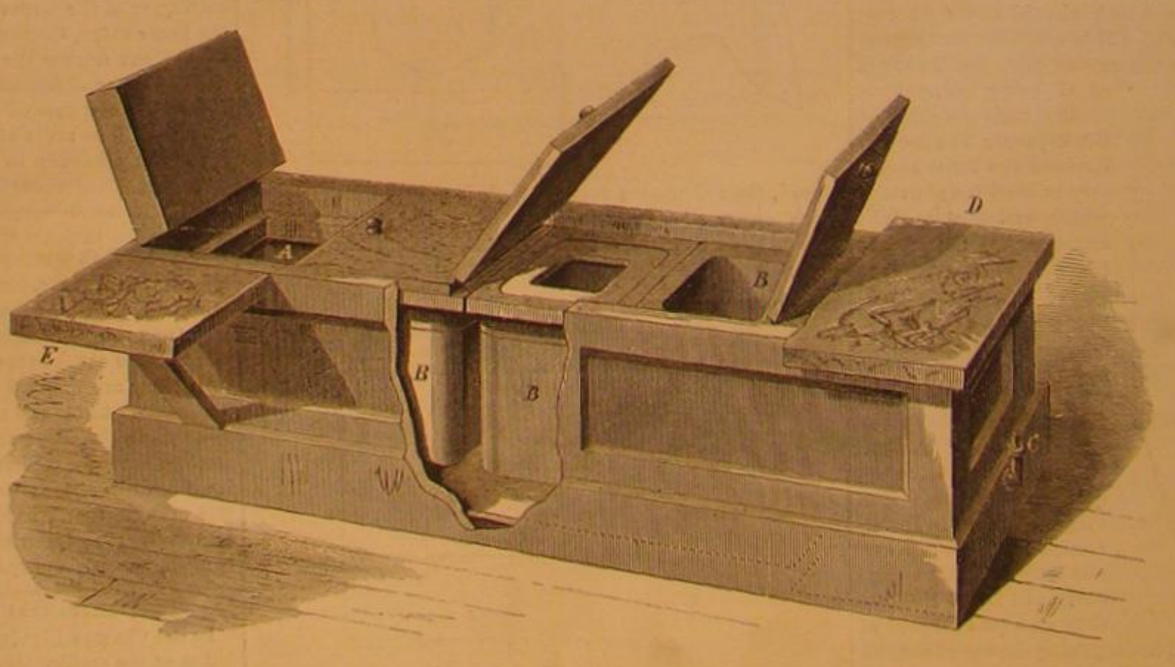


Fig. 3

For further information address the inventor and manufacturer, Mr. E. Harrison, New Haven, Conn.

IMPROVED REFRIGERATOR AND COUNTER.

We illustrate herewith a useful combination of counter and ice box, especially well adapted to the uses of dealers in butter, milk, poultry, and similar perishable staples. The idea is to convert the counter, or rather the unutilized space beneath the same, into a refrigerator. In winter, when ice is not required as a preservative, the refrigerator lids are closed, and a slab of marble or wood placed above. By this arrangement not only does the seller have his refrigerator conveniently at hand, but he is not obliged to find space for the storing of the same when its use is not required. Furthermore he is provided with an ice box of superior construction, which, by an economical employment of ice, refrigerates a large quantity of goods.



BARNES' REFRIGERATOR AND COUNTER.

From the annexed engraving it will be seen that the ice receptacle, A, is arranged in one end of the space within the counter, from the main portion of which it is separated by an open work partition which admits of the free circulation of air therefrom around the cooling vessels, B. These are supported by top flanges on side strips, so that there is an open space at their sides and beneath them, for the circulation above noted. The coolers are constructed of any suitable material, and in form suitable to the milk or solid articles which they are to contain. They may be used for milk, lard, butter, poultry, etc., or for either kind of produce alone. The lids of the coolers are hinged together in pairs, and are movable, so that they can be cleansed conveniently. The lid of the ice box is hinged to the center. The cold air from the ice receptacle keeps the coolers at a uniformly low temperature, as no air is admitted to the inside of the refrigerator by the opening of the lids of the vessels. This separate access to each cooler thus necessarily tends to economize the consumption of ice. The cooling effect of the latter is further increased by the passage of the cold drip water over the inclined bottom of the refrigerator to a depressed box in the further extremity of the same, where the water accumulates until it escapes from an adjustable faucet, shown at C.

The slab used to cover the box in winter is represented at D. When the refrigerator is in use, the lid of the ice receptacle, which need be opened for replenishing the contents but once daily, serves as a counter, and a hinged leaf, E, upheld by a brace, augments the space, and answers as a support for the scales.

The present arrangement, among the dealers in Washington and other large markets in New York city, is to pack their goods directly upon the ice when the refrigerator is used as a counter. As this is detrimental to the quality of meats and cannot be beneficial to butter in firkins, especially as that material is so easily affected by impure surroundings, the improved counter and refrigerator above described will doubtless be found an advantageous substitute.

Patented through the Scientific American Patent Agency, by Mr. H. H. Barnes, September 7, 1875. For further information relative to sale of rights and of patent, address the patentee, 1,004 Pacific street, Brooklyn, N. Y.

A Microscopical Soiree.

At the recent microscopical *soirée* of the British Association, 110 microscopes were arranged in classified divisions, devoted to crustacea, arachnidans, insects, marine and fresh water fauna, ciliary action, vertebrate circulation, fertilization of flowers, cryptogamia, microspectroscopes, etc. The idea of practically illustrating Sir John Lubbock's "Fertilization of Flowers by Insects" was novel, and so far carried out as to give a vivid idea of the processes to those who were previously unfamiliar with them. The geological division included an exhibition of the perennial *eozoon Canadense*, which must be exhibited again and again to live down the hostility to its animal nature.

THE Cincinnati Exposition closed on October 9. In spite of the prevailing business depression, the fair was in every way successful, having been visited by over 350,000 people. There will be no exhibition next year. It is intended to devote $400,000 to the construction of a magnificent brick building, in which will be held the Exposition of 1877.

ORIENTAL HORTICULTURE.

Our illustration introduces to us a curious phase of East Indian garden scenery. In the foreground is a noble talipot palm (*corypha umbraculifera*), the leaves of which are used by the Buddhist monks, prepared in small narrow strips, as books in which to record their sacred writings. The leaves of this palm are used also as umbrellas and sunshades, and everywhere the custom is universal to use them for covering huts and making temporary tents. It is one of the noblest of the palm family, growing to the hight of one hundred feet frequently. It only flowers once, and then dies.

A correspondent of the London *Gardener*, in writing of it, says: "I saw a noble grove about three years ago all flowering at one time; they had a truly grand appearance, and would produce some thousands of seeds."

At the left hand, is the sacred *bo* tree (*ficus religiosa*). Every temple has one of these in its vicinity, usually a cutting from the ancient tree at Andro Japoora, which was originally planted there by Buddha and his followers, and is said to be one of the oldest trees in the world. The temples are also always located near abundant water, and the vegetation is rich beyond description. With regard to the interest of the Buddhist religion in horticulture, Tennant's "History of Ceylon" says:

"One peculiarity in the Buddhist ceremonial served at all times to give a singular impulse to the progress of horticulture. Flowers and garlands are introduced in its religious rites to the utmost excess. The atmosphere of the wehara and temple is rendered oppressive with the perfume of champac and jessamine; and the shrine of the deity, the pedestals of his image, and the steps leading to the temple are strewn thickly with blossoms of the najaha and the lotus. At an earlier period the profusion in which these beautiful emblems were employed in sacred decoration appears almost incredible; the Mohawason relates that the *ruanwelli dagoba*, which was two hundred and seventy feet in hight, was on one occasion festooned with garlands from pedestal to pinnacle, till it resembled one uniform bouquet; and at another time, it and the lofty dagoba at Mehintala were buried under heaps of jessamine, from the ground to the summit.

"The various kings in succession formed innumerable gardens for the floral requirements of the temple. The capital was surrounded on all sides by flower gardens, and these were multiplied so extensively that, according to the rajaratnacari, one was to be found within a distance of four leagues in any part of Ceylon. Among the regulations of the temple built at Dambenia, in the thirteenth century, was: "Every day an offering of 100,000 flowers, and each day a different flower."

Another advantage conferred by Buddhism on the country was the planting of fruit trees and esculent vegetables, for the gratuitous use of travelers in all the frequented parts of the island.

On the rocks and monuments of India are edicts from the kings to their successors to continue the good work. One of their edicts, by the king of Magadha in the third century, B. C., commanded that "everywhere, wholesome vegetable roots and fruit trees shall be cultivated, and that on the road wells shall be dug and trees planted for the enjoyment of men and animals."

On the Action of Bromide of Camphor and Borate, Silicate, and Arseniate of Sodium Upon the Germination of Seeds.

M. E. Heckel says: "M. Vogel recently called the attention of physiologists to the curious results of the experiments undertaken in 1798 by Benjamin Smith and Barton, concerning the singular and unexplained property which camphor exercises upon vegetables, and he confirmed those results in their entirety. This observer, in treating the seeds of *lepidium sativum*, of *raphanous sativus major*, of *pisum sativum*, and of some other plants, placed between two sheets of blotting paper moistened with a solution of camphor, noticed that these seeds germinated long before those which had been maintained in ordinary conditions. Filled with these new ideas, and resting upon the fact, well known since the labors of Göppert, of the action of bromine, as an agent capable of hastening the germination of seeds, I asked myself, in the course of some researches touching the action of certain chemical compounds upon the germinative faculty, if the bromide of camphor, which is sometimes considered as a definite combination of bromine and camphor (the bromine replacing one equivalent of hydrogen in the camphor) and sometimes as a simple association of the same components, would present, from the biological point of view which occupied me, the sum of the properties with which the bodies composing it were gifted, or if the new chemical entity would manifest a proper attitude, decided enough to permit of a differentiation, either by the intensity or by the modality of the action, between the body and its components simply associated. With that end in view, I instituted the following experiments at the beginning of April, which have been carried on until now, with the seeds of *raphanus sativus* alone, but which I propose to extend to other seeds. Between several layers of double wadding wetted with water, I enclosed for each experiment twenty radish seeds, and I had care to have all the substances act upon the seeds under like conditions of heat and humidity.

In the first double of wadding I placed 7·7 grains of finely pulverized ordinary camphor; in the second, 7·7 grains of bromide of camphor equally reduced to powder; in the third one, sprinkled with bromine water, 7·7 grains of camphor; in the fourth one, the seeds were sprinkled with bromine water only; in the fifth one, the seeds were surrounded with 7·7 grains of crushed bromide of potassium; in the sixth and in the seventh ones, the seeds were sprinkled with chlorine water and iodine water. Incidentally, I should here say that I confirmed, by repeating the experiments, the experience of Göppert in regard to the activating action of chlorine, of bromine, and of iodine. These three bodies incontestably hasten germination, and with an intensity decreasing from chlorine to iodine. Thus, iodine water produced germination in five days on an average, bromine water in three days, and chlorine water in two days, and under normal conditions it required at least seven or eight days to obtain the same results. The action of bromide of camphor was still more rapid; in thirty-six hours the rootlets were striking.

In the double of wadding containing camphor alone, the phenomenon required between four and five days. In the third package (containing camphor and bromine water) the seeds germinated the first time thirty hours later than in the case of bromide of camphor, the second time twenty-six hours later, the third time thirty-six hours later. As for the bromide of potassium, it remained without effect, though dissolved in water; the germination was produced in the same length of time as with ordinary water These experiments, several times repeated, having always yielded identical results, I concluded that the bromide of camphor enjoyed a more considerable action than the sum of the two bodies of which it was composed, taken separately or acting in consort. I should add that the bromide of camphor acts without being dissolved. M. Vogel employed camphor in solution; the same solvent might have been employed to dissolve the bromide of camphor, which is insoluble in water, but without utility, since I obtained the two bodies simply pulverized. It must be admitted that they act by vaporization. I extended my researches to the boron and silicon series; I found the alkaline borates and silicates, employed in small quantities (3·9 grains for 309 grains of water), retarded germination from one to three days, and that with larger quantities (9·02 grains for 309 grains of water) the phenomenon was suspended entirely.

Arsenious acid and the soluble arseniates arrest germination and destroy the embryo, when relatively small quantities are employed (3·9 grains for 1,380 grains of water.")—*Comptes Rendus de l'Academie des Sciences*, 1875.

An Electrical Fish Bait.

In the Paris International Maritime Exhibition there is a small object deserving of notice. It is a platinum wire placed in a bottle and ignited by electricity from a bichromate battery. It is intended to be immersed in the sea, and the light emanating from it is said to attract an immense number of fishes. Experiments have been tried lately on the coast of the Côtes du Nord department with a fishing boat, and have proved very satisfactory, on a bank of sardines. The glass must be green or black, otherwise the fish are frightened by the glare and do not follow the submarine light

To tin small castings, clean and boil them with scraps of block tin in a solution of cream of tartar.

A BUDDHIST GARDEN IN THE EAST INDIES.

USEFUL AND CURIOUS INVENTIONS.

Below we give engravings of a number of ingenious inventions, extracted from the pages of Knight's "New Mechanical Dictionary."* These devices, as will be seen, relate to various subjects, the selection being governed either by their novelty or their peculiar adaptation to the various purposes for which they are designed.

KNAPSACKS.

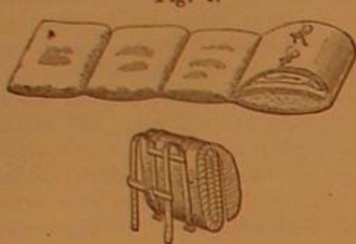
Of these, in Figs. 1 and 2, we give two ingenious examples.

Fig. 1.

Weber's Knapsack.

Weber's invention, Fig. 1, has a frame which may be changed into a couch, the cover forming a shelter. The central section has jointed and folding sides. Frodsham and Levett's knapsack, Fig. 2, consists of an india rubber casing, made watertight and containing a bag of finely cut cork, so as to convert it into a life preserver. A pocket is made in the rubber casing to contain articles of clothing, thus forming a knapsack, which, when unrolled, becomes a bed, the combined articles serving as a pillow.

Fig. 2.

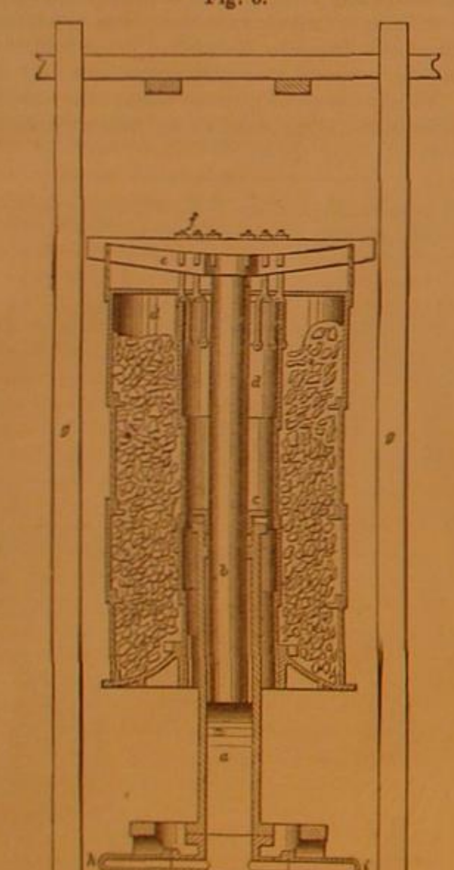


Frodsham and Levett's Knapsack.

ACCUMULATOR.

This is an apparatus used in working hydraulic cranes and other machines where a steady and powerful pressure of water is required. As shown in Fig. 3, it consists of a large cast iron cylinder, *a*, fitted with a watertight plunger, *b*, to which is attached a loaded weight case, *d*. Thus a pressure is obtained upon the water in the cylinder, equal to a column of water 1,500 feet high, or 660 lbs. to the square inch. As the water is pumped into the cylinder by the engines through the pipe, *h*, the piston with the weighted case rises, being guided by the strong wooden framework, *g*, and is made to regulate the amount of water pumped in, by actuating a throttle valve in the steam pipe of the pumping engine, which it closes after having reached a certain hight. When the cranes, etc., are in operation, the water passes from this cylinder through the pipe, *i*, to those actuating the motion of the cranes, and the weighted plunger naturally descends, always keeping up a constant pressure upon the water. In descending, the same causes the throttle valve to open again, and the water is again pumped in.

Fig. 3.

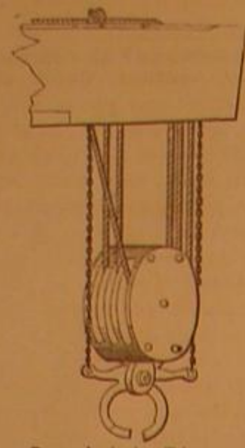


Accumulator.

AN ANCHOR TRIPPER

of ingenious construction is represented in Fig. 4. The anchor hangs from a clutch ring on the catblock, which is suspended below the cathead. When the fall is cast loose, the block descends, and the clutch is opened by the chains, which are attached to the cathead and to the projecting levers or prongs on the respective halves of the clutch. A single motion, the slackening of the fall, operates the tripper; the clutch is opened when the chains are made taut, by the descent of the block.

Fig. 4.



Duncan's Anchor-Tripper.

THE ARCOGRAPH.

Fig. 5 is an instrument for describing arcs of circles without the use of centers. A thin pliable strip of metal has its ends attached to a wooden bar which may be sprung into the required shape and then fastened by set screws. This device is susceptible of many variations, and is useful as a template or marker for different purposes.

ANGLE JOINTS

differ according to the material, thickness, purpose, and exposure. In Fig. 6 we give representations of several forms. *a b* are joints which are entirely dependent upon solder; such are used with tin ware and sheet lead. *c* is a miter joint. It is used for thicker metals with hard solders. *d* is a butt joint, otherwise similar to *c*. *e* is a lap joint; the metal is creased over the hatchet stake or by the spinning tool. It requires solder. In the joint shown at *f*, one plate is bent rectangularly, and the other is doubly bent, so as to recurve back on itself, lapping around the edge of the other. It needs solder to keep it from slipping apart. *g* has a fold to each plate; these lock upon each other and require no solder to perfect their hold, although it may be added to make the joint airtight and watertight where the closure is not absolutely perfect. *h* is a riveted joint, one plate being bent to lap upon the other. This joint is called the folded angle, and is common to all kinds of work. In *i* the edge of one plate is formed into tenons which enter mortises in the other, and are there riveted. *j* resembles *i*, except that the tenons are prolonged so as to be retained in the mortises by cotters. In *k* one plate makes a butt joint with the other, and is attached by L-formed rivets or screw bolts, the heads of which are riveted to one plate, while their screw stems pass through the other plate, and are fastened by nuts. At *l* two plates are shown, secured by being bolted or riveted to an angle iron, which is straight or bent into sweeps according to the shape of the object.

Fig. 5.

Arcograph.

Fig. 6.

Angle-joints.

Fig. 7.

Angular Gearing.

In Fig. 7 is represented a mode of

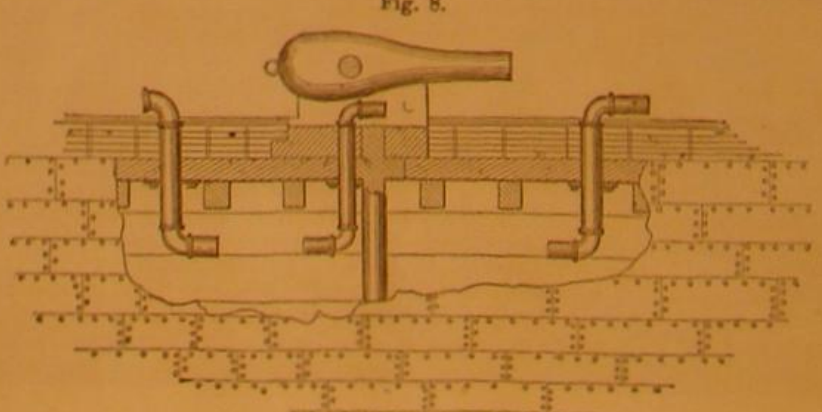
ANGULAR GEARING.

The wheels are quadrilateral, and the speed of the driven wheel is variable. The driving wheel, rotating at regular speed, will impart a quicker rate to the other wheel when the angle of the former is in contact with the flat side of the latter, and conversely. This device has been used in printing presses.

STEVENS' ALTISCOPE.

This invention, represented in Fig. 8, affords a means of training guns to a given angle with the axis of the vessel or on an object, while the gunner remains beneath the deck. There is attached beneath the deck, to the pintle of the pivoted gun, a graduated index plate by which its horizontal bearing may be read. A telescopic tube, with two rectangular bends and with reflecting mirrors at the angles, is so placed as to be used from beneath the deck; two of these may be so situated as to form a base of sufficient length to obtain, by simultaneous observation, the distance by triangulation. Two screw propellers, working in contrary directions, rotate the vessel so as to bring the guns to bear on the required point. The upper and lower limbs of the telescopic tube are parallel; the one above the deck is presented toward the object, the other to the eye. The image of the object, after being twice reflected, reaches the eye of the observer, whose body is not exposed. This device entered into other ingenious appliances connected with the Stevens battery.

Fig. 8.



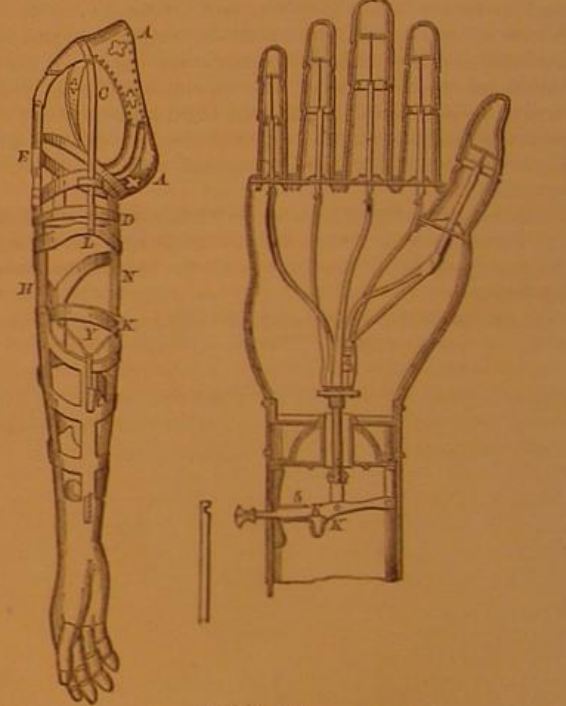
Stevens's Altiscope.

A large amount of ingenuity and inventive skill has been directed toward the replacing, by mechanical devices, of members of the body lost through accident or disease. In Fig. 9 we give an

ARTIFICIAL ARM

and hand, in which there are arrangements for moving the fingers and thumb. The shoulder cap is the basis for the various movements. The strap, C, is hinged to the cap, A, and connected by a rod to the ring, L. The straps, D E of the upper arm, are also hinged to the cap and the lower part of the upper arm; from the ends of the straps, D E, proceed the slotted bars, N, to whose lower end the forearm is pivoted. The three straps mentioned are the means of suspension of the arm, forearm, and hand, and the stump of the natural arm within this outer skeleton is the means of imparting motion to the forearm, wrist, and fingers. The ring, L, is connected to the strap, C, and hinged to the forearm behind the elbow joint; it is guided in its motions by the slotted bars, H N, sliding down the said slots as the stump is moved forward, and thereby thrusting upon the point of the elbow and flexing the forearm. Pivoted to the bars, H N, near the elbow axis, are the bifurcated ends of the wire, Y, which actuates the fingers and thumb, flexing them as the arm bends by means of tension on the tendons, which pass through the metacarpus and then diverge to follow the phalanges. By means of the lever, K, the spring slide, 5, and the notched slot, the thumb and fingers can be connected to or disconnected from the arm and forearm, so as to receive motion therefrom, or otherwise, as may be desired. In the rotary movement of the stump, the upper end of the strap runs on a rod attached to the shield, A, under the axilla.

Fig. 9.



Artificial Arm.

Effects of Stress upon the Magnetism of Soft Iron.

In the physical laboratory at Glasgow University, Sir William Thomson stretched steel and soft iron wire, about twenty feet long, from the roof. An electro-magnetic helix was placed round a few inches of the wire, so that the latter could be magnetized when an electric current was passed through the former, the induced current thus produced in a second helix outside the first being indicated by a reflecting galvanometer. When steel wire was used, the magnetism diminished when weights were attached to the wire, and increased when they were taken off but when special soft iron wire (wire almost as soft as lead) was used, the magnetism was increased when weights were put on, and diminished when they were taken off. Afterwards he discarded the electrical apparatus; and by suspending a piece of soft wire near a magnetometer consisting of a needle, a small fraction of a grain in weight, with a reflecting mirror

* Published in numbers by J. B. Ford & Co., New York

attached, the wire was magnetized inductively simply by the magnetism of the earth, and changes in its magnetism were made by applying weights and strains, the changes being then indicated by the magnetometer.

SCIENTIFIC AND PRACTICAL INFORMATION.

DISCOVERY OF A NEW ELEMENT.

At a recent session of the French Academy of Sciences, M. Wurtz presented a communication from M. Lecoq, announcing the discovery of a new simple body, a metal analogous and allied to zinc and cadmium, and found in blende or sulphide of zinc in Spain. The existence of the substance was revealed by spectral analysis, two lines appearing which could not be traced to any other other element. The lines are situated in the violet, the region in which the brightest zinc lines are found; one is very brilliant and takes, in the table of wave lengths, the 417th place; the other and weaker one has its wave length represented by 405. The new metal has not been reduced from its combinations, so that its physical characteristics remain undetermined. It has been obtained, however, in the state of hydrochlorate and sulphate, and its distinctive features have been so clearly recognized, showing its marked difference from either zinc or cadmium, that there is considered to be no reasonable doubt as to its existence. The discoverer patriotically names the new metal gallium in honor of France.

TESTING POTABLE WATER FOR ANIMAL MATTER.

Most of our readers are already aware of the danger arising from the use of water which contains animal excreta, or other animal matter in a state of putrefactive decay. Although no certain test has yet been found for these matters, it is not difficult to detect the decomposition products which always accompany them, and when the latter are absent we may safely conclude that the former cannot be present. This indirect analysis involves testing for carbonate of ammonia, nitrous and nitric acids, phosphoric acid, chlorine, and sulphuric acid.

The test for carbonate of ammonia is best made with a few drops of corrosive sublimate solution, or a little of the Nessler test. Nitrites are detected by slightly acidifying the water and adding a starch solution which contains iodide of cadmium. To test for nitrates, acidify with a few drops of dilute sulphuric acid, immersing in it for a minute a rod of zinc or cadmium, and then adding the starch and iodide of cadmium. Phosphates are detected with most certainty by a few drops of a concentrated solution of acetate of uranium.

JAPANESE BRONZES.

M. E. J. Maumené writes as follows: We recently received bronzes from Japan, the composition of which presents great interest. Their origin has been well and precisely established; they come from public monuments and from temples of habitation where great luxury reigned, which is attested by the dimension of most of the pieces imported, and which were destroyed during the great religious and political struggle which ended a few years ago.

We had occasion to analyze these bronzes, and here are the most striking results:

	No.1.	No.2.	No.3.	No.4.
Copper	86·38	80·91	88·70	92·07
Tin	1·94	7·55	2·58	1·04
Antimony	1·61	0·44	0·10	"
Lead	5·68	5·33	3·54	"
Zinc	3·36	3·08	3·71	2·65
Iron	0·67	1·43	1·07	3·64
Manganese	"	trace	"	"
Silicic acid	0·10	0·16	0·09	0·04
Sulphur	"	0·31	"	"
Waste	0·26	0·79	0·21	0·56
	100·00	100·00	100·00	100·0

The complex alloys thus formed are all of a granulat ed texture, blistered on the interior surface, full on the exterior surface (which can be readily polished with a file), showing a varied shade, which is sensibly violet when antimony is abundant, red when iron is present, etc.; all the specimens were cast in slight thicknesses, from 0·195 to 0·468 inch, and the molding was well filled. It appears from analysis that these alloys were not made with pure metals, but with entire minerals. We should, says the author, consider these bronzes as resulting from direct employment of copper pyrites and antimonial galena mixed with blende; and the calcination was not always complete, as the presence of sulphur in specimen No. 2 proves.

Antique alloys, Greek, Roman, old French, etc., present indications of the same nature: but we have never observed so great a complication and such clear proofs of the simplicity of metallurgic work.—*Comptes Rendus de l'Academie de Sciences*, 1875.

NEW AFRICAN EXPLORATIONS.

Mr. H. M. Stanley, the reliever of Dr. Livingstone, is now chief of an African exploring expedition fitted out by the New York *Herald* and the London *Daily Telegraph*. Letters recently received from him have appeared in those journals, from which the first tidings of his labors may be gleaned. Starting from Zanzibar on the coast, he began a journey of 720 miles to the great Victoria Nyanza lake. His progress was impeded by hostile savages, by the unknown nature of the country, and by the fearful mortality among his followers, 126 out of the 300 men which composed the expedition falling in battle or succumbing to disease; despite these obstacles, however, the march was accomplished in 103 days, an incredibly brief period when it is considered that by the natives the distance is counted as a nine months' journey. Launching his sectional steamer on the lake, Mr. Stanley began his explorations; and of those undertaken in April and May, the results are now reaching us.

The most important discovery thus far made is the verification of Speke's description of Victoria Nyanza as one great inland sea. This is contrary to the later decisions of many eminent geographers, who believe the lake to consist of a number of small bodies of water united by streams or tracts of frequently overflowed marshy country: a new view upheld by Speke's comrade the explorer Burton, and even by Dr. Livingstone himself. Stanley now, however, demonstrates Speke's account to be strictly accurate, and thus secures to that explorer the fame of being the first discoverer of the true source of the Nile.

PRESERVATION OF MEAT BY COMPRESSED AIR.

We recently described a discovery of M. Bert, relative to preservation of meat through keeping the same in a hermetically sealed compartment under a pressure of several atmospheres. M. Reynoso proceeds a step beyond M. Bert, and announces that, if the meat be removed from the compressed gas after remaining therein for several weeks, it may be exposed to the ordinary atmosphere indefinitely without decomposition. This was accidentally discovered through a fragment of flesh from the compression apparatus being left unnoticed in the laboratory. M. Reynoso finds that the meat dries slowly, keeping its color, odor, and consequently its fleshy taste.

The Relation of Patents to the Various Industries.

At a recent meeting of the New York Society of Practical Engineers, President James A. Whitney delivered an address on "The Relation of the Patent Laws to American Agriculture, Arts, and Industries." Passing over those portions of this address which present, in a concise and forcible manner, the several arguments and authorities in favor of these laws, we would direct especial attention to the following interesting historical and statistical information regarding several important American inventions. "Beginning with the printing press, we learn that the one used by Franklin over one hundred years ago gave but one hundred and thirty impressions an hour; as the result of successive patented improvements, this capacity was so advanced that in the year 1847 a machine had been perfected—the Napier double cylinder press—by which from twenty-five hundred to five thousand impressions an hour could be made—the former of large, the latter of small, newspaper size. It was then believed that with this machine the limit of speed had been reached, and yet the public demand for more newspapers and periodicals was advancing rapidly. It was at this juncture that the American inventor Richard M. Hoe brought forward his improved printing machinery, and, as the result of his genius and mechanical skill, it was soon brought to so great perfection that, in the year 1861, one of the New York papers printed a daily edition varying from one hundred and fifteen to one hundred and thirty thousand copies, all printed in four hours and a half. Though it is not claimed that this was the work of a single press, yet to have accomplished the same work on Napier presses would have required five additional forms of type, each at the cost of one thousand dollars a week, or two hundred and sixty thousand dollars a year. Another kindred invention, and one effecting even a greater relative improvement, was the Chambers folding machine. This was the invention of Cyrus Chambers, to whom the first patent was issued about the year 1859. In the year 1874, seventy-two of these patent news folders, for folding newspapers alone, were in use. Regarding the work accomplished by these machines in the several departments of paper, magazine, and book making, we read: "The cost of running these machines was $2 a day each, and each accomplished the work of five men. The same work by hand cost $8.75 per day, being a saving of $6.75 a day for each machine, and these newspaper folders alone, during the original term of the patent, effected an economy of labor amounting to upward of $1,165,000. During the same period the paper folders for duodecimo publications saved in labor more than $353,000; for octavos, more than $139,000: for quartos, more than $64,000; and for 32mos, more than $522,000—making from this one patent alone, in less than fourteen years, a saving of human toil and exertion amounting to more than $2,243,000. Thomas Silverthorn, the poor mechanic who invented the copper-toed shoe, little knew the significance and value of this simple idea. Through its adoption, it is estimated that from $6,000,000 to $12,000,000 are annually saved to the country, and yet the humble inventor had to wait for his good fortune until his patent was extended, when it was bought by a company for $67,000. Henry Burden, the inventor of the first successful machine for the manufacture of horseshoes, was able to sell a finished shoe, including the iron, for four and one half cents, whereas to make the same by hand would have cost sixteen cents, not including the iron. While the absolute benefit to the public by this invention cannot be calculated, it is known that the gain to the government alone during the late war amounted to $4,000,000. Under the head of "Profits of Patentees compared with Profits of the Public," the following interesting facts are presented: There is now in common use a little staple for fastening the rods to the slats of Venetian blinds. It has corrugated shanks to hold in the wood without clinching, and for this reason requires so much less iron in its manufacture that in five years' trade, in this country alone, it is estimated that five thousand tuns of wire have been saved. Seventy-five tuns of these little staples are used in the United States every year, at a yearly saving to the public of $100,000, while $20,000 was all that the inventor, Byron Boardman, received as his share. We are forced to pass over without mention many equally interesting and significant facts, of all of which Mr. Whitney makes use in confirming his views regarding the value of patents in fostering industry by rewarding the inventor, showing at the same time that the gain to the latter is by no means excessive compared with the saving to the public. A closing illustration enforcing this claim, and one which will be readily recognized by the housekeeper, may here be cited: Formally, when a tin can was soldered up, it was difficult matter to open it, but in 1859 John W. Masury hit upon the idea of making a portion of the cover of very thin metal, which could be easily cut through with a knife. Ten millions of these cans are made yearly. The Borden Condensed Milk Company use ten thousand each and every working day in the year. The invention is largely used in the paint trade, as it enables paint to be put up in liquid form, ready for use, therefore saving the painter's time and trouble in mixing paint. The United States Circuit Court decided the value of this improvement to be not less than three cents for each pound can; but the inventor granted licenses under the patent for a royalty of one quarter of a cent per pound can, that is to say, for every twelve cents the public gained from the invention, the inventor was content to gain one cent."

The above (from *Appleton's Journal*) contains only a small portion of Mr. Whitney's address, which abounds in interesting statistics, exhibiting on the part of the author a remarkable degree of research. We shall take occasion to make further extracts in a future issue.—EDS.]

Subterranean Festivities.

We acknowledge the receipt, too late, however, to enable us to get there, of a ticket to a grand "Basket Picnic and Subterranean Ball," given October 13, 1875, in the bowels of Leavenworth Mountain, within Marshall Tunnel, vicinity of Georgetown, Colorado. Our invitation says:—

"For the information of visitors it may be stated that the elevation of the Tunnel is 9,500 feet above the level of the sea, and the dance hall is 810 feet in from the mouth of the Tunnel, and is 500 feet below the surface. From the mines cut by this tunnel millions of dollars have been taken—

And below this argentiferous floor
Are many, many millions more.

The exercises will be opened by a brief address from Commodore Stephen Decatur.

Guests are privileged to ride on the palatial rock cars from mouth of tunnel to hall.

The festivities will be prolonged until ten boxes of wax candles are consumed."

Effects of Heat on Steel Wires and Rods.

Professor W. F. Barrett has found that, if steel of any thickness be heated by any means, at a certain temperature the wire ceases to expand, although the heat be continually poured in. During this period also the wire does not increase in temperature. The length of the time during which this abnormal condition lasts varies with the thickness of the wire and the rapidity with which it can be heated through. It ceases to expand, and no further change takes place till the heat is cut off. When this is done, the wire begins to cool down regularly till it has reached the critical point at which the change took place on heating. Here a second and reverse change occurs. At the moment that the expansion occurs, an actual increase in temperature takes place, sufficiently large to cause the wire to glow again with a red-hot heat. It is curious that this after-glow had not been noticed long ago, for it is a very conspicuous object in steel wires that have been raised to a white heat and allowed to cool.

The Electric Light as a Military Signal.

The roof of the Siemens-Halske factory at Berlin, was recently the scene of a series of experiments with the electric light, which filled all the streets in the vicinity with a crowd staring with astonishment at a supposed wonderful natural phenomenon, up in the clouds. The apparatus, which gave a light so powerful that ordinary writing could be read by its illumination at a mile distance, was arranged with an inclosed mirror, so that the rays were projected against the clouds, which served as a screen. In front of the mirror the signals were made, and these were repeated, of course on a gigantic scale, in the clouds. The light is to be adopted to the German army for night signaling.

The Force of Expansion.

The boiler stack (60 feet in hight) of the Ohio Iron Company, of Zanesville, recently fell with a sudden and heavy crash, killing one of the furnace men instantly. The boiler had just been heated up, after having been cold, when the stack gave way. It appears that the gas flame had destroyed the inside lining of the stack, and had partly destroyed some of the brick and weakened the brickwork, so that, when the stack became suddenly heated again, the expansion resulted in the demolition of the whole structure.

New Oil Car.

A. P. O'Dell, of Oil City, Pa., is the author of a new oil tank car, which, if it fulfils the expectations of the inventor when put to a practical test, will greatly lessen the cost of transporting oil to the seaboard. The tank is swung underneath a platform, which can be used as an ordinary gondola car for carrying freight on the return trip. At present the tank cars have to be returned empty, which is a dead loss in freight.

To render glass impervious to the direct rays of the sun, but not so opaque as to exclude light, powder some fluorspar and mix it with sulphuric acid, and rub the mixture on the glass with a piece of lead. Then heat the glass on some stove or other arrangement by which the fumes can pass up the chimney; and when cool, wash the plate with a dilute solution of potash, and rinse in water

Important to Inventors and Patentees

REDUCTION IN THE COST OF FOREIGN PATENTS.

MESSRS. MUNN & Co. take pleasure in announcing that they have effected arrangements by which the cost of Patents, in all Foreign Countries, for American Inventions is Greatly Reduced, and they are now ready to receive applications for such patents at the annexed rates, which include both Government and Agency fees for all ordinary cases.

Some applications may require a number of drawings, and a specification of unusual length, for which an additional charge will be made. But the annexed very low prices will be adhered to, except in special cases, when the inventor will be notified of any additional cost before any expense is incurred.

CANADA.

The expense of applying for a Canadian Patent is reduced to $50, currency.

A Canadian Patent is granted for 15 years, divided, if the applicant desires, into three terms of five years each. The expense of applying for the 5 year patent is $50. Model and drawings required as in this country. American inventions already patented here can be patented in Canada if the application is filed within the one year from the date of the American patent. Caveats can be filed in Canada. Expenses, $25 in full. Send for pamphlet giving all particulars.

ENGLAND.

The expense of applying for an English Patent, which covers England, Scotland, Wales, Ireland, and the Channel Islands, is $75, currency, payable in advance, and an additional fee of $175, payable within 3½ months, to complete the patent. Certain government taxes are required after 3 years. Patents granted to the first person who files in the complete specification and pays the fees, whether he is the original inventor or merely the introducer. For full particulars, send for pamphlet.

FRANCE.

The expense of applying for a French Patent is reduced to $100, currency, payable $75 on making the application, and $25 on arrival of the Patent. A small annual tax is required after the first year. For amount of this tax and particulars about working the patent, see pamphlet. Sent free.

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GERMANY AND AUSTRIA.

The expense of applying for Patents in Germany and Austria is $100 each, payable in advance. Send for pamphlet giving details.

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GENERAL REMARKS.

No models required in any of the Foreign Countries except Canada; and sometimes in Prussia, the officials require a model when in doubt about the novelty of the invention, but it is seldom that one is demanded, and never till the application is secure.

All persons who desire to take out Foreign Patents are requested to communicate with the undersigned. They may depend that their cases will secure prompt and careful attention. We have had an experience of nearly *Thirty years* in the business of soliciting American and Foreign Patents; and as is well known, a very large proportion of all patents obtained by American citizens, both in this country and in foreign lands, are solicited through the Scientific American Patent Agency.

To secure a foreign patent, all that is necessary is to write to the undersigned, transmitting the fees and a copy of specifications and drawings. We can then at once proceed. The personal presence of the applicant is not necessary.

A pamphlet, giving full detailed information regarding each country, sent free. Address, MUNN & CO.,

Office of the SCIENTIFIC AMERICAN, New York.

Recent American and Foreign Patents.

Improved Horse Boot.

John B. Hall, St. Paul, Minn.—This invention relates to boots or wrappers for horses' feet, to aid in the cure of diseased feet, and consists in a boot or wrapper applied to the foot, having attached thereto a spring plate to press against sponge on the frog.

Improved Wrench.

Richard J. Welles, St. Joseph, Mo.—The handle is threaded and movable on a screw shank so as to form an adjustable jam nut to the revolving nut, through which the sliding jaw is moved.

Improved Corset.

Daniel H. Horne, New York city.—This corset has bosom-supporting cups of suitable wire gauze, which are connected by sockets with the stays. As the air passes readily through the wire gauze, the corsets are cool and healthy.

Improved Wagon Spring.

Lucien B. Devendorf, Utica, N. Y.—This spring is so constructed as to prevent the box from tipping when getting into and out of the wagon, and which may also serve as a reach in skeleton wagons. The springs are inclined or curved upward from the ends toward the middle, and bent inward so that their middle parts cross each other.

Improved Magazine Fire Arm.

Emil A. F. Toepperwein, Boerne, Tex.—This improved repeating fire arm is contrived with a sliding breech block, which is drawn back by a crank on the right hand side of the gun, connected with a pair of toggle levers, pivoted, respectively, to the breech closer and the breech frames. There is a cartridge lifter below the block, which is thrown up to present the cartridge to the barrel by an arm of the block just before it comes to rest in the backward movement. The shell is partly expelled by stops, against which the lower edge strikes at about the same time, and the new cartridge finishes the work, and it is held in position by a spring, when the lifter drops back, till the breech block pushes it in the barrel. The cartridges are put into the magazine through the opening made by sliding the breech block back, the block being moved not quite far enough to throw up the lifter.

Improved Tripod for Rock Drills.

Joseph C. Githens, New York city.—This is a tripod and clamp for holding the shield, in which the steam cylinder of a steam rock drill moves up and down. It is so constructed as to hold the cylinder securely while the drill is being used, and to enable the drill to be adjusted to work at any desired level and at any desired angle.

Improved Escapement for Watches.

Edouard Bourquin, La Heutte, Switzerland.—This invention is an improvement in the escapement whereby one pallet is made to serve the purpose of the two commonly used, and so arranged that it works with less friction, and is more certain in its action. There are two rows of reversely inclined teeth on the side of the scape-wheel, in combination of a single pallet in the lever. The teeth are arranged to receive and lock the pallet by their points, and give the impulse by their inclines.

Improved Plane Guide.

Walter S. Shipe, Minerva, O.—This invention improves the plane guide for which a patent has been granted to the same inventor under date of January 6, 1874, so that it will work more steadily and accurately, and be readily set to any desired angle. The invention consists, mainly, of a recessed handle extension of the yoke part in connection with a slotted arc piece of the guide strip-connecting plate, the arc piece being pivoted to the yoke and set by a clamp screw thereto. A wire key with bent end is inserted into a hole of the guide strip for being readily available for turning the clamping screw nuts.

Improved Crozing and Leveling Tool.

Samuel S. Steel, of Martin, and George W. Reel, of Woodville Ohio.—The stock of the leveler or plane, which is made of segmental form, has a projection on its inner or concave edge, to which the crozing tool is attached by means of studs. The crozing plate has a projection to which the crozing cutter is attached. In using the tool, the thumb is placed on a piece, and spring pins are pressed through the stock, so that their ends bear upon the inner surface of the stave ends, and thereby prevent the crozing bit from cutting while the barrel is being leveled.

Improved Machine for Bending Wire Frames of Bottle Stoppers.

Charles de Quillfeldt, New York city.—This invention relates to a machine for bending rapidly and accurately the wire parts of bottle stoppers, being mainly designed to manufacture the wire lever frame and yoke of the bottle stopper, for which a patent has been granted to the same inventor under date of January 5, 1875. The invention consists of different mechanisms, to which the wire blanks are fed for being bent in consecutive order into the required shape, one wire lever frame or yoke being turned out at each revolution of the driving shaft.

Improved Combination Lock.

Alfred E. Peters, Moncton, Canada.—This invention consists of a spring-acted roller with interchangeable pins, that are acted upon by spring bars depressed by a pin inserted through perforations of the face plate. The springs are engaged by a sliding and toothed spring bar that releases the preceding spring, and secures thereby the return of the spring-acted roller, except when the correct combination is set in regular succession, which prevents the return of the roller and allows the throwing of the bolt.

Improved Colliery Plant.

Rufus A. Wilder, Cressona, Pa.—The coal is dumped into the chutes above the platform. When it is covered with dirt from the mines it is washed, by means of the attached hose, with water under pressure. The fine parts unfit for use, as well as the water, run off below the platform. In this state, the men employed on the platform to assort the coal can easily distinguish the pure from the impure, and cast the latter upon the conveyer, to the rear of the platform, which carries it to the dirt wagons or elevators for that purpose, while the former is separated, if desired, and the lump and such sizes as it is not desired to break are thrown upon the side conveyer, which takes it directly to the loading chutes, while the rest is thrown upon the conveyers in front of the platform and moved to the breakers. Over the breaker is a slotted pipe, which throws a thin stream of water into the breaker, to lay the dust produced by breaking the coal. As the coal falls from the breaker upon the next conveyer, which delivers it to the elevator, it is struck by a forcible stream of water, steam, or compressed air from the pipe under the breaker, to assist in spreading the coal over the surface of the conveyer, and partially separate it from the slate. Along each side of the conveyer, boys or men are seated to pick out impurities. At the end of the conveyer there is a thin opening under a separating plate, to take out small, thin pieces of slate not observed by the pickers, while the revolving rakes assist in moving the coal over this plate to the buckets of the elevator, which take the coal to the head of the chutes. A movable conveyer at the head of the elevator is used to convey and separate the coal, as conveyed from the main chutes to any number of platforms placed parallel to the tracks of the railroad.

Improved Journal Box.

John Schellkopf, Tidioute, Pa.—The object of this invention is to provide a simple form of adjustable journal box; and it consists in a journal box provided with diametrically opposite pivots, in combination with holders upon each side, one of which is provided with a socket or depression which receives and supports one of the pivots of the journal box, and the other of which holders is provided with an elongated depression or mortise, which receives the other pivot of the journal box; by means of which construction the said journal box is free to adjust itself upon its pivots as an axis, and has also an adjustment at right angles thereto, equal to the length of the mortise.

Combined Wheat Drill, Corn Planter, and Roller.

Samuel Brown, Lebanon, Mo.—The invention relates chiefly to hinging the frame that carries the hoppers, to the main frame, in which the revolving roller has its bearings, and providing the roller with cams which operate the seed slides through the medium of levers pivoted to the hinged frame.

Improved Heel for Boots and Shoes.

Robert Vint, Brooklyn, N. Y.—The outer surface of a casing forms an exact extension of the heel portion, while the inner is tapering toward the lower edge to form a rim that guides a conically tapering heel plate of rubber that is attached to cushioning band springs securely attached to the casing. A recess in the stiffening plate may also be used to secure the skates. The heel plate fits exactly into the tapering casing, and has shoulders which serve to form contact with the interior of the casing and give a perfectly level position to the heel plate when depressed by the foot. The under side of the heel plate is made grooved or channeled. When the heel plate is pressed up far enough to be within the extremity of the heel casing, the rim of the same is brought into use, and thereby the wearing out of the heel plate retarded.

Improved Cultivator.

Martin McNitt, Mound Station, Ill.—This invention is an improvement in the class of cultivators whose teeth are attached to pivoted bars, whereby their pitch may be adjusted at will. The improvement relates to the arrangement of the pivoted handles of the implement to act as pawls in conjunction with the ratchet bars, by which the rack bars are adjusted and held in any position.

Improved Cartridge Case for Blasting.

Paul A. Oliver, Wilkesbarre, Pa.—The invention consists of a cartridge shell provided with one or more tubular sections that telescope therein, for adjustment to the requisite length.

Improved Mining Machine.

J. J. Weirrel, Allegheny Township, Pa.—The invention relates to means whereby a coal drill may be conveniently adjusted and operated in the mine, and consists in novel combinations by which a person can drill more closely to, and more nearly with the walls of the mine, thus leaving nothing to be trimmed with the pick.

Improved Baling Press.

Christopher C. Campbell, East Chatham, N. Y.—This invention relates to certain improvements in perpetual baling presses, or presses in which the platen and follower are successively interchangeable, and the operations of pressing and tying are both conducted at the same time, the compressed bale being held in position for being tied, while the box is being filled and the succeeding bale pressed. It consists in the peculiar construction and arrangement of the stop devices for holding and retaining the follower in the rear of the bale, which has been forced into the slotted portion of the box ready for tying, so as to admit of the filling of the box in the rear for a new bale.

Improved Centrifugal Water Wheel.

J. H. Meacham, Petersburg, Va.—The invention relates to turbine wheels adapted to be run by the vertical or centrifugal action of a liquid, and consists in a wheel of conical form, with curved grooves running from apex to periphery of base.

Improved Hat-Brushing Machine.

Simon P. Siver and George H. Swords, Fishkill Landing, N. Y.—This consists of a conical hat-carrying roller and a conical revolving brush, arranged side by side to brush the hat between them, and contrived so that the brush can be swung away from the roller and back again readily, to facilitate the adjusting of the hat body.

Improved Balance Valve.

John F. Allen, New York city, assignor to George T. Hope, Bay Ridge, N. Y., and Charles T. Porter, New York city.—This valve is balanced so that it can be adjusted to any pressure at any time without opening the steam chest. It will lift when a locomotive engine is running after the steam has been shut off, and prevent the piston from pumping air into the boiler by allowing the air to escape from the front to the rear of the piston under the valve. It also acts as a relief valve to the engine in case the cylinder is filled with water.

Automatic Bale-Rolling Attachment for Compressors.

Henry Riesel, Galveston, Tex.—This device is designed especially for attachment to the press known as Tyler's cotton compress, but is applicable to other presses, for rolling the bale, when compressed and bound, from the press to the floor. It consists in a bar provided with two or more forwardly projecting prongs upon its upper end, the spring latch, and the inclined bar, in combination with the follower and the base of the press. When the follower is down in the position to receive the bale, the prongs of the bar rest in the grooves of the said follower, and the bale, when placed upon the follower, rests upon them. After the follower has been raised, the bale compressed, and its bands secured, it is again lowered. As the follower descends, the lower end of the bar strikes against the latch, which stops the said bar, and causes the prongs of said bar to rise against the rear part of the lower side of the bale, and roll or tumble it off the follower. As the follower continues to descend, an inclined bar strikes the latch and pushes it back from beneath the bar, allowing the said bar to drop into place, and the machine is ready to receive another bale.

Improved Sinker for Fishing Lines.

Edward Pitcher, Brooklyn, N. Y.—This sinker is cast with looped wires at each end. The inner extremities of the wires concealed in the body of the sinker are swiveled therein.

Improved Farm Fence.

Joseph E. Winters, Fincastle, Ohio.—This invention consists of posts which are set by feet, legs, or spikes, on a rock or block, and connected by slats in zigzag or worm shape, for supporting a light straight paling running intermediately between the posts placed in the front and rear of the same.

Improved Roller Bearing for Speeders, etc.

Samuel Dyer, Natick, R. I.—A bearing plate and a screw are used to attach and support the bearing, the said plate and the bearing being screwed on to a lug under a cup. The removable bearing plate is introduced, so that when worn, it can be easily and cheaply replaced.

Improved Clip for Fellies and Tires.

Robert Ray, Carrollton, Miss.—This invention consists of a meta clip to wrap around the joints of the felly of a wheel for splicing and holding it, and having flanges to clip the edges of the tire and hold the tire on the felly without bolts or screws.

Improved Heater.

Mifflin W. Bally, Pottstown, Pa., assignor to himself and R. J Baldwin, of same place.—A valve in the hot air passage is so balanced that when the registers in the room to be heated are closed, and but little air is passing up through the opening from the furnace on which the valve is seated, the valve will fall and close the register and open an air inlet above the fire, thus checking the same; but when more air passes by the increased draft caused by more open registers, the increased pressure on the valve will lift it and close a damper, and open an air inlet to increase the fire accordingly, thus automatically regulating the fire by the hot air delivered into the rooms.

Improved Machine for Cutting Roll Paper.

Louis P. Cohen and Ignatz Frank, New York city, N. Y.—This an improved machine for cutting rolls of any width directly from the roll papers, for telegraph rolls and other purposes; and it consists mainly of movable roll-clamping standards provided with one or more revolving ring-shaped heads carrying the cutting knives that are fed forward simultaneously by suitable mechanisms.

Business and Personal.

The Charge for Insertion under this head is $1 a Line.

Notes & Queries

A. P. can cement leather to wood by using good glue.—C. F. S. will find a recipe for a red marking ink on p. 129, vol. 28.—G. W. H. will find a good recipe for mucilage on p. 251, vol. 31.—H. D. P. will find directions for gilding moldings on p. 347, vol. 31.—G. H. R. will find a recipe for hair wash on pp. 267, 363, vol. 31.—A. W. P. will find a formula for fulminating powder on p. 90, vol. 31.—W. B. and D. A. R. will find directions for proportioning cone pulleys on p. 100, vol. 25.—N. H.H. will find a recipe for filling for millstones on p. 251, vol. 31.—G. W. will find directions for removing peach stains from linen on p. 283, vol. 31.—C. A. B. will find directions for gold and silver plating on p. 405, vol. 32.—J. B. can caseharden his plow moldboards by the process described on p. 42, vol. 33.—F. D. T. will find explanations of the egg-hatching process in the *Science Record* for 1874.—W. R. B. will find directions for grinding a parabolic mirror on p. 276, vol. 30. Silvering glass is described on p. 234, vol. 30.—W. B. I. will find directions for preserving cloth goods from mildew on p. 90, vol. 31. Dyeing wool black is described on p. 75, vol. 32. Dyeing feathers on p. 299, vol. 31.—W. F. R. will find directions for mounting chromos, etc., on p. 91, vol. 32. Cleaning gilt frames is described on p. 27, vol. 31.—W. R. H. will find directions for making fruit jellies on p. 281, vol. 26.—J. C. will find directions for exterminating moths in fur on p. 388, vol. 29.—C. M. W. should read the SCIENTIFIC AMERICAN, and he will not then waste his time on the perpetual motion nonsense.—H. B. B. will find a description of the hydraulic ram on p. 269, vol. 31, and one of the construction of windmills on p. 241, vol. 32.—C. S. will find a formula for the dimensions of a fly wheel on p. 288, vol. 28.—C. E. F. will find a full explanation of the ball dropped through the earth coming to rest on pp. 138, 250, vol. 31.—C. H. S. can color paraffin with any aniline dye.—H. Y. will find that the proportions of a fly wheel are given on p. 288, vol. 28. The temperature of compressed air is discussed on p. 123, vol. 33.—H. B. can galvanize iron by the process given on p. 347, vol. 31.—A. Y. S. can waterproof canvas by the process described on p. 347, vol. 31.—E. H. P. is informed that the maximum pressure of steam depends on the maximum temperature. See p. 81, vol. 29.—G. F. G. will find a description of the carving pantagraph on p. 95, vol. 33.—C. W. M. will find directions for making plaster of Paris on p. 399, vol. 29.—C. T. S. can clean rust off an engine by the method described on p. 267, vol. 33.—J. L. B. should not run the risk of spoiling her hair by using nostrums, which are always deleterious.—A. A. D. can make battery carbons by the process described on p. 35, vol. 33.—W. R. should apply to Seth Green, Esq., Rochester, N. Y., for the best method of stocking a stream with trout.—E. H. will find a description of lap and lead on p. 101, vol. 32. Crucibles are described on p. 309, vol. 31.—J. F. W. will find a recipe for axle grease on p. 90, vol. 31.

(1) J. A. M. asks: How can I clean stone ware jars that have had muriatic tin crystals in them, so that they can be used for fruit, etc.? A. The tin may be removed by muriatic acid.

(2) J. M. H. says: The phenomena referred to on p. 193, vol. 33, can be easily and satisfactorily explained by supposing that the boiler in the first case was quite hot and not of very large size, but of thick iron; and the water being introduced—not very rapidly—the small quantity became heated intensely, producing the 190 lbs. pressure indicated. In the other case, it is probable that the boiler was not so much heated as supposed, or the boiler iron not so heavy, or both, or the water may have been introduced much faster than in the first instance. If the boiler was not very hot and the water was introduced quite rapidly, it would have had precisely the effect stated. The first water introduced would be converted instantly into steam, which was suddenly condensed by the rapid cooling of the boiler and its contents by the working of the pump. These are the several conditions which, I think, would, separately or together, have produced the results stated. A. Our correspondent is entitled to especial commendation for the clear and satisfactory explanation here given. Of course the causes of such occurrences must be matters of theory to a great extent, but J. M. H.'s views are very reasonable.

(3) J. P. M. says: Having had a conversation with the late chief engineer of the United States Navy, he says tallow or grease of any kind should never be used in the cylinder of any engine, only a little pure beeswax on the piston rods. Ought we to stop using tallow, as we now do? A. If you are sure that the tallow is pure, you may continue to use it without fear. But in general, we think it is preferable to use good oil.

(4) A. B. C. asks: There are two boilers in Rensselaer county, N. Y., which are running without safety valves or steam gages. Is there any law to prevent this? They are old boilers, but have recently been repaired. A. We do not think there is any law, and we can scarcely believe that any one would be foolhardy enough to carry much pressure under such circumstances. We wish you would send us further particulars. If the owner of the boilers is running them in entire ignorance and carelessness of the pressure, you will be doing good service by sending us his name for publication. We may add that, in the absence of a special preventive law, the owner of these boilers can be prosecuted on the complaint of any one who thinks that he is conducting his business in a manner that is dangerous to the community.

(5) J. A. D. asks: How can I polish wrought iron? A. Warm your goods till they are unbearable to the hand; then rub with new clean white wax. Heat the goods again so that the wax may soak in them; then rub them over with a piece of serge.

(6) G. R. asks: Is there a practical way of determining when an engine is precisely on the center, independent of the guides? A. Strike on the end of the crank a circle of the same size as the crank pin; then (for a horizontal engine) place the crank pin as near the center as the eye will direct, then place a straight edge with one end resting on the crank pin and the other even with the corresponding diameter of the circle. Upon the straight edge rest a spirit level, moving the crank till the level stands true. If, however, the cylinder is not set quite level, first place the spirit level on the piston rod, note how the bubble stands, and then move the crank pin till the bubble of the spirit level, applied as directed, stands as upon the rod.

(7) F. H. D. asks: 1. Is there any difference in the tractile power of a locomotive drive wheel when the crank goes over or under the axle in ascending a grade? A. No. 2. Is the leverage on the axle the only leverage there is in ascending a grade? A. Yes, as we understand your question.

(8) C. A. asks: Why does a ball, fired from a barrel 6 inches long, fail to go straight to its mark at 10 yards distance? A. The barrel is too short to throw a ball with any degree of accuracy to the distance you mention. The resistance of the air to the ball at such a distance also causes deviation

(9) J. W. K. says: I have been told that some planters in Louisiana employ electricity in the process of purifying cane juice. The juice itself is said to form part of the battery. Is this so? A. We have never heard of such use of electricity, and do not think the statement can be correct.

(10) C. S. R. asks: 1. How can I put a point of metal or iron on a worn-out metal plow point, in a common smith's fire? A. The remains of the old steel or the plow will show the shape of the weld. Use shear or cast steel, using borax as a welding compound; be careful not to overheat the steel. 2. How can I temper cold chisels, and drills for drilling iron and other metals, and stone? A. You will find directions for tempering drills and cold chisels for metal, etc., in "Practical Mechanism," No. 4, p. 21, vol. 31. To temper cold chisels for stone, heat the chisel in a charcoal fire, and temper to a brown color.

(11) E. A. K. asks: What can be added to a tempering solution that will give the steel a bright silver color without impairing the tempering qualities of the solution? A. Nothing.

(12) F. B. M. asks: How can I test gold with acid, and what kind of acid is used for that purpose? A. The touchstone used for this purpose is a piece of black basalt, or even black slate, over which the gold to be tested is drawn so as to leave a streak of the fine particles upon the surface. This streak, of course, remains untouched when moistened with nitric acid; but if a streak of any base alloy (of copper and zinc, for example), made to imitate gold, be made upon the touchstone, the nitric acid will immediately dissolve it. The acid employed in this test is generally mixed with a minute proportion of muriatic acid (98 parts by weight of nitric acid, of specific gravity 1·34, 3 parts hydrochloric acid of specific gravity 1·173, and 25 parts water. The streak is not apparently affected by the acid if the gold is not below 18 carats fine; by making several streaks in succession, or by grinding off a portion of the surface upon the touchstone, any error arising from the thin external coating of fine gold may be avoided; a feather or glass rod serves for moistening the streaks with the acid. In order to determine by the touchstone the proportion of gold which is present in the alloy, the streak is compared with that made by a series of touch needles, composed of alloys containing gradually diminishing quantities of gold. In experienced hands the quantity of gold may thus be ascertained, with an error of not more than one part in a hundred.

(13) G. B. asks: 1. Will a copper ball, made hollow and perfectly tight, float on the water inside a steam boiler with the steam at any desired pressure? A. Yes. 2. Will the heat of the steam injure a brass or steel spring? A. Yes. The injury to a well made spring will be very slight, however.

(14) B. T. P. asks: Please give me directions for tinning wrought iron wire. A. Clean the wire, cover it with a solution of muriate of zinc, and dip into melted tin.

I wish to send some dead birds 1,500 miles. How can I prepare them so as to prevent decomposition? A. It will be best to pack them in ice and sawdust or tan bark.

(15) N. A. W. asks: What are hyperbolic logarithms? A. The hyperbolic logarithm of a number is the power to which it is necessary to raise the quantity 2·7182818, in order to produce the given number.

(16) J. J. M. says: A Hunter's screw has a lever 51 feet long. The distance between the threads of larger screw is 1 inch, and between those of the smaller, ¾ inch. How much weight can a man whose power is represented by 175 lbs. move with such a screw? A. Disregarding friction, the relation of the force to the weight is about as 1 to 1,200, that being the proportion between the distances passed over by each in the same time.

(17) J. A. McC. asks: Is there any kind of steel that may properly be called a natural production? A. Steel is an artificial production, in the sense in which that term is ordinarily employed. There is no native steel.

(18) F. B. asks: Upon a railroad car in rapid motion, I let fall a ball striking the floor. A friend says that the ball will strike at precisely the same point that it would if the car were standing still. I say the projective force given to me and the ball by the engine ceases to act upon the ball after it leaves my hands until it strikes the floor, hence the floor is a curved line. A. Your idea is correct, but the time of descent is so slight that the curve is practically a straight line.

(19) J. B. F. says: I have a pair of cylinders, 2½ inches bore × 4 inches stroke, and a boiler with 169 tubes of half inch internal diameter; outside shell is 18 inches in diameter by 28 inches high. I want to run a boat 30 feet long by 5½ feet beam. 1. What will be the size of a propeller suitable for this engine and boat, pressure of steam being 150 lbs.? A. Use a propeller of from 28 to 30 inches diameter and of 3 to 3½ feet pitch. 2. What speed could be obtained with the above? A. Probably from 6 to 7 miles an hour.

(20) C. J. A. says: 1. I have a muzzle-loading rifle that carries a ½ oz. round ball, and a 1 oz. conical ball; and with the same elevation of sight, same kind of patch, same charge of powder, and sighted at same object, it will throw the conical ball nearly twice as far as the round one. Why is this? A. The conical ball, on account of its shape, encounters less resistance from the air than the other. 2. In shooting over water for a thousand yards or more, does it cause the ball to fall more than it would over the same distance of land? A. No.

(21) W. H. L. asks: What is the most simple way to make a battery for plating? A. See answer to F. C., on this page.

(22) J. T. H. asks: Who is Darwin, and what is his doctrine? A. He is an English naturalist, and his theory is that all animal forms have a common origin. This is commonly known as the theory of evolution.

A friend says that if a thimbleful of gunpowder be confined in a solid block of steel of 4 feet cube, and ignited, it would burst the steel. I say it would not. Which is right? A. You are.

Suppose I have two tubes with 4 inches of water in one and 10 inches in the other, and I put 1 inch of water more into each tube, will this last inch create any more pressure at the bottom of one tube than the other, the tubes being the same size? A. Yes, as we understand your question.

Will a 3 horse engine do the same amount of work that 3 good horses do? A. An engine exerting an effective horse power can do more work than an ordinary horse in a given time.

(23) F. O. says: The floor of my verandah is made of tongued and grooved boards, and painted over. The boards have shrunk, and water leaks through in rainy weather. I have filled the space between the boards with putty, but would it not be best to cover the whole floor with canvas or duck, tacked on and covered with paint? A. Try asbestos cement, which is procurable from the manufacturers of heavy iron skylights.

(24) J. C. asks: What is the proper way of setting picket fence posts? The posts are 3½ feet above ground, tapering from 5x5 inches to 5 x 3 inches. A. It depends upon what kind of picket fence you wish to build. If the rails are to be sunk into the sides of the posts, in the usual way, and the pickets extend above the top of the posts, set the latter so that they will appear of uniform width from top to bottom when viewing them from the front or back; set the front side of the post perpendicular, and let the incline be entirely on the back.

(25) W. A. asks: Has anything been invented of the nature of a looking glass for discovering anything at the bottom of deep water? A. Marine telescopes for this purpose have long been in use. Some of them are provided with lamps.

(26) N. K. B. asks: Can you give a formula for finding the area of an inscribed regular polygon, when the perimeter of polygon and area of circumscribed circle are known? Can you give formulas for finding the number of its sides? Are the data sufficient when only one polygon will answer the conditions? A. We do not think that direct formulas could be given, but the solution might be made by the aid of properly constructed tables.

(27) A. B. S. asks: 1. Where was the first railroad built in the United States? A. From Milton to Quincy, Mass., in 1826. 2. Where was the first in the South? A. The Baltimore and Ohio railroad was commenced in 1828, and 15 miles were opened to travel in 1830.

(28) A. L. M. asks: What is meant by the number of inches of water used in driving a turbine wheel? A. It refers to the size of the aperture, as generally employed.

In a recent issue you say one requisite for an artesian well is that it should be surrounded by mountains or high land. If so, how does it work in a level desert? A. The high land in such a case is at a great distance.

Can you explain how logarithms are calculated? A. You will find the formula, in as simple terms as it can well be expressed, on p. 283, vol. 32. The whole subject is well treated in Law's "Logarithms," Weale's series.

Would hickory sawdust do to make paper pulp of? A. You should address a wood paper manufacturer.

How is the angle for bevel gearing found? I have a plan for finding it which, if not identical with yours, I will communicate. A. We should be glad to see your method. It is quite a simple problem.

(29) C. B. B. asks: What method is used to obtain the brilliant polish usually observed on steel watch chains, buttons, etc.? A. Use first emery (on belts), then crocus, and lastly rouge or polishing powder.

(30) M. says: I want a 50 horse power boiler, but can get from none of the makers satisfactory information as to what constitutes a horse power. Makers of tubular boilers rate their boilers by the number of square feet of heating surface that they allow to a proportionate amount of grate surface, and they range all the way from 10 to 22½ square feet. We are thus led to infer that a horse power is merely a nominal thing. But there must be something definite that constitutes in all cases a horse power in a boiler. The makers of some sectional boilers claim that the evaporation of 30 lbs. water into good dry steam per hour constitutes a horse power, therefore the evaporation of 1,500 lbs. of water per hour will give me a 50 horse power boiler. This seems like something tangible, but is it correct? Must a boiler evaporate that amount per hour in order to fill the requirements, and should a boiler that falls short of doing this be rated less? A. There is no standard for the horse power of a boiler. The proper way to rate the capacity of the boiler is by the number of lbs. of saturated steam that it will furnish in a given time, as, for instance, an hour.

(31) J. W. F. asks: Please give me directions for crystallizing pears, cherries, etc., to produce articles equal to the French fruits. A. Wash carefully, and then dry, dip in thin gum arabic, and sprinkle with finely granulated sugar.

(32) J. N. P. says: "The Catechism of the Locomotive" gives the following rule for calculating the average or mean pressure when steam is used expansively in the cylinder: Divide the length of the piston's stroke in inches by the number of inches at which steam is cut off; the quotient is the ratio of expansion; find the hyperbolic logarithm of the ratio of expansion, add 1 to it, and divide the sum by the ratio of expansion, and multiply the quotient by the mean absolute steam pressure in the cylinder during its admission. The result will be the mean absolute pressure during the stroke." Why do I have to add 1 to the logarithm? A. It is the result of a mathematical investigation too long to be given here, but which you will find explained in works which treat of the theory of the steam engine. 2. How do I find the hyperbolic logarithm of a number? A. To find the hyperbolic logarithm of a number, multiply the common logarithm by 2·302585.

(33) G. B. asks: What can I use to form a hard transparent varnish for paper, that will stand handling and cleaning with water? A. We think that good dammar gum in turpentine will give satisfactory results.

(34) F. C. asks: 1. How can I construct and use the simplest battery that can be made for gold and silver plating? A. Put a little sulphate of zinc in a jar of water; place a piece of sheet copper, to which a wire is soldered, at the bottom of the jar, and suspend a piece of zinc at the top. Connect the zinc with the object to be plated. The wire from the copper, which should pass through a glass tube in the jar, is then connected to the other electrode in the plating solution. A few lumps of blue vitriol must be dropped in the battery after it is set up, and more added from time to time, but care must be taken that the blue line does not quite reach the zinc. From one to three cells will be required. 2. Would an unglazed flower pot do for a diaphragm? A. It is probably baked too hard.

(35) E. G. F. says: A friend asserts that a locomotive will pull more than it will push. I contend that its power is equal in both directions. Which is right? A. You are.

(36) A. S. G. asks: 1. What is the chemical reaction in the Grenet battery? The fluid is sulphuric acid, water, and potassa bichromate. No gas is perceptible, but a little vapor condenses on upper part of cell. A.

$$K_2Cr_2O_7+4H_2SO_4=2KCr_2SO_4+4H_2O+3O$$
$$3Zn+3H_2SO_4=3ZnSO_4+3H_2$$
$$3H_2O$$

2. In using a small induction coil I find that, on bringing my finger near one pole of outer coil, sparks pass, seemingly from the finger to the coil. I can feel nothing from the other pole unless the circuit is made through me. Changing the direction of primary current seems to make no difference; the same pole receives sparks, and the other is indifferent. How is this? A. Appearances seem to indicate that one end of the coil is not properly insulated from the base. 3. What is the object of the pole changer on induction coil? A. Convenience in reversing the direction of the current, which is often desirable in experimenting with Geissler tubes and for cutting the battery out of circuit.

(37) S. H. L. asks: Is there any process by which ivory, exposed to the atmosphere, may be made to retain its original whiteness? A. Cover it with some transparent protecting varnish.

(38) P. K. W. asks: 1. If a filter be built of brick in a cistern closed at the top, and covered with water, will not pumping out of the filter draw more water into the filter? A friend claims the pumping does not help to draw the water in the filter, that it only runs in of its own accord. A. Your friend is right. 2. I claim that air can be forced in the filter until it will exceed the pressure of the water outside the filter, and keep the water out. Is this so? A. Unless the top of the cistern be airtight, you cannot force air into the filter to a greater pressure than that of the atmosphere without; and if it is airtight, and the spring is near the bottom of the filter, the water will still enter the filter as high as the top of the spring, or until it traps it. If the spring is in the top of the filter, the water will entirely displace the air, and fill the filter, no matter what is the pressure.

(39) J. S. S. asks: How much power is required to run a 3½ feet burr, to grind 6 bushels of meal per hour? A. From 4 to 5 horse. It would be more economical, however, to use a smaller mill for this limited amount of work.

(40) C. B. B. says: I have a toy steam engine, and the engine, which screws on to the boiler, is rusted in so that I cannot unscrew it. How can it be unscrewed? A. Heat the connection in a gas flame.

(41) W. W. says: I read, on p. 187, vol. 33, in reply to G. D.: "It is likely that the law of your State, forbidding the sale of goods manufactured under your patent without a seller's license, may be enforced," etc. As letters patent under the law of Congress are to grant unto the patentee, his heirs or assigns, for the term of 17 years, the exclusive right to make, use, and vend his invention throughout the United States and the Territories thereof, will not State legislation, which imposes conditions and burdens on the rights thus guaranteed, in effect abrogate a law of the general government? A. Any State law which imposes special taxes upon patented goods, or aims to interfere with the free exercise of a patentee's privileges in the sale, manufacture, or use of his patent or invention, is invalid. This has been so decided by the United States Courts. On the other hand it has also been held that States have a right to impose equal taxes for the support of their local governments: have a right, for example, to tax their own citizens and all other persons who vend goods within the State. All venders are treated alike, and the vender of patented goods is not excused from such taxation.

(42) E. M. R. recently asked: "Why does water shorten a rope?" One of our learned professors charged with the answering of this query gave the following reply: "We were under the impression that wetting a rope exposed to strain caused it to stretch." The absurdity of this answer has been noticed by several of our correspondents. Everybody knows that the wetting of a rope exposed to strain or when not exposed to strain causes it to shorten. This is doubtless due to capillary attraction, by which the water is drawn in between the fibers with such force as to push them apart, thus causing a longitudinal contraction of the rope. The energy of the contractile force developed by wetting strained ropes is often usefully applied, and there have been many remarkable examples. C. L. T. tells that he was riding on a train when the locomotive got off the track; it required lateral movement of two inches for replacement. No appliances were at hand except a large dry rope. This was attached to the locomotive and to the trunk of a neighboring tree, then strained as tightly as possible. All hands were set to work to wet the rope, which quickly began to contract, and soon the locomotive was on the rails again. J. A. T. says: In the army a man is always supposed to be left in charge of a certain number of tents, to loosen the stay ropes in case of rain; and I recollect, upon one occasion when this precaution was neglected, a heavy rain coming on, all the posts to which these guys were attached were drawn out of the ground by the shortening of the ropes, and the tents were soon flying before the wind. B. says: All housekeepers have an experimental knowledge of the contractile power of wetted clothes lines in drawing the rope posts out of perpendicular.

(43) L. K. L. says, in reply to a query as to the maximum speed ever attained by steamboats: The Daniel Drew, the Mary Powell, and the Chauncey Vibbard, Hudson river steamers, are the three fastest steamboats in the world, remarkable time having been made by all. I have been informed that the Daniel Drew has made 25 miles per hour. The Mary Powell has beaten this, having made 27 miles an hour. But best of all, and I got it from good authority, the Chauncey Vibbard has run from West Point to Newburgh, 10 miles in 20¼ minutes, or at the rate of a little less than 30 miles an hour.

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 Coast of Texas. By F. W. R.

On Steam Boiler Phenomenon. By W. B., and by P. K.

On Gravity on the Earth and the Moon. By F.C.

Also inquiries and answers from the following:

J. C.—R. K. T.—J. C.—J. S.—J. B. H.—E. B.—C. A. A.—J. S. B.—W. H. R.—L. F.—S. W. J.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells aneroid barometers? Whose is the best steam pressure gage? Who makes telescope objectives? Why do not makers of ships' compasses advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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DESIGNS PATENTED.

8,663.—GLASSWARE.—J. C. Gill, Pittsburgh, Pa.

8,664.—CHILD'S CARRIAGE.—L. B. Harrington, Jr., Boston, Mass.

8,665.—HANDLES.—C. F. Haviland, Paris, France.

8,666.—BOTTLES.—G. C. Ovens, Red Bank, N. J.

8,667, 8,668.—FANS.—C. Rowland, New York city.

8,669.—SIGN.—F. McLewee, New York city.

8,670, 8,671.—BOTTLES.—W. R. Warner, Philadelphia, Pa.

8,672.—INKSTAND BASE.—B. Brower, New York city.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,

September 28 to October 2, 1875.

5,216.—E. H. St. John, Springfield, O., U. S. Sewing machine. Sept. 28, 1875.
5,217.—J. S. Bogle, Springfield, O., U. S. Seeding machine. Sept. 28, 1875.
5,218.—H. Courtellle, New York city, U. S. Manufacture of blasting powder. Sept. 28, 1875.
5,219.—H. S. Wolf, South Bend, Ind., U. S. Cleansing gas retorts. Oct. 2, 1875.
5,220.—L. E. De Waru, Philadelphia, Pa., U. S. Forming seams of boots, leather, etc. Oct. 2, 1875.
5,221.—G. S. Thompson, Port Hope, Ont. Threshing machine. Oct. 2, 1875.
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5,237.—C. C. Holman, Hamilton City, Ont. Box. Oct. 2, 1875.
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