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Scientific American



AN ILLUSTRATED

JOURNAL OF ART, SCIENCE & MECHANICS

Vol. XXXI.

NEW-YORK
PUBLISHED BY MUNN & CO.

Центральна Наукова
БІБЛІОТЕКА ВРИ ХПІ
Інв. № 110623

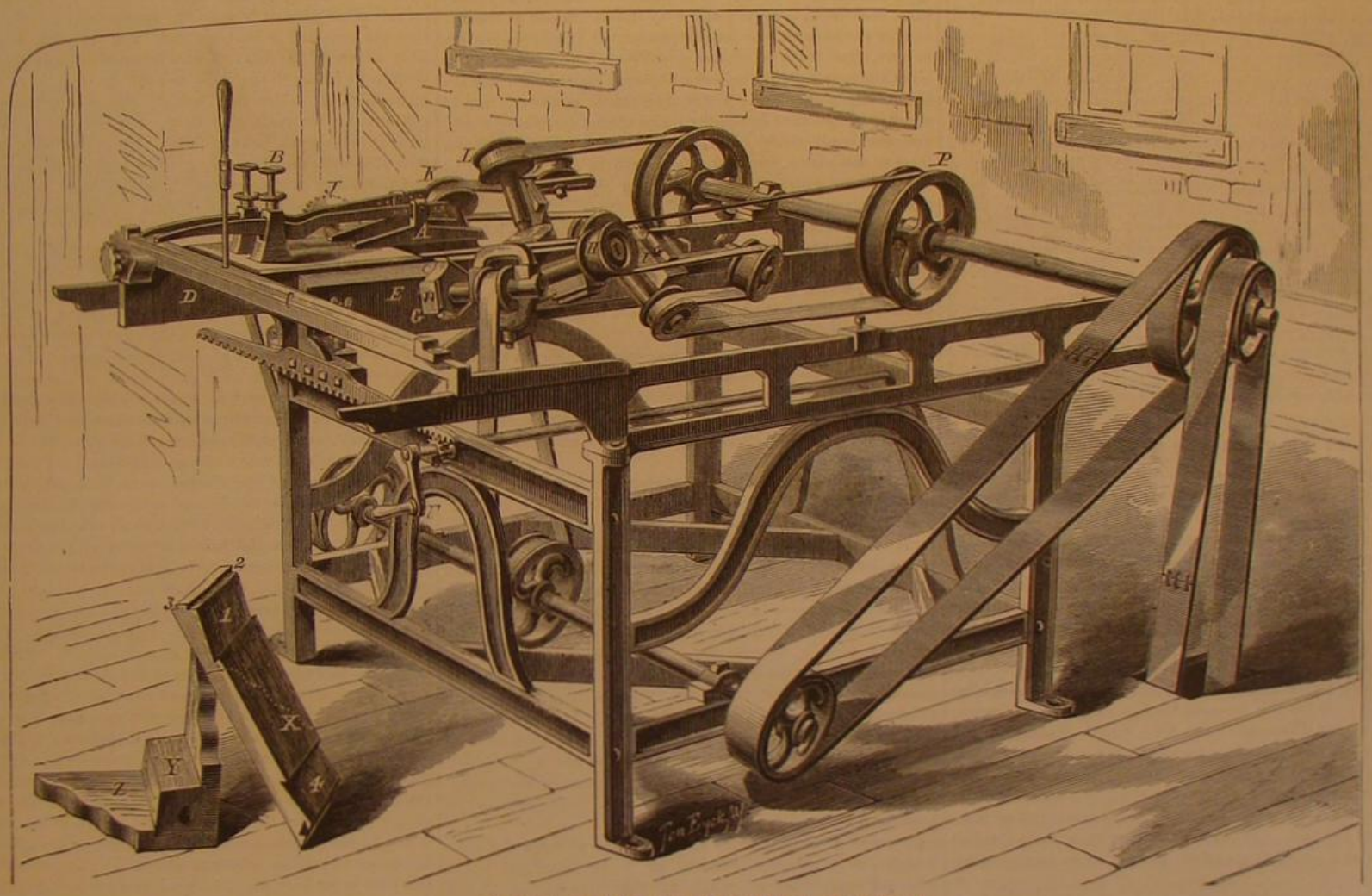
SCIENTIFIC AMERICAN

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

Vol. XXXI.—No. 1. (NEW SERIES.) NEW YORK, JULY 4, 1874. $3 per Annum, IN ADVANCE.

IMPROVED DOVETAILING MACHINE.

In 1839 Ari Davis obtained a patent for a machine for making a miter dovetail joint. Upon that device, within a few years, improvements were made and also patented. These were followed by other modifications, added by Mr. Asahel Davis, the brother of the inventor, each augmenting the capacity of the apparatus, and all ultimately uniting in the production, at the present time, of the machine which forms the subject of our engraving and of the following description.



DAVIS' MITER DOVETAILING MACHINE.

In briefly summing up the capabilities of the device, we may state that it cuts to length and squares and dovetails both ends of the boards operated upon, at once, requiring them to be passed through but a single time. It can be changed for different length of stock while running, as easily as the guide on a saw bench. The dovetailing is accomplished on any bevel, angle, or flare, with great accuracy, and a rabbet or groove is also cut for an inside corner. It is claimed that the machine will prepare boards so as to make from six hundred to one thousand cheap boxes per day of ten hours, doing its work in cross-grained or knotty lumber as well as upon clear stuff, and with very little more expenditure of time. It is well adapted for casket and coffin work, ornamental box work, and for the manufacture of trays, hoppers, moldings, picture frames, cornices, patterns, and, in short, of all flared and many-sided objects.

Referring to our illustration, Fig. 1, at A are feet which serve to hold the board to be operated upon firmly in place. These are connected with levers which pass through standards, and the play of which is regulated by the set screws, B. In order to raise or lower the feet, so as to place or release a board, the outer lever arms are connected with a cam bar, C, to which a handle is secured. By carrying the latter from a vertical to a horizontal position, the bar, C, is turned, thus raising the lever arms, and so forcing the feet firmly down upon the work.

The board rests upon traveling ways, one of which, D, moves upon the outer portion of the frame of the machine. The other moves upon the frame, E, which is arranged upon a support having a motion transverse to the apparatus, so that the ways may be adjusted to suit varying lengths of boards to be cut. This adjustment is effected by means of a horizontal rack connected to the moving frame, in the teeth of which engages a pinion rotated by the crank, F. Upon the bar of the frame, to which the pinion is secured, is marked a suitable index, by means of which accurate adjustments may be made. The cutters and tools upon the moving frame are actuated by the pulley, P, which is arranged to slide freely along while revolving with its shaft.

The board being placed as we have described, is carried over the machine in the direction from left to right in the engraving; and during its passage both of its ends encounter certain cutters and saws, which form it in the shape represented in the portion, X, shown to the left, on the floor. To understand this operation, it is necessary to consider the action upon each end separately, and therefore we will begin with the upper extremity of the board, as represented beside the machine. This, it will be observed, has the male portion of the dovetail, which, when being cut, rests upon the traveling piece on the frame, E. As the stuff is carried along, it is first met by the cutter, G, which forms half the inside dovetail, which is marked 1, in the sample piece, X. A second cutter on the arbor, H, then makes the lower half of the male dovetail of the miter joint, marked 2. At I, a saw and cutter are so arranged that the former cuts off the

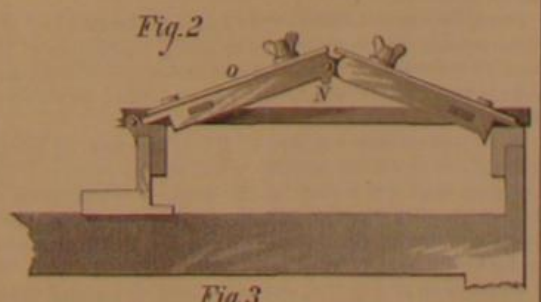


Fig. 2



Fig. 3

board and thus determines the length of the male portion of the dovetail, while the latter, a thick tool, forms the other re-entering portion, 3, thus finishing the end.

The other extremity of the board is first met, as before, by a cutter similar to G, which makes the other half of the inside dovetail, 4, then by a saw, J, which cuts the end to the proper miter. A tool at K next forms the upper half of th female dovetail, and another saw, at L, finishes by making the lower half of the same. If now the piece, X, be cut diagonally in two, in the direction of the spiral dotted line, and its dovetailed ends fitted together, a third piece, Y, slipped into the inside dovetail, formed by 1 and 4, completes the joint, which appears as in the second sample piece, Z.

All the various heads belonging to the cutters which we have described are arranged with set screws, so as to be adjustable to cut the dovetails deeper or wider, and in order to compensate for wear.

In Figs. 2 and 3 is shown an attachment for guiding boards at suitable inclinations to the saws, so as to be mitered to any desired angle. This consists in a table, N, hinged in the middle, the angle formed by the parts of which becomes greater or less as the movable way is carried further from or nearer to the stationary one. The board laid upon the inclined surface is presented to the tool at the angle to which the table is adjusted. In order to cut the edge for flaring work, such as hoppers, caskets, etc., after the table, N, is placed in position, the location of the board may be altered so that the miter is made diagonally instead of straight along the end, by resting the piece against a guide, O, Fig. 3, which is locked in place by a set screw, which passes through a slot in the table.

The machine represented is claimed to be well adapted for the joinery of flasks, ordnance boxes, feet for furniture, and ice chests. For samples of the joint which it makes, the inventor refers to the refrigerators made by Messrs. L. H. Mace & Co., of this city, which may be found in the stock of almost every hardware dealer. The principal improvements of the machine were patented May 19, 1874. For further particulars, address Mr. Asahel Davis, 16 Middlesex street, Lowell, Mass.

A POWER SUPPLYING COMPANY.—The Rochester (N. Y.) Hydraulic Company is an incorporated institution owning more than half a million of dollars' worth of real estate; it carries on no manufacture, but rents its buildings to various manufacturers, supplying the power to them from the water flowing in the river beside the shops. A short time ago the rock was cut so as to make a deep well, and two of the largest water wheels, yielding over 1,000 horse power, were placed therein. It is the intention of the owners to add another wheel, which will swell the power attained to over 1,500 horse power.—*Commercial Bulletin.*

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..... $3 00
One copy, six months..... 1 50
CLUB RATES { Ten copies, one year, each $2 50..... 25 00
Over ten copies, same rate, each..... 2 50

VOLUME XXXI, No. 1. [NEW SERIES.] *Twenty-ninth Year.*

NEW YORK, SATURDAY, JULY 4, 1874.

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HOT WEATHER AND HYDROPHOBIA.

Dog days are sorry days for dogs. Not that the sultry season orings any distemper to them, least of all hydrophobia; but it does to Dogberry. As surely as warm weather returns, so surely are petty magistrates all but universally smitten with a sort of caniphobia, which knows no remedy but that instrument of canine torture, the muzzle. How the delusion originated, there is no telling. It is equally hard to tell how it survives in the face of experience, statistics, the protests of the intelligent, everything, in fact, that ought to influence the official mind.

The canny juryman had twenty-three good and sufficient reasons to offer for the non-attendance of a brother juror. The first was: "The mon's dead, y'r honor." Reasons as numerous if not as cogent may be given for opposing the law that dogs shall not be suffered at large without a strap over the nose or some similar device for closing their mouths, at the time when an open mouth is most essential to their health and comfort. It is enough to say that the enactment is useless as a precaution against danger from canine madness.

Dogs do not go mad in public places. For hours, perhaps days, before the outbreak of the disease, the victim skulks within doors, hiding in dark places, under furniture, in mangers, and the like. Unless the muzzle is insisted on as a permanent fixture, therefore, it is no safeguard whatever. The distemper is developed at home, where the muzzle is not worn, and the rabid animal escapes to run amuck at a stage when muzzling is impossible. Besides, the dogs which do the most mischief are commonly pets, house dogs, and stable dogs, not allowed at large, and therefore seldom or never subject to municipal supervision.

To make the regulation really effective, it would be necessary, as already intimated, to require all dogs to be muzzled at all times, night and day, in doors and out, the year round. As a matter of mercy to the poor brutes under such circumstances, as well as to ensure perfect security from dog bites, we should recommend that the muzzle be riveted to the *os frontis*, or, better, to a steel disk three or four inches in diameter passed between the cervical vertebræ. This would necessitate the throwing away of the larger part of the dog, we admit; still as a precaution against hydrophobia it would be absolute, and the animals would be free from the useless torture incident to the common method of muzzling.

Seriously, while it would be a blessing to the community if four out of five of the canine population were thus effectually muzzled, we have no hope that so practical a measure will ever be carried out. To the end of the chapter the complaint will be heard—too many dogs. And so long as there are dogs there will be mad dogs, and dogs that will bite without going mad, with equally bad consequences to the victims. Not until common sense and knowledge take the place of ignorance and superstition in the treatment of dogs and dog bites, will the risks of hydrophobia in man and beast be measurably abated. The precautions adopted must be of the right kind, and taken at the right time, else they are useless or worse; and above all, people must cease to trust to measures of prevention and relief which are demonstrably of no effect.

First of all, it is needful to overcome the popular belief that there is any necessary connection between hot weather and hydrophobia. The fact is that canine madness, technically *rabies*, is more prevalent in winter than in summer, in cold countries than in warm. Readers of Dr. Kane and other arctic explorers will remember the frequency of the disease among sledge dogs in the depths of arctic winter. On the other hand, in the West Indies, where the climate is hot and dogs are abundant, the malady is rare. The Southern States and the countries of Southern Europe are notably exempt from it; while it is very common in Northern Europe, in Canada, and throughout our Northern States. Statistics show also that more animals go mad in January, February, and March than during any other season, the fewest cases occurring in summer time.

It is also a mistake to suppose that hydrophobia always follows the bite of a mad animal, or is necessarily caused by such a bite. Between 1863 and 1868, there were 320 persons bitten by rabid animals in France, and hydrophobia ensued in only 129 cases, less than half. According to Faber's statistics, out of 143 persons bitten by rabid animals in Würtemberg, only 28 had hydrophobia. Hertwig inoculated a large number of animals with the saliva of rabid specimens, and succeeded in communicating the disease in but 23 per cent of the animals operated on, 77 in the hundred escaping.

In view of these facts, it is impossible to come to any absolute conclusions in regard either to the conditions of the disease or the adequacy of measures adopted for its prevention or cure, since there is always a degree of uncertainty as to what the result would be were nothing done. Still we are not wholly in the dark. From the French records, it would appear that wounds in the face and throat are most dangerous, nearly all those reported terminating fatally. From bites in the hands, hydrophobia ensued in two cases out of every three: while of those bitten in the legs, two out of three escaped the disease.

So far the statistics seem to favor the common belief that the greater immunity in case of wounds in the legs is due to the protecting effect of clothing; but the fact that bites on the body, which is always clad, result in hydrophobia as frequently as bites in the hands, which are commonly bare, puts a different face on the matter.

Possibly clothing may serve somewhat to prevent the flow of saliva into the wound, and the saliva seems to be the bearer of the virus; but the circumstance that five thicknesses of cloth have been bitten through with fatal effect should prevent any great reliance on so uncertain a safeguard.

Nor should speedy action be neglected from any doubt as to the health of the biting animal. Hydrophobia has frequently resulted from the bite of animals showing no symptoms of rabies. Dr. S. G. Cook described a case of this sort in the *Journal of Psychological Medicine*, January, 1871, and called attention to another fatal case of the same kind which occurred some years earlier. In these cases, both of which occurred in this city, the biting animal was a bitch, in "heat" but otherwise in normal health; and Dr. Cook raises the question whether the bite of an animal in that condition may not always be specially virulent. Further observation must determine the justness of the suspicion; meantime extra caution would be advisable in such cases, even to the extent of preventing any licking of the hands or face by such animals, hydrophobia having been communicated by such seemingly innocent means, when the skin happened to be broken.

It is well to be extremely cautious also of dogs (or cats) which are unusually irritable, or which manifest other unusual symptoms, especially in regard to eating. Long before the dread of water appears, the approach of rabies is shown by a morbid appetite, which impels the ailing animal to devour filth and other obnoxious substances

If valuable, the suspected animal should be promptly and securely chained in a place convenient for its execution should rabies be developed; if worthless, killing cannot be too speedy, whether a disposition to snap at persons or things has shown itself or not. In all cases of doubt, the animal's stomach should be examined, as well to relieve the apprehensions of the bitten, should the bite be probably harmless, as to ensure thorough treatment of the wound in case hydrophobia is threatened.

The following substances were found in the stomach of a suspected dog, and were held to be strong indications of the animal's madness: Hair, mud, two bumblebees, a large butterfly, a small white mushroom, straw, grass, and a small piece of the victim's cheek!

The bitten child was treated by Dr. de Marmon, of Kingsbridge, New York, apparently with perfect success. The treatment consisted chiefly in the prompt cauterization of the wounds with a saturated solution of carbolic acid, afterwards keeping them wet with a weaker solution, accompanied by internal doses of *liquor ammoniæ*.

In all cases of dog bite, cautery should be resorted to immediately. If possible, a ligature should also be applied and the surrounding tissues drained of blood by means of cupping glasses or otherwise. Of the French cases already mentioned, 134 were cauterized, more or less promptly, and 92 escaped. Of 66 who neglected the precaution only 10 escaped. Sometimes simple excision of the wound appears to be effective, an operation which Dr. Hammond of this city has performed half a dozen times for wounds received from animals certainly rabid, and always with success so far as heard from. In four other cases he used caustic, with apparently the same effect. Mr. Youatt (author of so many works on dogs and other animals) relied entirely on the caustic action of nitrate of silver. As he treated as many as four hundred cases of bites by rabid animals, always with success, his experience is certainly worth considering. Four times he had occasion to perform the operation on himself; but there is a probability of its failure at last, since he committed suicide while suffering from what were supposed to be the initial symptoms of hydrophobia. Niemeyer advised both excision and cautery, in addition to cupping, as the most promising means of removing or destroying the virus; and in view of the horrible and fatal character of the disease, these precautions, however heroic, would seem to be justifiable. This is one of the cases in which prevention is not merely better than cure, it is the only cure. *Once* the disease has declared itself, there is little hope save that its more horrid symptoms may be mitigated, and the patient allowed to die in something less than agony.

Cure there is none, though the resources of medicine have been exhausted to find one. True, every now and then some one proclaims a specific, but unhappily the first genuine case of hydrophobia usually proves its inadequacy. Hot air is the latest remedy proposed; it appears, however, to be a delusion, since we recall at least one case in which the Turkish bath seemed only to aggravate the victim's agonies. Nevertheless, in his work on the diseases of the nervous system, Dr. Hammond says that, in the present state of knowledge, he would be more disposed to rely on the hot air bath at a temperature of about 200° Fah., with the administration of hydrate of chloral in large doses frequently repeated, than on any other plan of treatment, apparently for the reason that the plan had never been tried, and therefore might possibly succeed. At least he cites no cases of such treatment, though he refers to the case treated by Dr. Cook, already mentioned, in which the Turkish bath was proposed, but, owing to the parent's objections, was not tried. The only remedy employed was chloral, hypodermically injected, which, though tardily used, greatly mitigated the severity and frequency of the spasms. The child died, but remained conscious to the last, and showed no disposition to injure himself or others.

Perhaps the most encouraging case of mitigative treatment on record is one reported not long since by Professor Polli of Milan. The subject was a man who had been bitten by a mad dog about a month before, the symptoms of hydrophobia being fully developed when the experiment began, twelve hours after the patient's admission to hospital. The remedy employed was hachish, in 8 grain doses of the solid extract repeated every four or five hours. The effect was immediate and happy. Convulsive madness and fury gave place to good humor, even gaiety, and for forty-eight hours the patient lay on his bed free and tranquil, then died calmly. The horrid symptoms of the disease were thus almost entirely removed; a result accomplished neither by opium nor morphine, nor by daturine. "Hachish," concludes Professor Polli, "is therefore the best palliative and sedative in hydrophobia. It changes a raving, unmanageable, suspicious, or aggressive maniac, who bites and curses, into a poor invalid, content and tranquil, who blesses you."

A very recent and somewhat remarkable case is that of the late Dr. Francis Butler, of Brooklyn, N. Y., who died of hydrophobia June 16. He was an educated man, the author of a book upon the breeding and diseases of dogs, and of late years had made the training of these pets his especial occupation. He was almost a total disbeliever in the reality of the transmission of any poison or disease from animals to mankind. He entertained the view, promulgated by Dr. Brown-Séquard and others, that hydrophobia in man is simply a nervous disorder, brought about by the imagination. In his various publications, Dr. Butler has given many directions about the proper treatment of sick and mad dogs, and has shown how easily all persons when bitten might cure themselves. His sad death proves the fallacy of his principal theories upon the subject. About six weeks ago he received a sick dog for treatment, and, in an attempt to administer his favorite remedy to the animal—salt—was bitten upon the thumb; the wound was slight and soon forgotten. On the day preceding his death, when in the act of placing a cup of tea to his lips, he was seized with dreadful spasms, which, with intervals of calmness, increased in intensity. He rushed about his house, he barked like a dog, while streams of foaming saliva spurted from his mouth across the apartment, propelled as if with the force of an engine. It required the efforts of several strong men to hold him. He was attended by skillful physicians, whom he implored to take his life and release him from agony. Every effort was made for his relief, but neither by the stomach nor the hypodermic method was it possible to apply medication. During the last hours Dr. Lorette succeeded in forming a blister on his breast with mustard, and on this abraded surface of the skin he dusted sulphate of morphine. In ten minutes the drug acted on the patient's system, the opium delirium came on, and he died without further suffering, exclaiming toward the last: "Oh! I am in heaven!"

Dr. Carnochan, one of our most eminent physicians, in a recent case of this awful malady, recommended the use of the tincture of Calabar bean. Its good effect was immediately seen, and the doctor thought there might have been a recovery had it been sooner applied.

THE NEW COMET. COGGIA.

Our new celestial visitor, which may be now discerned in the northern heavens, is daily increasing in brilliancy, and will soon be a very conspicuous object. The discovery of this body, known as Comet II., 1874, was made by M. Coggia, at Marseilles, on April 17 last. It is wholly without the earth's orbit, but is gradually drawing nearer to our sphere. The circumstances under which the comet appears are very favorable for spectroscopic examination, and hence the scientific world will look eagerly for results which will

give us a further insight into the physical nature of these celestial vagrants.

Rating the light of the new comet at 1 at the time of its discovery, its progressive increase in brilliancy will be as follows:

July 2	17·8	July 26	146·3
" 10	32·3	Aug. 3	245·0
" 18	64·8	" 11	130·0

From the investigations of Secchi and Huggins upon Tempel's comet, it was found that the nucleus is partially self-luminous and composed of gas in a luminous condition, containing carbon. Nuclei, beside emitting their own light, reflect, with the coma and the stars, the light of the sun. Hence the latest theory is that the comets are composed of minute solid bodies, like a cloud of smoke or dust; and as the mass approaches the sun, the most easily fusible constituents become wholly or partially vaporized and in a condition of white heat, overtake the remaining solid particles, and surround the nucleus in a self-luminous cloud of glowing vapor. It should be remembered, however, that our positive knowledge on the subject is very limited, and that the above is merely a hypothesis which, to a certain degree, accounts for observed phenomena. Tyndall has put forward another theory of great ingenuity, founded on physical experiment, in which he regards the tails of comets as resulting from the formation of a species of actinic cloud by the action of the solar rays after their character has been altered during their passage through the comet's head. Zöllner considers that the small comets are masses of vapor consisting of water or perhaps of liquid hydrocarbons, an idea which is fortified by the character of certain nebulæ. He also believes that the electricity developed by the solar rays, either in the process of evaporation or by the molecular disturbances they produce, is amply sufficient to cause the luminosity and also to form the train.

The length of comets' tails is rarely less than 500,000 and often reaches 150,000,000 miles. The breadth of that of the comet of 1811 was 14,000,000 miles, and the comet of 1828 had a nucleus 528,000 miles in diameter.

PROTECTION FROM FIRE.

A recent amendment to the building laws of New York city provides that every dwelling occupied by more than one family above the first floor, including all hotels, lodging and boarding houses, shall be provided with fire escapes, doors, and alarms. Stores, warehouses, or other buildings, except dwelling houses, schools, and churches, shall be provided, above the first story, with fireproof shutters, capable of being opened and closed upon the outside. The occupant is required to close the shutters before leaving the premises at night.

We welcome all enactments like the foregoing, which make it inconvenient and vexatious for people to own or build inflammable structures. The tendency of such laws is to hasten the good time when nothing but fireproof materials will be permitted in the erection of buildings. This is the only sure and practical method of averting the dangers of general conflagrations, to which all of our towns and cities are now constantly exposed. We are confident that, if laws were passed to encourage the erection of dwellings and other buildings wholly fireproof, our architects and builders would soon invent the methods and means of accomplishing the work at costs not greatly exceeding those of the structures now commonly put up, in which wood is so largely a component.

Until a clean sweep out is made of everything of a combustible nature in our building materials, we must submit to be saddled with the expenses and annoyances of special laws, fire insurances, fire brigades, police, private watchmen, steam and hand engines, water tanks, chemical extinguishers, fire escape apparatus, and other paraphernalia.

The losses by fire in New York city in 1873 are put down at $2,650,000. The expenses for running the fire department of the city during the same period amounted to over $1,500,000, requiring the employment of 600 men and 150 horses, 40 steam engines, 18 hook and ladder machines, and 4 chemical engines. In addition to the foregoing, the indirect losses and expenditures due to the use of combustible building materials in New York city may be safely estimated at $2,000,000 per annum, making a grand annual total of $6,000,000.

SCIENCE READS AN ORACLE RELATING TO THE METALLURGY OF THE FUTURE.

One of the most interesting incidents of the visit of the American Society of Civil Engineers to the Stevens Institute of Technology, at Hoboken, suggested the above title for our article. After witnessing the beautiful experiments exhibited by President Morton, inspecting the multitude of interesting objects in the lecture room of the Department of Engineering, and spending a pleasant quarter of an hour with Dr. Mayer among the mysterious physical apparatus of his laboratory, the party crowded into the little lecture room of Professor Leeds. The professor had thrown upon the screen the images of several contorted and rather uninteresting looking specimens of mineral. These, he states, were pieces of a "fulgurite," or thunderbolt, as it is often called, sent him from North Carolina. When a heavy flash of lightning strikes the earth, it sometimes fuses the soil in its track, and, on solidification, it becomes a solid bar or rod, which may be, and often is, dug out of its bed. In this case, the lightning had penetrated a bed of pure white sand, melting the silex and forming a hollow shaft two or three inches in diameter and four feet long, filled within and surrounded without by the white sand of the locality. The shaft, however, was not white. Its color varied from a dark to a light pearly gray. Chemical analysis showed it to contain iron, and so accurate was the work that, on estimating it as usual, as oxide, the figures proved some error to have occurred. Estimating it as metallic iron, the figures were correct. Apparently, therefore, the fulgurite was discolored by finely divided metallic iron, and this deduction was confirmed by other and direct experiment. This would explain the peculiarity of color, since the oxide would have colored the silex green. But metallic iron does not exist in Nature on the earth's surface, and the chemist was compelled to seek some explanation of its existence here by an examination of the peculiar conditions under which it was produced.

The final conclusion seemed necessarily to be that, at the immensely high temperature at which silica melts (the extreme limit attainable with the oxyhydrogen blowpipe), iron "dissociates" from oxygen, and that here, dissociation having occurred, the metallic iron, transported by the electric flash from some subterranean deposit, became encased in molten sand, and was preserved unoxidized within the fulgurite. The melting of that immensely refractory material, silex, the dissociation of iron from oxygen, and the transportation of such an amount by electrical action, were circumstances at once remarkable and interesting. After describing this interesting research, Professor Leeds called upon his colleague, Professor Thurston, whose frequent contributions to the SCIENTIFIC AMERICAN have made his name familiar to our readers; and that gentleman then gave his fellow members of the society and of his profession an outline of the possible bearing of this curious instance of natural metallurgy upon the future of the art. He stated that, while it could hardly yet be considered as probable, it certainly did not appear impossible that at some future time the processes of art might imitate what was here seen accomplished by Nature, and that this interesting phenomenon might be a strong intimation of the direction in which metallurgical changes might lead. Could a material be obtained of which to build furnaces which should be capable of resisting the temperature at which silex melts, and could such a temperature be attained in the furnace, we need but throw our ore upon the bed of the furnace and allow it to reach the temperature of dissociation, when the oxygen would pass off up the chimney, without the use of carbon or other deoxidizing agent, and the metal would flow down upon the hearth. The requirement of a new refractory material may not improbably be fulfilled. Equally remarkable discoveries are frequently made. The attainment of so high a temperature necessitates probably the invention of a method of preventing the dissociation of oxygen and hydrogen by high temperature. As we also have stated, in an editorial article in our last issue, the limit of combination of these gases, or their temperature of dissociation, is stated by Deville at about 4,500° Fah., and this is, therefore, the limit of temperature attainable by their combustion. Oxygen and carbon dissociate at a lower temperature.

The speaker referred to the possibility that this elevation of the limit may be attainable by carrying on combustion under pressure, as already proposed by Bessemer, and as probably illustrated in some slight degree by the elevation of pressure within the converter, and the extraordinary temperatures there observed. This interesting subject and the novel ideas suggested by it were evidently looked upon as important as well as entertaining by the visitors, one of whom expressed the idea which is embodied in the title which we have assumed for our article, and nearly all of whom forgot professional dignity so far as to applaud heartily. Many of our readers, by the character of their pursuits, are also interested in this subject. We hope that some may be so fortunate as to be able to aid in securing the benefit here indicated as possibly attainable.

THE ASTOR LIBRARY.

By the munificent endowment of the late John Jacob Astor and of his son William B. Astor, the splendid institution known as the Astor Library was founded in this city. Its doors are open free of charge to all comers, and here the reader may call for any books on the catalogue and spend as long a time in their study in the alcoves of the library as he desires. There are 147,640 books and pamphlets now upon the shelves, which, with the building, have cost something over $700,000. The twenty-fifth annual report shows that during the past year 116,694 volumes were given out to readers, of which about one half were books relating to the department of Science and Art; and of the twenty divisions of this department, by far the largest number of books called for by alcove readers were those relating to patents. This is an instructive fact, showing the useful influence of our patent laws in leading people to study up the recorded knowledge of subjects which have specially engaged their minds.

PHILOSOPHERS ON SOUND.

The phenomena of sound and light are, as every student knows, closely analogous.

In media of uniform density, luminous impulses travel in straight lines. In media of various or varying density, the lines are broken or curved. A rod wholly in water or wholly in air appears straight; if partly immersed, it seems to be broken at the surface of the water. The rays of the rising and setting sun come to us through miles of atmosphere increasing in density, and are so curved in their passage that we see the sun when it is really below the horizon.

As sonorous impulses are refracted according to substantially the same laws, similar acoustic phenomena must occur under corresponding conditions; in other words, sound waves passing through atmospheric strata or other media of different densities will be bent from a straight course, rising or falling, or swerving to right or left, as the conditions may determine.

These are elementary principles, taught and illustrated in every textbook of physics, though the phenomena are less studied in the case of sounds than in the sister department of optics. It happens, too, in our ordinary thinking, that we seldom take them into account, probably because the sounds we have to do with rarely come to us through media greatly varying in density; or if they do, the precise direction of the sounding body is seldom a matter of serious importance. The ear measures angles very rudely, and usually a rough approximation to a correct estimate of the course of a sound wave is quite sufficient for our needs.

This fact is of little moment in itself; but in view of the conflict of opinion between Professor Tyndall and Professor Osborne Reynolds, as to the proper explanation of the irregularities observed in the transmission of sounds under varying conditions of the atmosphere, it rises to some degree of dignity. At least it serves as a striking illustration of the tendency of philosophers to overlook simple and familiar laws in seeking the causes of unfamiliar phenomena.

The reader will remember that Professor Tyndall lately investigated the variable sonorous power of fog horns, whistles, artillery, and other sound producers, and arrived at the conclusion that the unequal range of the sound of a given instrument on different occasions must be owing to the greater or less "acoustic transparency" of the atmosphere, due to the presence or absence of streaks of vapor or unequally rarefied air. At night and during cloudy, rainy, or foggy days, the atmosphere is to a great degree homogeneous; consequently, sound travels freely and reaches its maximum distance. On the contrary, on clear days the sun rays produce unequal effects on different substances, giving rise to columns of vapor or heated air, and the sound is quenched, Professor Tyndall asserts, by reflections and partial echoes from their surfaces.

The theory is a pretty one, but unfortunately it does not tally with fact. The sound waves, which Professor Tyndall assumed to be quenched, are shown by the observations of Professor Osborne Reynolds to have been simply deflected upward and carried over the listener's head. Thus, in one instance the sound of a bell, which was inaudible thirty yards distant on the ground, could be plainly heard at seventy yards when the observer stood up. At one hundred and sixty yards, the deflection was so great that the bell could not be heard at an elevation of thirty feet, though it was distinctly audible a few feet higher.

Professor Tyndall's columnar reflectors would therefore seem to be only figuratively "in the air." Such things might cause the stoppage of sounds, but the evidence is rather that they do not; and Professor Tyndall is fairly convicted of unscientific haste in coming to his very decided conclusions.

On the other hand, Professor Reynolds appears to have overlooked the familiar laws of refraction. According to his mode of accounting for the facts, the lifting of sound is due to the increasing velocity of air currents as the elevation increases, and is in direct proportion to the upward diminution of the temperature. The reasoning by which this position is supported, however, seems to be rather the consequence than the antecedent of the conclusion. Undoubtedly both wind and temperature are modifying elements, Professor Tyndall's reflecting columns sometimes entering the problem in like manner; still the effects of these conditions are accidental, and probably small in comparison with the refracting influence of atmospheric columns of varying density, and more especially the diminishing density of the atmosphere upward. One of Professor Reynolds' observations suggests a course of experiment which students may find attractive. We quote his fifth general conclusion:

"In all cases where the sound was lifted, there was evidence of diverging rays. Thus, although on one occasion the full intensity was lost when standing up at 40 yards, the sound could be faintly and discontinuously heard up to 70 yards. And on raising the head, sound did not at once strike the ear with its full intensity nor yet increase quite gradually, but by a series of stops and fluctuations in which the different notes of sound were variously represented, showing that the diverging sound proceeds in rays separated by rays of interference."

Trusting to Professor Tyndall's somewhat "treacherous imagination," we should interpret the facts very differently, accounting for the observed fluctuations by difference of refrangibility between high notes and low notes rather than by "interference," the conditions of which do not seem to be present. As a matter of prudence, however, we prefer merely to suggest that the matter be tested by experiment.

Recurring to the analogy of light, and remembering that the refrangibility of light rays increases with their rate of motion—red rays, for example, being less refracted than the more rapid green and blue rays—and bearing in mind the fact that sound notes differ, as colors do, simply in speed of vibration, we should naturally expect a corresponding difference in their refrangibility, producing under suitable conditions the effects observed by Professor Reynolds. It would be an easy matter to test this conclusion by means of a prism of gas, after the fashion of the gaseous lenses sometimes used in acoustic experiments. The analysis of sounds is no new thing; but its prismatic analysis has not, to our knowledge, been attempted. The experiment would therefore be novel, and, we think, sufficiently interesting to repay the trouble involved.

QUICKSILVER has been discovered in the mountains back of Boralitos, Santa Cruz county, Cal. Claims have been located and a company has been formed to work one of them.

ELECTRIC PHENOMENA OF THE LEAVES OF THE FLY CATCHER.

The *dionæa muscipula* or fly catcher is one of the most curious examples known of a vegetable gifted with motion. The leaves of this plant, which are shown in the annexed engraving, for which we are indebted to *La Nature*, are terminated by a limb which carries two concave plates or valves united by a kind of hinge. If an imprudent fly venture to rest upon the inner surface of this trap, the plates, the minute bristles upon which become irritated by the presence of a foreign body, suddenly snap together like the covers of a book quickly closed. If the insect struggles, the portions adhere more closely, holding him prisoner until he dies or until, tired out, he remains motionless. Then the plates slowly open, ready to close again, however, on the least movement of the fly. If this does not take place, the trap allows its victim to fall out and remains set for new prey.



THE FLY-CATCHING PLANT.

Professor Burdon Sanderson, of the Royal Society, has recently made some interesting investigations into the electric condition of this singular plant, proving that its movements are due almost entirely to electrical circumstances. By connecting sometimes the limb and sometimes the petiole of a living leaf with the circuit of a galvanometer, two permanent currents have been discovered, acting in contrary directions, one passing through the limb from base to apex, and the other directed from the base of the limb to the base of the petiole. The experiments of Professor Sanderson throw considerable light on phenomena heretofore very obscure. The peculiar movements of vegetables, it may be considered as established, result from changes in tension produced in the tissues, either spontaneously or accidentally. The tensions are due to the unequal turgescence of the cellules, the surfaces of which either absorb the water which surrounds them or else abandon it, by virtue of a special property of their substance under the influence of physical forces, such as light, heat, and without doubt electricity. The most recent researches, for example, show that the drooping and the erection of the leaves of the sensitive plant result from a displacement of the water which swells alternately the superior and inferior vessels of the base of the petioles.

The Samuel Owen Centenary.

The hundredth anniversary of the birthday of Samuel Owen, May 13 last, was made the occasion of a public celebration in Stockholm. To Owen is due the credit of first instructing the Swedes in the use of their native iron, and he is now termed the father of Swedish steam navigation.

Leaving England with but one hundred pounds sterling, Owen established a manufactory at Kungsholmen and devoted himself to teaching his workmen not only to improve their labor but their lives. Hearing of Fulton's successes with steam navigation in America, he began researches into the same subject, which, it is said, led him in 1815 to the discovery of the screw propeller. He did not, however, prosecute his experiments in that direction, having neither time nor money, but continued labor in his factory, from which, up to 1843, when the works were closed, thirty steamboats, two of which were of iron, were produced. He died on February 15, 1854.

Professor Edlund, of the Stockholm Academy of Sciences, read an account of his life and services and pronounced a fitting eulogy, and subsequently a monument, bearing a fine bust of Owen, erected by the ironmasters of Sweden, was unveiled.

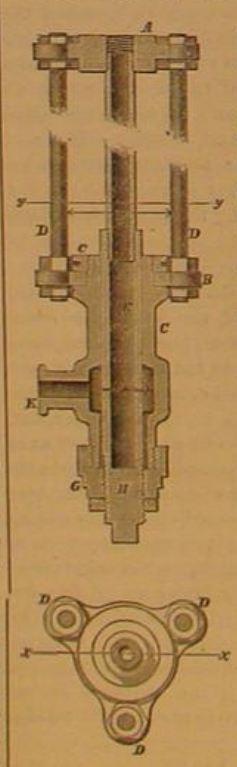
The Fort St. Philip Canal.

A bill has lately passed the House of Representatives which provides for a canal two hundred feet deep at the bottom, and twenty-five feet deep, to form a permanent highway from the Mississippi river to the Gulf of Mexico. The work is to be constructed by the United States, to be free to all nations, to be completed within three years, and to cost not more than eight millions of dollars.

For many years past, all the efforts which have been made to keep open the channels through which the great river empties into the Gulf have been attended with failure. As far back as 1837, extensive dredging was attempted but abandoned as unavailing, and in 1852 jetties were put down at the mouth of Southwest Pass, and another trial of deepening made, the results of which work, however, completely disappeared within the four years subsequent. Latterly steam dredging boats have been employed, rendering the river mouths practicable at times for large vessels, but not effecting the opening of the permanent channels for which the large commerce of New Orleans is now suffering. The present proposed canal, which is to extend a distance of six and a half miles, from the left bank of the Mississippi below Fort St. Philip to a point four miles south of Breton Island, was projected by Benjamin Buisson some forty years ago. The plan was favorably regarded by Congress and several surveys were made of the route, up to the beginning of the war, which put a stop to further proceedings. At the present time, the urgent necessity for the work has been brought to the notice of Congress, and it seems probable that it will before long be begun. The canal will form an outlet for the great region drained by the Mississippi, covering some 750,000 square miles and producing yearly a billion of bushels of cereals; and its construction will tend greatly to the speedy development of the commerce of New Orleans and the adjoining country.

BONSER'S PATENT STEAM TRAP.

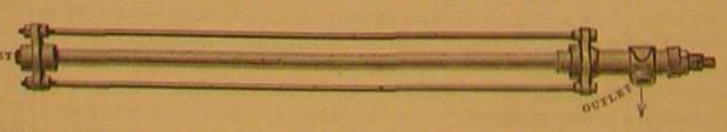
Absence of floats, disks, and levers, thus avoiding lost motion, a positive operation, simplicity, and durability, are the advantages claimed for the improved steam trap represented in vertical section, horizontal section, and in perspective, in the annexed engravings.



At the top of the instrument is a triangular head, A, and a similar triangular plate, B, is screwed to the cylinder, C, by the nut, *c*. These plates are held together by means of three rods, D, which are provided with screw nuts. Within the cylinder, C, is a tube, E, to which is attached a second tube, F, screwed in the triangular head. These tubes are of copper or other suitable metal. H is a tubular spindle, held in cylinder, C, by the thimble nut, G, and its upper end with the lower extremity of tube, E, both being flat square surfaces, form a joint, J, surrounded by the chamber, I, which chamber is in communication with the outlet pipe, K.

The water of condensation enters tubes, E and F, and is discharged between the ends of tube and spindle and thence out of the pipe, K. Steam then enters and takes the place of the water, when the tubes, E and F, will expand downward in length from the head piece, A, sufficiently to close the aperture in joint, J. When water again accumulates and becomes cold, the tubes (or one of them) contract and a discharge once more takes place, and so on indefinitely.

The thimble nut, G, allows the tubular spindle, H, to be adjusted with great nicety, so that the joint, J, will close when the tube contains steam and open when it contains water or when the temperature falls.



It will be seen that the instrument, when properly adjusted, is governed by the degree of temperature. Its operation will be the same if steam enters only tube, F.

For further particulars address the inventor, Mr. S. Bonser, Dover, N. H. The patent is offered for sale on reasonable terms.

The King of Siam's Dinner Service.

A superb service of silver plate, of the total value of $50,000, and weighing 15,000 ounces, has just been manufactured by the eminent firm of Messrs. Elkington & Co., Birmingham, England, and which exemplifies, in a high degree, the great perfection in taste, design, and workmanship to which the art of the silversmith is carried. It is a state dinner service, made to order for the King of Siam, and is, in every respect, well fitted to grace a royal table. It is, of course, solid silver throughout, and consists of a large number of pieces, being intended to dine about sixty persons in state. Conspicuous among the others is the principal centerpiece, a splendid and massive piece of workmanship. It is nearly four feet high, and the design is that of a three-headed elephant—a symbol of the Siamese religion—standing upon a plateau, and bearing on its back a castle, above which is a double vase with a tower-shaped stem. The trappings of the elephant are of delicate gold work, and gold tassels depend from the ears. Though the idea of gracefulness, in conjunction with a three-headed monster, might seem rather difficult to conceive, the heads are so arranged as to detract in no degree from the appearance of the figure. Standing in front, just under the heads, are two keepers in martial attire, each with a long staff, from the top of which projects the national flag of Siam. This piece, which weighs 700 ounces, bears in three places the coat of arms of the King, in high relief and richly molded and chased. There are fourteen other centerpieces of smaller size, but all of the same design as the principal one. Six four-light candelabra, of palm tree design, with a three-headed elephant standing under each, will help to illumine the royal banquet whenever the service is used; and among the other pieces which compose the set are six wine coolers, six large hot water dishes and covers, six rice dishes, six oval *entrée* dishes, twelve bread baskets, eight sauce tureens, six cruet frames, four large oval trays 28 inches long, and four salvers of smaller size, and about 150 dozen of spoons and forks.

The design is Oriental, and an elephant with one head forms the handle of each of the dish, tureen, and other covers. Every piece has also carved upon it the King's coat of arms and his name in a monogram.—*Ironmonger*.

Hydrophobia.

The Board of Health of this city, referring to an ordnance requiring dogs to be muzzled during the hot months, state that hydrophobia is imparted only by inoculation and that a rabid animal may give the disease through a metallic muzzle as easily as if the obstruction did not exist. Hydrophobia occurs in the coldest as well as in the hottest weather, and with perhaps greatest frequency during the spring months. Male dogs are more apt to be affected than females, and the condition of the animal, whether household pet or vagrant, has no influence on the taking of the malady. Owing to a portion of the deadly saliva being retained by the clothes of the person bitten, it is found that only five to twenty per cent of those thus injured become inoculated. An eminent veterinary surgeon, of this city, gives the following symptoms by which the approach of rabies in the dog may be recognized. When the period of inoculation is passed (three to seven weeks), the animal becomes restless and watchful. It shuns the light and its bark changes to a kind of a howl. The skin shrinks and tightens, the head is depressed, and mucus appears at the mouth and nostrils. Nervous symptoms are very prominent, and the whole aspect of the animal denotes an unusual condition. Dogs or cats thus suffering should be immediately destroyed.

In the wholesale crusade against the dogs which has just begun in this city, carbonic acid gas is for the first time used as a means of destruction. The old plan was to place the unclaimed animals in a huge vat and pump in water until they were drowned. The present idea is a large chamber, into which forty curs at once are placed, and there kept until a plentiful supply of the deadly gas ensures their death.

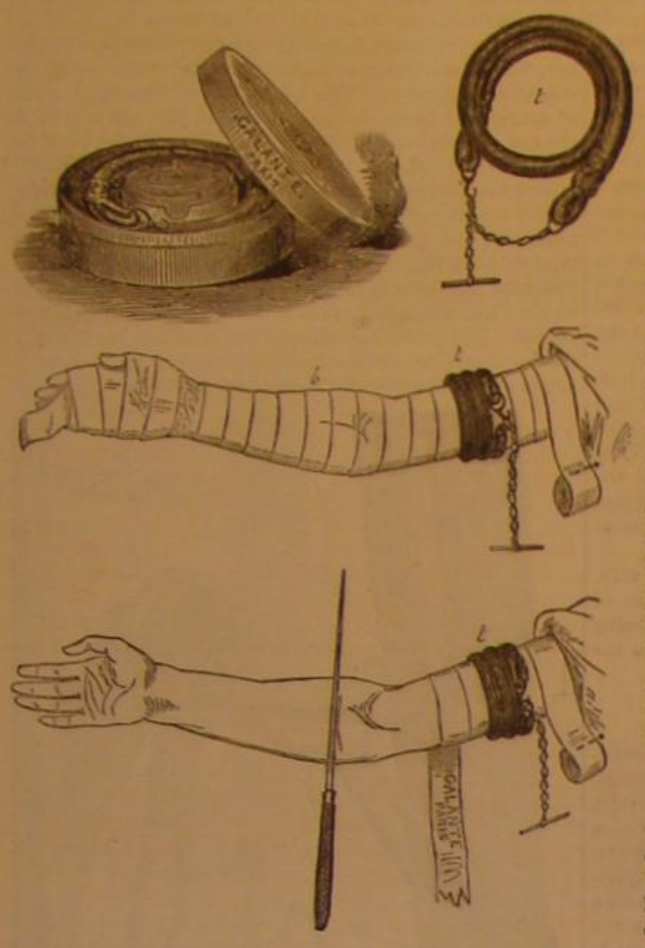
Evaporation Instead of Ice.

Ice threatens to be an expensive luxury this summer, and many persons will doubtless be obliged to dispense with its use. In the country, where water may be drawn cold from the well or the spring, and a clean cool cellar or dairy preserves the food fresh, it is not so much missed, but even there water and butter cannot remain many minutes, in the temperature of the eating room, without losing their agreeable qualities. Several thicknesses of wet cloths, wrapped about the pitcher, will, by evaporation, keep the water tolerable. A common flower pot, inverted over a plate of butter, and kept covered in the same way, with wet cloths, will keep butter in that state of solidity which is essential to its attractiveness.

If proper provision is made for expansion, portable engines can be made quite as durable as stationary engines.

BLOODLESS SURGERY.

We have already briefly alluded to the Esmarch process for performing surgical operations without provoking the usual hæmorrhage. The annexed engraving, extracted from *Les Mondes*, represents the devices used in connection therewith by the inventor. These consist in an elastic bandage, measuring 26 feet in length by 18 inches in breadth, and a tube or cone of strong vulcanized rubber, having a hook at one end and a chain and bar at the other.



The application of the apparatus is very simple. Supposing that an arm is to be amputated, the bandage is tightly wound around the member from the extremities of the fingers up to a little above the point at which the division is to be made. By this uniform compression, the blood is forced back and out of the vessels. At the upper limit of the bandage, the rubber end is passed three or four times around the arm as closely as possible, and fastened in place by the hook and chain, thus preventing the return of the circulation to the member after the bandage is unwound. The latter, on being removed, leaves the arm white and free from blood and hence ready for the operation, which is accomplished with a very trivial effusion.

A Specimen Book Catalogue.

Mr. E. Steiger, of 22 Frankfort street, New York city, has circulated a specimen of a proposed catalogue of the whole American literature, and desires the opinion of the press on the system. A work, similar in its object but far less complete in its details and not so well arranged, is used in England, and is found especially valuable to librarians and readers as well as to the publishing trade. When we state that the specimen pages now before us give the titles of books and names of authors in full, the dates of the editions, number of pages, size, binding, price, and publisher's name of each volume, our readers will understand the thoroughness of the scheme, and will believe the author when he says that the undertaking is not remunerative.

A Public Benefactor.

The splendid charities of Peter Cooper and George Peabody have been overshadowed in extent, though not in spirit, by the extraordinary munificence of Mr. James Lick, of San Francisco. This gentleman, the possessor of enormous wealth, has recently, in a single instrument, deeded away the sum of two million dollars for the establishment of institutions for the public benefit, preferring to superintend the disposition of his fortune and enjoy the fruits of his beneficence during his lifetime, rather than to follow the usual course of bestowing his bounty by will. The deed, which is a lengthy document, containing some eighteen articles, is dated the 2d of June, 1874, and conveys to seven trustees, for a nominal consideration, an immense amount of property, which they are instructed to sell. Out of the sum obtained, $700,000 is set aside for the placing on land, on the borders of Lake Tahoe, Placer county, Cal., "a telescope superior to and more powerful than any telescope ever yet made, with all the machinery appertaining thereto." If the above site is found to be unsuitable, provision is made for the selection of a more appropriate locality. The announcement of Mr. Lick's intention thus to provide for the "million dollar telescope" appeared in our columns, it will be remembered, some months ago, and with the delivery of the present deed, the practical establishment of the great observatory—the greatest the world has ever seen—begins.

After this donation, which commences the series, follow gifts of $25,000 in gold to the Protestant Orphan Asylum of San Francisco; $25,000 to a similar institution of San José Cal.; a like sum to the Ladies' Protection and Relief Society of San Francisco; $10,000 to the Mechanics' Library Association, $10,000 to the Society for the Prevention of Cruelty to Animals, both of same city; $5,000 for a monument for the donor's mother, and a like amount for memorials of two other relatives; $100,000 for an Old Ladies' Home; $150,000 for public baths, $150,000 for a statue of Francis Scott Key, author of the song of the "Star Spangled Banner"; and $250,000 for a statue illustrating the progress of the State of California in education, mechanical arts, and mining, for designs for which sums of $10,000 and $5,000 are offered. $300,000 is devoted to the foundation of the "California School of Mechanical Arts," for the education of both sexes "in the practical arts of life, and in whatever industry to which mechanical skill now is or can hereafter be applied."

The residue of the proceeds is divided between the California Academy of Sciences and the Society of California Pioneers, to be expended for buildings, library, apparatus, etc. The donor provides for all his living relatives and reserves a handsome income for himself.

Mr. Lick is the son of a farmer and was born in the town of Lebanon, Pa. His early life was spent working on the farm. While quite a young man, he went to South America and there became a large cattle raiser, supplying horses to the Governments of Brazil and Buenos Ayres. At the breaking out of the gold excitement in California in 1849, Mr. Lick was in business in Valparaiso; but turning over his affairs to a friend, he took $20,000 in doubloons and started for the new country. With great sagacity he immediately invested his funds in real estate in San Francisco, holding fast to his bargains, and building slowly and carefully. The rapid rise in value of his property resulted in immense profits, out of which he erected the Lick House in San Francisco, one of the finest hotels in the world. It is a portion of the colossal fortune, thus made, which Mr. Lick has devoted to the uses above detailed, thus placing himself in the front rank of philanthropists.

A Lecture Experiment with Potassium.

To show the green color of gaseous potassium, it is volatilized in wide horizontal tubes through which hydrogen passes, which becomes spontaneously inflammable, and burns with a brilliant violet flame, while the hot part of the tube becomes filled with green vapor, condensing in the colder parts as a mirror. When the experiment is finished and air gradually admitted, the potassium is first oxidised to the blue quadrant-oxide.

FEATHERING ARROW HEADS.

Our engraving shows an arrow head from the collection of L. G. Olmstead, LL.D., of Fort Edward, N. Y., found near Peoria, Ill. It is believed to be unique, not existing in any other collection in this country or Europe. Its peculiarity



consists in the beveled edges, as shown in our illustration, which give rotation to the arrow when it flies through the air, thus improving the accuracy of the missile. This is believed to be the earliest example of the feathering projectile extant.

Correspondence.

Explosion of the Fireless Locomotive.

To the Editor of the Scientific American:

The New York and Brooklyn papers recently gave the history of the Thermo-Specific Motor Company's new engine, which has just been built at the Grant Locomotive Works at Paterson, N. J. This engine was brought to the South Ferry, Brooklyn, and thence taken to East New York. On May 22 a large party of editors and reporters were invited to attend the trial trip. The engine was filled with boiling water within 9 inches of the top, and steam was raised to a heat of 380° Fah., with the following results:

"An explosion, which might have resulted disastrously, occurred yesterday afternoon at East New York. One of the new engines which it is proposed to introduce on Atlantic avenue was hauled out for inspection and testing. The engines are built on a novel principle, having no generating boiler, but taking steam from a "service tank" at the end of the road. The engine drew up to the tank, and was in course of obtaining its supply of steam, when an explosion occurred which threw the tank nearly a hundred yards up the track, the lid being blown about fifty feet further and broken to pieces.

Several of the bystanders had very narrow escapes, but, fortunately, nobody was injured; everybody was badly scared, and the excitement in the village was intense for some time."

None of the reporters present published an account in any paper. This account was obtained by a reporter of *The Argus* meeting a person who saw the explosion. The *débris* was immediately cleaned off, as I am informed, and a visit to the officers of the company gave the reporter no farther information. I have not as yet heard of any investigation. Is it possible that the press can be so quieted, and that a new steam boiler, with steam at 380° pounds pressure,* can explode the first time it is used, and no investigations be made? If I recollect rightly, your paper, in about March or April, 1873, published a full account of the thermo-specific that was to supersede horses on the street cars. I hope the opportunity will not be lost, and that a full and impartial investigation will be made.

EDWIN BAKER.

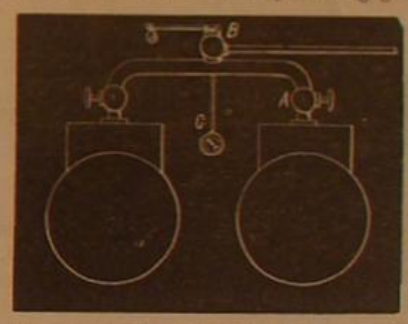
240 Atlantic avenue, Brooklyn.

Boiler Explosion near Geddes, N. Y.

To the Editor of the Scientific American:

A disastrous boiler explosion occurred this morning at Ashton Mills, Geddes, N. Y., killing two men outright, and two more are not expected to live. How many more are injured I have, as yet, been unable to ascertain. Some men here are making or attempting to make a mystery of the affair; others are trying to find fault with the boiler, the engineer making the statement usual in such cases, namely, plenty of water, not much steam, explosion incomprehensible, etc.

The cause will be obvious to you, in view of the idiotic manner in which the connections between the exploded boiler and its mate were made, which the engraving will explain. A is the globe valve, of which there was one to each boiler, B the safety valve, and C the pressure gage.



The boilers were both run together by day, and only one at night, the latter being shut off by its globe valve, A, which, it will be seen, shut it off both from the safety valve, B, and the steam gage, C, it being left to the night watchman to open it and fire up the boiler in the morning. Neglect to open that valve is the unmistakable cause of the disaster, as it is of many others which have happened to boilers so connected. That it could have been no fault of the boiler is certain, as it is not broken in any place by the steam. But the heads are forced out, by a gradually increasing pressure, until the sheet left the tubes, when the reaction of issuing steam caused the boiler to fly end over end, doing great damage. In my opinion the excellence of the boiler is manifest by its condition.

OPERA MUNDI.

Syracuse, N. Y.

Bullets Impacted in the Air.

To the Editor of the Scientific American:

Having seen a statement in one of your city papers that a wonderful curiosity, in the shape of a rebel and a Union bullet impacted in the air, was soon to be placed in the Museum of the Ordnance Department, at Washington, I inclose you a bullet which I found on the rebel earthworks in front of Petersburgh, on the sabbath after the surrender of that city.



Peekskill, N. Y.

H. ANDERSON.

CHROMIC ACID SOLUTION FOR BATTERIES.—An improved cirepe, by which a stronger current is produced, is as follow: 12 parts by weight potassium bichromate in 150 parts water, with addition of 25 parts of sulphuric hydrate.

*Our correspondent doubtless means 380° Fah., as previously mentioned which would be about 190 pounds pressure.—EDS

A NOVEL MECHANICAL MOVEMENT.

Mr. Bernard Frese, of Gilman, Ill., has patented, January 6, 1874, an ingenious device for converting rotary into rectilinear reciprocating motion, or *vice versâ*. Its object is to transmit an even and uniform power to a wheel, for example, and, when used in connection with a single cylinder engine, it obviates the possibility of a dead center. It is hardly necessary to point out the many applications of which the invention is susceptible, as these will be readily apparent from the following description of its operation:

Our engravings show the apparatus in two views, the first of which, Fig. 1, may be termed the working side, and the second, Fig. 2, the governing side. A is a frame upon guides in which travels the reciprocating head, B, to which is attached a rod, C, passing through one end of the frame. Journaled in the central portion of the latter, and passing through the long slot shown in the head, is a shaft which, at

Fig. 1

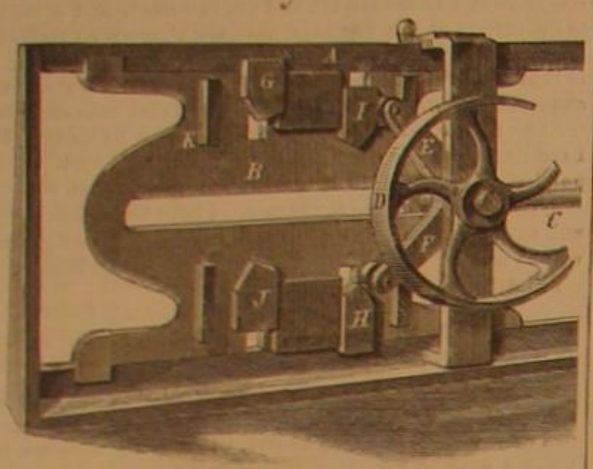
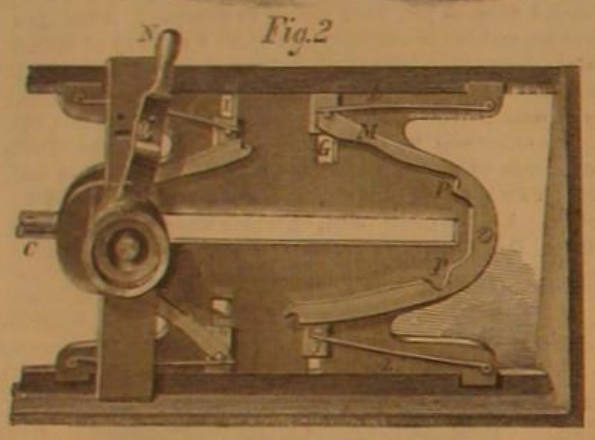


Fig. 2



one extremity, carries the belt wheel, D. At the same end of the shaft, but on the other side of the journal, are two arms, E F, at right angles to each other, formed from a single piece and rigidly attached, at their angle, to the shaft. The head, B, has on its edges four slots, which serve as guides for four small movable plates or blocks, G, H, I, and J. Adjoining these last are four fixed studs, K, firmly secured to the head. The rear sides of the blocks are shown correspondingly lettered in Fig 2, and upon each is a pin, against which springs, L, act so as to hold the blocks against the inner ends of their slots.

Pivoted at each end of the head are V-shaped pieces, M, in each arm of which is a notch, which, when engaged with the pins on the back of the blocks, tend to hold the latter to the outer portions of their slots, or, in other words, to act against the springs, L. It will be observed that, in our engravings, the blocks, G and H, are thus immovably held, while the blocks, I and J, are free to travel forward and back in their slots, pushing, of course, in one direction against their springs.

We can now follow the operation of the device under the conditions represented. The head, being at the extremity of its stroke to the left, begins its motion to the right. The arm, E, of the pair secured to the shaft, is first struck by the block, I, which impinges against a friction roller on the end of the same. The block, traveling to the right, carries the arm with it, so turning the latter into a lever to rotate the shaft. The arm, F, being unobstructed, for the corresponding block, H, is held back out of the way, is necessarily carried upward, so that the two arms, being placed at the proper distance apart, arm, F, after the head has traveled half its stroke, enters between the block, G, and the stud on the left of the same, and takes against said stud. We have now the arm, E, between the block, I, and its stud, and the arm, F, between the block, G, and its corresponding portion. This arm, F, is next acted upon, and being caused to turn to the right, by the pushing against it of the stud, rotates the shaft, and in so doing brings the arm, E, so that its extremity takes against the right hand inclined edge of the block, J. The latter is, however, merely held forward by its spring, so that it readily yields to the pressure of the arm, which slips behind it. The head is now at the end of its stroke, the ends of the arms are once more in a vertical line, and the shaft has made half a revolution. The return movement being begun, the same operation is repeated. The arm, F, travels over from the outside of block, G, to the inside of block, H, and the arm, E, over against the block, I, which, in turn, yields, so that at the conclusion of the stroke the various portions are once more as represented in the engraving.

In order to reverse the movement or cause it to stop, the lever, N, Fig. 2, working loose on the shaft, engages with a projection, O, which passes through a curved slot in the frame. This projection is formed upon a bar, not shown, which also works upon the shaft. At either side of the latter and formed on the under portion of the bar, are two projections which, by turning the lever so as to throw either end of the bar at an angle to the vertical, may be placed one in advance of the other in respect to either end of the head. Near the curved portions of the V shaped bars, M, are notches, P, into which the lugs on the governing bar may enter. As placed in Fig. 2, it is clear that the upper lug on the bar is thrown in advance or to the right, and the lower one to the left. Now suppose the lever to be thrown over the other way, and the stroke of the head to begin. The lower lug is now in advance, to the right. Consequently, as the head finishes its stroke, the lower lug will strike the lower side of the forward bar, M, enter the notch, and, by tilting the V downward, disengage the hook in the upper bar from the pin on the upper block, causing the latter to be thrown inward by its spring, while, at the same time, causing the hook on the lower bar to catch the pin on the lower block, holding the latter immovably, as we have already explained. The return stroke does the same with regard to the other V bar and the other pair of blocks, so that the result is that, instead of blocks, G and H, being held, as in Fig. 1, they are left free, and I and J fastened. A little consideration will show that the result, on moving the head, will be a reverse motion of the arms to that already described. If now the lever, N, be placed exactly in the center, the effect is to throw all the hooks of the V bars off the pins on the block, and the arms, pressing equally on both blocks nearest them, are unable to move in either way, and thus the motion is arrested.

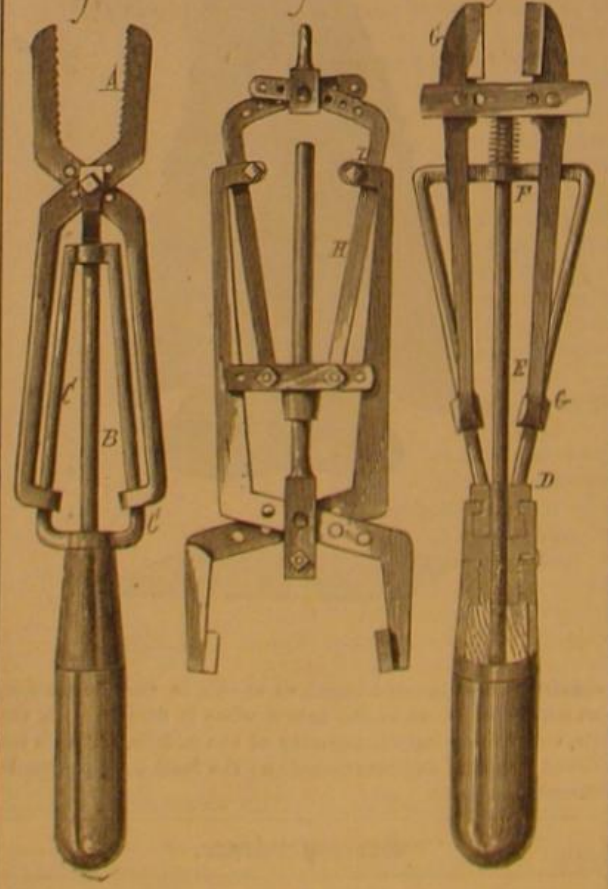
It is claimed that this device will be of considerable utility as applied to hoisting engines, as it allows the motion of the machine to be quickly altered or arrested, while using almost the full power. For further particulars address the inventor, as above.

IMPROVED GRAPPLING TOOLS.

We illustrate herewith three forms of grappling tools patented March 18 and 25, 1873, through the Scientific American Patent Agency, by Mr. Simon B. Dexter, of Mason City, Iowa. In Fig. 1 is shown a device which may be used as a wrench, pincers, or grapple for raising and carrying weights. The jaws, A, by means of a series of holes, are made adjustable to adapt them to articles of different sizes. A shank rod, B, is connected by means of a fork on its end with the fulcrum pin, and extends back into the handle. Upon it is a wedge shaped slide, consisting of two rods, C, which pass through eyes on the pincer handles. When any object is secured between the jaws, it is griped by pulling upon the handle, causing the arms of the pincers to come together, and is loosened by a contrary movement. This feature adapts the tool for grappling for articles under water, as well as for carrying heavy articles in foundries.

Fig. 3 is an improvement on the above mentioned device, in which, by turning the handles, a swivel band, D, is also turned. The shank rod, E, is provided with a screw thread, and passes through the swivel band, so that, by the above mentioned motion, the slide, F, is moved up or down on the

Fig. 1. Fig. 2. Fig. 3

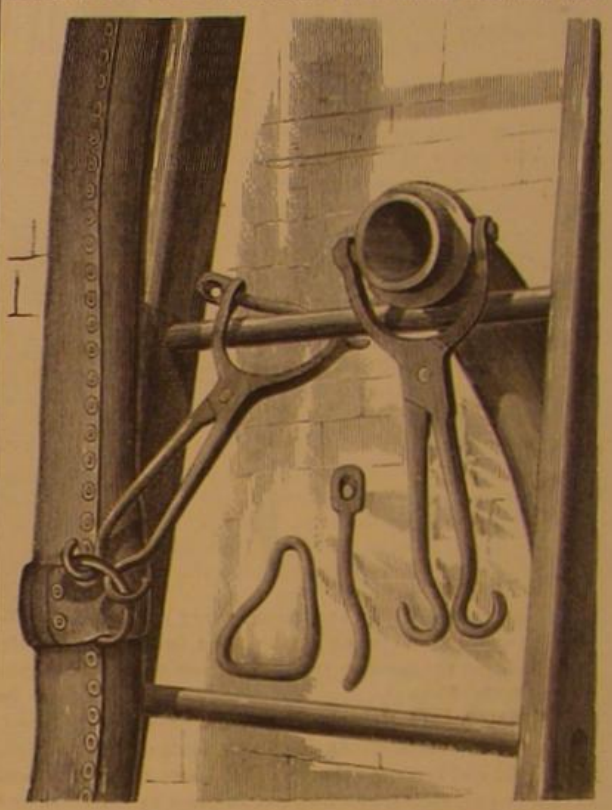


rod. The long ends of levers, G, are thus spread apart or brought together. In this manner the jaws may be adjusted with great nicety and with sufficient power to make the instrument valuable as a hand vise.

The device shown in Fig. 2 is intended for raising or turning stones for buildings, etc., by means of derricks or cranes. It has adaptable jaws, the upper ends of which are turned towards each other to receive the bars, H, confined in forks therein by rollers, I, and bolts. It will be seen that these bars incline from the vertical guide rod, and together form a wedge-shaped slide for each of the levers. In drawing upwards, the bars bear against the rollers, I, and so close the jaws, and by pushing downwards the reverse takes place.

POND'S PATENT SPANNER.

It is unnecessary for us to dwell upon the importance of any invention which will facilitate the extinguishment of fires. A series of disastrous conflagrations has fully informed the public mind upon this point. Pond's patent spanner, which we illustrate herewith, is an invention of the character referred to. This instrument is, essentially, a pair of tongs, with an eye at the end of each jaw, and a hook at the end of each handle. The advantages claimed over the common spanner are as follows: It cannot be put on wrong; it will turn the coupling either way without being removed; it will not drop off; it can be used in carrying the hose, the point of lifting being at the heaviest portion thereof, namely, at the coupling, instead of one or two feet from the same. The hook handles may be instantly inserted in rings or straps on the hose, which may thus be the more easily dragged or carried. The device also enables the hoseman, by hooking the handles into a ring in his belt, to carry the hose up a ladder or elsewhere while he has both hands free, and also



to fasten the hose to any projecting point or to a ladder. For this latter purpose a pin is furnished, which passes through the eyes at the ends of the jaws of the instrument. One point of excellence which will recommend this spanner to the firemen, especially on cold winter nights, is the fact that by its use hose can be handled without touching the wet exterior with the hands. In short, it is claimed that, by the use of this invention, hose can be handled more easily, quickly, and advantageously than by any other method. Pond's patent spanners are made of malleable steel, finished in best English japan, weighing one pound each, and of sizes to fit different kinds of hose.

Patented in the United States November 25, 1873, and in the Dominion of Canada, May 19, 1874. For further particulars address Lewis Pond, patentee and manufacturer, Foxboro', Mass.

Restoration of Burnt Steel.

J. L. Davies, Landore, near Swansea, Wales, writing to *Iron*, says: "I have found that resin oil, with which is intimately mixed one fourth (more or less) its weight of the residue of paraffin stills, has a wonderful effect upon burnt steel.

"Chisels which have been burnt and rendered useless may be, by means of this fluid, restored and made as valuable as ever. This fluid, which was many months ago christened *restitutor chalybis*, may be used as follows: Burnt steel must be heated red hot, then plunged into the restitutor for a few seconds; then re heated and cooled in the ordinary way. The steel after this process is perfectly restored.

"Experience in the use of the restitutor will quickly enable persons to give any desired temper to their tools, but it may be stated that tools can be made especially hard by heating them red hot, dipping into the restitutor, then reheating to a slightly white heat, and immediately cooling in pure water."

INCOMBUSTIBLE PAPER AND INK.—An English inventor has secured letters patent for an incombustible and fireproof ink. The pulp for the paper is composed of vegetable fiber, one part; asbestos, two parts; borax, one tenth part; and alum, two tenth parts. The ink can be used either in writing or painting, and is made according to the following recipe: Graphite, finely ground, twenty-two drachms; copal or other resinous gum, twelve grains; sulphate of iron, two drachms; tincture of nut galls, two drachms; and sulphate of indigo, eight drachms. These substances are thoroughly mixed and boiled in water. The graphite can be replaced by an earthy mineral pigment of any desired color.

THE JUBÆA SPECTABILIS PALM.

This very handsome palm, known also as the coquito palm, of Chili, is the only species of the genus, and is one of the most southern of American palms. It has a stout trunk, swollen in the middle, which, in its native country, sometimes attains a hight of nearly 40 feet. The summit is surmounted by a crown of large, spreading, pinnate leaves, of a full deep green color, and from 6 to 12 feet long, the leaflets being from 1 to 1½ feet long and about an inch wide, springing in pairs from nearly the same spot, and standing out in different directions. The leaf stalks are very thick at the base, where they are inclosed in a dense mass of rough brown fibers, which grow upon their lower edges. In an account of the Royal Gardens, at Lisbon, mention is made of a specimen growing there in the open air, which has attained a hight of 32 feet, and the trunk of which measures 13 feet 8 inches in circumference at its base. "In Chili," says the "Treasury of Botany," "a sweet sirup, called *miel de palm*, or palm honey, is prepared by boiling the sap of this tree to the consistence of treacle, and it forms a considerable article of trade, being much esteemed for domestic use as sugar. The sap is obtained by the very wasteful method of felling the trees and cutting off the crown of leaves, when it immediately begins to flow, and continues to do so for several months, until the tree is exhausted, providing a thin slice is shaved off the top every morning, each tree yielding about 90 gallons. The nuts are used by the Chilian confectioners in the preparation of sweetmeats, and by the boys as marbles."

The soil for this plant, says *The Garden*, from which we extract the engraving, should be a mixture of one half rich loam and one half a compost of peat, leaf mold, and sand. It withstands the winters in the open air near London, in a poor condition; but if grown in tubs in the conservatory in winter, and placed in the open air in summer, it will prove an excellent subject for association with the hardier palms.



THE JUBÆA SPECTABILIS PALM.

Gurjun Oil in Skin Diseases.

At a late meeting of the Medical Society of London, Professor Erasmus Wilson showed some of this new remedy, and stated that this material, which was also called wood oil, was an oleoresin, obtained from several species of the *dipterocarpus*, an immense tree growing on the Malayan coast of the Bay of Bengal, where it was so common as to be used instead of paint, for houses and ships.

In March, 1873, Dr. Dougall, of the Indian Medical Service, took charge of the convict establishment of the Andaman Islands, when he found twenty-four of the prisoners suffering from leprosy. He was deeply impressed with the misery of these poor people; and realizing the impracticability of availing himself of all known methods of treatment, he hit upon the idea of trying the gurjun oil, both as an internal and external remedy, and determined upon giving it a six months' trial. Dr. Dougall's method was to have the patients washed thoroughly in a neighboring stream, using dry earth instead of soap. They were then made to rub themselves for two hours with a liniment composed of gurjun oil and lime water, one part to three, and to swallow two drachms of the balsam, also combined with lime water. After this they had their breakfast, and were set to any work they were capable of doing. In the evening the same process was repeated, except the washing. The effects of this treatment, at the end of six months, were marvelous. Neuralgic pains were allayed, sensibility was restored to the anæsthetic skin, tubercles subsided, and ulcers healed. Dr. Dougall was astonished at the energy of these formerly helpless ones.

Mr. Erasmus Wilson remarked that he had used a liniment composed of equal parts of the gurjun oil and lime water, in cases of painful eczema, in lupus, and in cancer, with very encouraging results, and stated that Mr. Hancock had applied it in a case of cancer of the skin, with the effect of dispersing tubercles and healing ulcerations; but its most useful property was that of relieving pain. A lady in constant pain from cancer of the integument, who had been unable to sleep without narcotics for weeks, was relieved of all suffering, and enabled to sleep, by means of this liniment. Mr. Wilson suggested that this very simple remedy deserved a trial at the hands of the profession, and believed that it would be found a valuable agent of cure in many affections where the skin was painfully attacked.

A Vehicle Dynamometer.

The Royal Agricultural Society of England has recently employed a new instrument for determining the amount of work done in hauling vehicles along a circuitous course, the maximum, minimum, and mean pulls exerted, and the irregularity of strains arising from the varying rigidity of the load. The device is in brief a skeleton horse mounted on wheels and drawn by horses. It is harnessed in the shafts, and the body contains the necessary apparatus. It is believed that the figures obtained will give accurate results regarding the vexed questions of broad and narrow, large and small, wheels, hight of load, weight on horse's back, etc.

From a description of the invention published in the *Engineer*, we learn that it consists of a pair of parabolic steel springs, 4 feet long and connected together by a single joint at one end and a double one at the other. The front blade of these springs is attached at the middle of its length to a horizontal cast iron bed plate which forms a rigid foundation. The back spring plate is attached to a horizontal spindle, supported at its front end in an iron pedestal and at its back end in an oil cylinder. Between the bearing and cylinder, a cast iron swiveling draft plate is loosely jointed to the spindle. This swivel plate is designed to represent the shoulder and collar of a horse, and is fitted with draft chains and hooks, similar to those on collar hames. Beneath the draft plate are castors arranged to run upon the bed plate. The draft plate, with its joints and castors, will transmit the direct, horizontal components only, of the pull on any vehicle, to the main spindle, and will eliminate the transverse components of angular pulls, whether in a vertical or horizontal direction. A lever is jointed to the spindle to multiply any movement of the spindle three times on the horizontal counter bar above it, which carries in bearings upon it a small integrating disk, which touches and is set in motion by a large disk, which in its turn is driven at the rate of one revolution to the yard by a suitable beveled gear from one of the hindermost traveling wheels of the instrument. The driving gear to the large disk registers distances traveled in yards upon another counter. The moving counter bar has a pointer which indicates the draft at any time in pounds on an adjustable scale attached to the frame, and also a suitable arm, having a metallic pencil at its end, which will describe the variations of draft on a sheet of metallic paper wound round a cylinder, which is set in motion at will, at a speed proportional to the distance traveled. The ordinary saddle chain, usually attached to one of the shafts of the cart, is passed over a light wrought iron saddle suspended from one end of a lever; the load resting on the saddle, representing that on a horse's back, is registered on a spring balance at the other end of the lever. If found necessary for going down hill, "breeching" chains may be attached to the back end of the instrument, and in hauling carts a belly band may be passed beneath the instrument to avoid any risk of tilting backwards. For quickly testing the springs in the field, a bell crank lever is provided, having arms, one of which is connected with the main spindle, and the other can be loaded by known weights. The instrument is mounted upon a timber framed carriage, having four broad cast iron wheels. The carriage can be raised or lowered between moderate limits.

With this, as in other instruments, the actual number of foot pounds of work done in any experiment is determined by simply multiplying the register of the integrating counter by a constant depending on the spring in use. The product so obtained, divided by the number of feet run as indicated by the distance counter, gives the mean draft during the experiment. The actual draft at any time is indicated by the pointer, and also on the metallic card, if it is put into gear. It is obvious that this apparatus will have a very wide application, especially in the trial of reaping and mowing machines, portable engines, artillery, and in fact all vehicles drawn by shafts, and also in ascertaining the comparative resistances of roads for any given vehicle.

Dog Dentistry.

It is well known that the bites of rabid herbivorous animals are rarely dangerous, because their teeth are made flat-faced, for grinding their food without penetrating or tearing the tissues. Hence their bite is little more than a severe bruise, differing from that of a carnivorous animal, which pierces immediately through the skin. A veterinary surgeon of Paris, M. Bourrel, recently captured three mad dogs and, tightly securing them, proceeded to file down the teeth. These animals he let loose with six other dogs. The latter were immediately furiously attacked and frequently bitten, but in no case did the pointless teeth inflict more than a bruise. Not content with this, M. Bourrel put on a thin kid glove and then worried the mad dogs with his hand until they bit him several times. Although pinching quite hard, the glove was not broken in a single instance, while the skin beneath was uninjured.

As to whether we had better substitute a city dog dentist for the present pound master, we leave the question to the humanitarians who are endeavoring to abolish carbonic acid and the muzzle.

New Process of Determining the Alcohol in Wines.

If to a known volume of water larger and larger quantities of alcohol are added, the density and the superficial tension of the mixtures obtained are simultaneously diminished, and consequently there is an increase in the number of drops which they form if allowed to flow slowly from a given aperture. If this aperture has constant dimensions, the number of drops corresponding to each alcoholic mixture is constant also. The difference between the numbers thus found is large enough to furnish a basis for a very sensitive alcoholometric method. The instrument proposed is a pipette holding 0 3 cubic inch. It is filled with the alcoholic liquid under examination, and the number of drops escaping is counted. From this number the proportion of alcohol is calculated by the aid of tables which the author has drawn up. Slight traces of liquids more diffusible than alcohol, such as acetic ether, greatly increase the number of drops. —*M. Ducleaux.—Chemical News.*

Theory of Dissociation or Thermolysis.

The theory of dissociation may be summed up in the following propositions: 1. Dissociation is the opposite process to chemical combination, the gaseous body resuming its molecular motion which it lost on combination as heat, and converting it into a new form of motion. 2. The amount of heat which the dissociated bodies take up is exactly equal to that which they lose on combination. 3. The temperature of separation is higher than the temperature of combination. 4. Compounds whose constituents are not volatile cannot be separated by heat.—*Fr. Mohr.*

A New Double Ship.

Some years ago there were employed on what was then termed the Navy Yard Ferry, between New York and Brooklyn, a set of steam ferry boats having double hulls, propelled by a paddle wheel placed in the middle, between the hulls. The two vessels were coupled together by strong beams, and covered by a broad deck. These boats were roomy, and gave satisfaction except that they were slow.

Recently, in England, they have launched a new ferry boat, built on the above general plan, intended to ply across the English Channel, between Dover and Calais, 22 miles. At present they run very small boats, and passengers are greatly troubled with sea sickness. The new boat has two hulls, each 17 feet wide and 290 feet long, separated 26 feet, and united by a deck or superstructure 60 feet wide and 183 feet long. This makes a broad and comfortable boat for passengers, and will be a great improvement over the existing vessels. The new ship has been christened the Castalia. She will be propelled by a central wheel, with engines of great power. Each hull has a rudder at the bow and stern, making four rudders in all.

Palm Paper.

Mr. James P. Herron, of Washington, D. C., has invented a process of making paper from varieties of the palm. The material is cut or torn into pieces of suitable size, then cooked in a close digester, with thorough agitation and under steam pressure, in a weak solution of alkali, naphtha, benzine, or soap; then it is completely ground, while steam passes freely through the grinder and intermingles with the stock, reducing, bleaching, and finally washing it.

THE CONVENTION OF THE CIVIL ENGINEERS.

We continue our abstract of the proceedings of this association.

Mr. G. W. R. Bayley, of New Orleans, La., followed, with an exhaustive communication on the subject of

THE TEREDO

or ship worm, well known for its ravages upon timber under water. It belongs to the first subclass of mollusca, known as *acephala*. Although having no head, the animal feeds itself and reproduces its kind. The body is surrounded by folds of the mantle, and it has a shell consisting of two valves. The animal secretes calcareous matter and deposits it upon the extreme edge of the shell, when the secretion hardens and becomes converted into a layer of solid testaceous substance. Every newly formed layer enlarges the diameter of the shell. The ship worm moves by means of an extensive fleshy organ called a foot. It is a muscular mass, capable of being pushed out from between the mantle lobes and the valves, and of adhering, by the exhaustion of the air and water under it, firmly to the front end of the tube, when the teredo is engaged in excavating or boring.

The long bridges across Bay St. Louis, 10,055 feet, and Bay Biloxi, 6,136 feet, built (on heavy, yellow pine piles from 15 to 20 inches and more in diameter) in 1869 and 1870, had to be reconstructed in the winter and spring of 1871 by driving an entire new set of piles in the place of those destroyed by the teredo. The Bay St. Louis bridge piles—the new ones—were covered with felt and copper, and the Beloxi bridge piles with felt and zinc, from the water line to the bottom, the depth of Bay St. Louis being from 10 to 12 generally, and at Biloxi Bay from 10 to 15 feet. In 1872 the writer found that many of the piles in the Bay St. Louis bridge had been damaged by the teredo below the coppering. To remedy the evil, sand and clay were hauled and dumped round the new piles in sufficient quantities to cover the exposed posts, thus cutting off the teredos' connection with the aerated salt water, and killing them in a few days. The piles much injured were replaced with new ones, previously charred, with coal of tar poured on them, washed with clear oil, and coated with coal tar varnish; and all loose or broken sheets of copper were renailed under water. It was estimated that this coppering, already considerably thinned by decomposition, was good for perhaps three or four years.

The teredo, cannot penetrate any soft, fibrous, or spongy substance, as felting, thick paper, or the bark of pine timber, and this is the reason why the spongy, fibrous wood of the cabbage tree palm is never attacked. The action of salt water upon copper or zinc sheets is very destructive, and tarred felt is even a better protection than metal for submerged timber; with metal only, the sea water can penetrate under the sheets, especially when loose or broken; and when sea water ebbs and flows with the tides, so can the ship worm enter and work. If felt, saturated with the dead oil of coal tar and well coated with thickened coal tar, can be secured to and maintained on the outside of submerged timber, it may be considered safe from the ravages of the teredo.

The partial report of the committee on the

MANUFACTURE OF RAILS

was next submitted. The English system of rails is not applicable to this country, as it requires strength, while the American system demands endurance and wear. Where there is the most wear of rail, strength should be the first consideration, and the rails should contain the greatest amount of metal; but where there is less wear, the rails should be as light as experience shows to be safe. As there is the most wear on the head of the rail, there should also be at that point the greatest amount of metal. There was no theory more erroneous than that a head of 2½ inches wide was more endurable than one three inches wide. With the present heavy machinery, the narrow high rails will not last as long as the low wide rails. An inflexible or rigid rail is more sure to break than one moderately flexible. If the rails were laid on a better foundation, and there were no frost, the rails might be made stiffer. In answer to the question why rails should not be made square, the committee believed that it would be too flexible, especially when of iron, and that rails with stem and base were much better. It would be even advisable to place 60 per cent of the metal in the head; but a double headed rail wears out faster than a single. The average wear of an iron rail is equal to a pressure of 4,000,000 tuns of dead weight, or 10,000,000 tuns of gross weight. The stone ballast of the American roads has been too large; and on a good road a rail would last fully 25 per cent longer than on a bad one. In cold weather, the metal is more brittle than in summer; consequently the breakage of rails in winter is greater in proportion. No definite figures had been received as to the comparative values of iron and steel rails, but the committee were of opinion that a steel rail was 20 per cent better than a good iron rail, 40 per cent better than a fair iron rail, and 100 per cent superior to the ordinary rail used on many railroads.

FIRE IN THE COAL FIELDS.

Mr. Martin Coryell, of Wilkesbarre, recited the particulars of the conflagration now existing in the coal at the Kidder slope. At first water was pumped out of the mines by locomotives; but subsequently, this proving unsuccessful, a new plan was adopted. Steam boilers were erected at various points, and the work of forcing steam into the mines was begun. This appears to be working with great success. At one time during the hight of the fire, the thermometer at the mouth of the air shaft registered 212 degrees. When 50 pounds of steam pressure were forced into the mine, the thermometer fell to 120°; and when 70 pounds pressure was introduced, the thermometer fell to 100°. The men are now at work *boring* a nine inch hole with a diamond drill, so as to be enabled to put in, at a different point, another stream of steam to aid the others. The work is apparent going on successfully. The steam has evidently created a great amount of carbonic acid gas; but as yet there have been no means of ascertaining the quantity thus created, or whether it was aiding the steam in doing the work of extinguishing the fire. The mines are at least 600 feet below the surface, and therefore very difficult to reach.

An interesting history of the

DOCK SYSTEM OF NEW YORK CITY

was given by Mr. John D. Van Buren. The speaker, after sketching the past dock facilities of the port and pointing out the advantages as a harbor, referred to the operations at present in progress.

The river wall, recommended by General McClellan and adopted by the present department, is composed of *béton* blocks weighing from 25 to 50 tuns each, extending from the foundation to within two feet of low water mark, and, above this level, concrete laid in mass, faced with ashlar granite masonry. The idea of using *béton* blocks for this arch is due, he said, entirely to General McClellan, and the late operations of the department show that the plan is an exceedingly expeditious and cheap one. On the Christopher street section, now being built by the department, 14 blocks, weighing about 450 tuns, were laid in one day, and 109 blocks, weighing 3,560 tuns, were loaded, transported, and laid in 18 days of from 10 to 12 hours each. The crew consists of 10 men, including captain and engineer. The total cost of loading, transporting, and laying, in 14 feet of water, will not exceed $1.50 per cubic yard. The cost of the blocks, exclusive of the rent of yards, is about $12.50 with cement at $5 per barrel, this material alone costing about $8.50 per cubic yard. It does not cost the city, considering all expenses, over $16 per cubic yard laid. This wall is being built considerably within the estimate, made by General McClellan, of $2,500,000 per mile, including the cost of filling.

The departments are now building four large wharves of wood on the Christopher street section, of an improved quality, and have nearly completed three of them. Another is built at Canal street, North river. In these structures they have not found it possible to allow the engineers to introduce any artificial preservatives, except external coatings of fish oil and paint: but in the general character and strength of the woodwork and fastenings, every care has been taken to make them complete and of the very best quality. The pile heads are the only novel features of these piers; they are constructed of built-up columns 20x20 in section and 75 feet length, placed in rows 12½ feet apart, and about 9½ feet apart in rows. The rows are sheathed for low water up to the girders on both sides with 5 inch planking, the ends of which are protected with boiler plates. The heads of the columns are securely passed into the caps and girders. The piles used in the pier, some of which are 94 feet long, are driven in rows 8 feet apart, and 5 feet apart in the row. The square timber is 12x12 in section.

The plan of construction, then, which seems to commend itself as the proper one for the improvement of the water front of New York is: To construct a quay wall along the main street of granite masonry, increasing the width of the street considerably, and from the wall to throw out piers of the very best quality of wood, preserved against decay by all possible means, and at once establish a broad main street and have good piers built and taken care of according to a settled plan; and it will shortly follow that all known means of facilitating the handling and transportation of freight will be introduced by the interested persons then under certain general restrictions.

These public works should go slowly on, say at the rate of half a mile per annum. If in 10 years the wall could be completed on the East river and to West 11th street on the North river, its progress would be all that could be desired. The city would then possess the finest dock facilities in the world.

THE EDUCATION OF CIVIL ENGINEERS

was the topic of a paper by Mr. Thomas C. Clarke, of Clarke, Reeves & Co., the well known iron bridge constructors. Mr. Clarke contrasted the English and Continental systems of professional education, and pointed out that the former was mainly practical, while the latter required the student to be thoroughly versed in theory before entering upon actual work. He believed in combining the advantages of both systems, and advocated a thorough training in the natural sciences. Too much time, the speaker said, was now wasted in studying the higher mathematics, which rarely are brought into practical use. The student should be limited to ordinary analysis, and the time thus gained devoted to the study of Nature. After graduating from college, practice in the field should be immediately begun, and then, after an insight had been obtained into the actual labor of the profession, the young engineer might profitably attend a technological school for the purpose of devoting himself to some specialty. In conclusion, reference was made to the late John Edgar Thompson, and his life was held up as an example of the value of concentration of energies upon business and of thorough training, by which the possessor was enabled to conduct the great operations under his control.

EXCURSIONS, ETC., OF THE CONVENTION.

The reading of papers being concluded, on the following day the delegates made visits to the Stevens Institute at Hoboken, where they inspected the Stevens Battery, and subsequently to the East river bridge, Hell Gate excavations, and Fourth avenue improvements. An excursion was also made to Ashley, Pa., the ascent of Wilksbarre Moun, tain accomplished, and the mines of the Wilkesbarre Coal and Iron Company examined. The journey terminated with a visit to Mauch Chunk, a ride over the Switch Back railway, and an inspection of the works of the Bethlehem Iron Company and the Lehigh Zinc Company at Bethlehem, Pa.

New Remedy for Dysentery.

In a recent issue of the *Archives de Médicine Navale* is published an official note, addressed by Dr. Robert, who is the medical chief of the naval division of China and Japan, to the Inspector General of the Health Service in the French navy, calling attention to a drug used by Chinese physicians in the treatment of dysentery. It consists of the root bark of the *ailanthus*, very common in China, also cultivated in France and in this country.

The bark of the root is the only part employed. An infusion of the bark, however, exhales a slightly nauseous odor, and possesses an excessive bitterness, resembling that of sulphate of quinia. The Chinese physicians employ the root in the fresh state only; but Dr. Robert, having been compelled to use some that had become dry, found no sensible difference in its action in the two states.

For administration, 1½ ounces weight of the root is cut into very small pieces and triturated with 2 ounces of hot water for a few minutes in a mortar, in order to soften the bark, and then strained. A teaspoonful of this strong infusion is administered as a dose morning and evening, alone or in a cup of tea. Taken in this form, it provokes vomiting. The medicine is administered in this manner during three days, the patient being kept upon full diet. After that time the ailanthus is omitted and the diet is altered to broths until health is restored. If after eight days' treatment the patient is not cured, the Chinese physicians recommence the use of the ailanthus; but Dr. Robert states that he has not met with a single case in which this resumption has been necessary, although he had under his notice some where the disease had lasted several months, as well as others of more recent origin.

The principal symptoms which follow the administration of the ailanthus are said to be nausea, and sometimes vomiting, followed by a temporary lowering of the pulse. The disappearance of blood from the evacuations commences on the first day and is completed on the second; the colic ceases a little later. The effect of the drug upon the color of the evacuations is variable. Dr. Robert sums up by expressing his opinion that the administration of the ailanthus gave superior results to those of ipecacuanha, astringents, alone or combined with opiates, or calomel.

French Improvements in Manufacturin Steel.

Those who have followed for the last dozen years the progressive steps in the manufacture of steel know the difficulties which surrounded the first efforts in the Bessemer process. These were not thoroughly surmounted, nor the process rendered thoroughly practical, until the idea was struck of pushing the refining process to complete decarburation, and then adding to the bath a certain proportion of iron rich in manganese, called spiegelesen. The object of this seemed to be to add again to the metal the necessary quantity of carbon to make it steel, and also to give it, at the same time, certain mysterious virtues, which were known as a steely propensity. It was soon recognized that the importance of this addition was more considerable than at first supposed. The best gray irons were not suitable to replace the spiegeleisen. It follows, then, that the manganese must affect the iron in a useful manner. A more minute investigation of the process shows that, under complete reduction of the carbon, the iron becomes oxidized and brittle, and the action of the manganese is to destroy this excessive oxidation, and to restore to the metal its original good qualities.

In the Martin-Siemens process, also, the addition of a manganesic iron was recognized from the first as practical and necessary. This method answered all requirements for rolled rails and such goods; but a demand arose for a metal milder and softer, for plates and parts of machines. Here this addition of spiegeleisen involved a serious dilemma. For with the necessary quantity of manganese must be introduced so large a quantity of carbon that the hardness was produced, which was precisely the thing wished to be avoided. There was then no other resource than to push the reduction of the carbon further still, so as to be perfectly sure of total removal of the carbon, and then, by the addition of a quantity of spiegeleisen as rich as possible, to get a minimum of carbon in the resulting steel. This is, at best, but an uncertain and dangerous method, though much in use at present, and is very liable to give a result too hard, or still very oxidized and brittle.

The company of Terre Noire sets itself to produce alloys of iron and manganese, and claims to be able to make alloys of iron with manganese having forty to seventy per cent of the latter, and that, so to speak, in illimitable quantity. This gives a metal very mild, but with all the tenacity of steel. Another great field for the use of ferro-manganese has been unexpectedly discovered, both by the company at Terre Noire and, independently, elsewhere. A series of experiments had been made, upon ores of inferior quality and with large admixture of phosphorus. In seeking to purify or use these ores in some way, it was found, most unexpectedly, that the phosphorus was no detriment to the laminability and tenacity of the metal, provided that the carbon, combined with the manganese, was very small indeed. Here is a great field for the use of ferro-manganese—to produce mild steel from many second rate brands of iron. This renders the working up of all the old material of wrought iron rails into steel, which opens a most valuable market for the old permanent way of many railways.

The above details give sufficient grounds for supposing that

ferro-manganese will become quite in large demand, and hence give ample employ to any company undertaking the special manufacture and application of it. The following is what this French company proposes to undertake:

1. The sale and manufacture of alloys of iron and manganese. 2. The application of those alloys to the production of metal with all the properties of mild steel. 3. The application of these alloys to the production of steel more or less phosphoric, either by the Bessemer or the Martin-Siemens process. 4. The fixing and making of all plant suitable for these productions and applications.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE NEWLY DISCOVERED CRATER OF MAUI.

Mr. T. M. Alexander, in a letter to the *Hawaiian Gazette*, gives an interesting account of his discovery of very remarkable volcanic phenomena on West Maui, one of the Sandwich Islands. He found a crater in which were nearly a score of volcanic pits, not cones, from fifteen to fifty feet broad, and ten to twenty feet deep, with shrubbery within concealing the chasms below. From six of the pits columns of steam or smoke were rising, which were destitute of sulphurous fumes and had very little warmth. It is believed that these pits are connected with subterranean chambers heated by volcanic action, and that the air arising from the warm depths on a cold morning becomes changed to fumes of steam. No similar instance is found on any of the islands except Hawaii.

PROGRESS OF THE EAST RIVER BRIDGE.

Work upon the great suspension bridge between Brooklyn and New York, which has been temporarily suspended, is now resumed. The Brooklyn tower has reached an elevation of 222 feet above high water mark, leaving 40 feet of masonry yet to be laid. The workmen are engaged upon the arches, several courses of which are in position. The keystones will weigh ten tuns each, and constitute the heaviest blocks in the structure, the ordinary stones weighing some three tuns. It is expected that before winter the "saddles" or castings over which the cables will pass will be in position.

The New York tower is now 123 feet high, and will probably reach 200 feet during the present season. The anchorage on the Brooklyn side is 6 feet high, and contains 8,334 cubic feet of masonry. Its total elevation will be 66 feet. On the New York anchorage, or on the approaches, work has not yet been begun.

THE GERM THEORY OF DISEASE.

That hay fever, a disease quite prevalent during the present month, is traceable to vegetable organisms, is a curious discovery, tending toward the confirmation of the theory that disease is originated and propagated by independent organic germs, recently made by Professor Binz, of Bonn. The investigator has been himself subject to the malady, and has pursued his researches over a number of years.

On examining the nasal secretions with a powerful immersion lens, he found the organisms to be absent except when the disease attacked him during spring. Then the parasitical bodies were clearly seen in motion, vibrating on the slide and increasing in size after several days. By using a neutral solution of sulphate of quinine, applied by the nasal douche, Professor Binz found that the animalculæ were completely destroyed, and that subsequent examination failed to show their existence in the secretions.

A SIMPLE ANALYSIS OF ARABLE EARTH.

M. Schlösing gives the following simple process for separating the clay in soils from other constituents, and consequently for determining the quantity of the former present.

The earth is thrown in water and the calcareous matter is eliminated by means of hydrochloric or other suitable acid. The carbonate of lime and humic acid, found in nearly all vegetable earth, hinders the clay from remaining in suspension in the water, and it is hence precipitated. By treating the liquor with ammonia, the humic acid is removed. The residue is composed of sandy matter and clay; but the former falls to the bottom, leaving the clay in suspension in the liquid, from which it may be separated by decantation. This method, though almost mechanical, it is said, will prove of much value to agriculturists. M. Schlösing has found that earths, considered argillaceous, in some cases contained little over 2 or 3 per cent of clay, while others, supposed to be composed almost entirely of that substance, contained but 30 per cent.

CORROSION OF TIN.

Tin is generally regarded as the least liable to change of all our common metals; but a case, recently reported to the American Academy of Arts and Sciences by Mr. S. R. Sharples, State Assayer of Massachusetts, cites a circumstance which appears to be wholly contradictory to such a theory. A tank, belonging to an hotel in Collinsville, Conn., was lined with block tin containing less than 2 per cent of impurities. Some time after the construction of the receptacle, white deposits were noticed upon the lining, and the owners, fearing that the water might be rendered deleterious, sent specimens of the powder and of the water to Mr. Sharples for analysis. The white powder proved to be oxide of tin with a mere trace of iron, and the water, which was led to the tank through 100 feet of lead pipe, was entirely free from the latter metal.

During the month of March last, an interval of nearly two years having elapsed since the above examination and the tank lining being some five years old, the proprietors called Mr. Sharples' attention to the fact that the lining had become perfectly riddled by corrosion, and this although there had been a free and constant circulation of fresh water, an analysis of which showed even better results than before. There were 4·20 parts of inorganic matter and 0·80 parts of organic matter in 100,000, and no nitrates were present.

This extensive corrosion can hardly be accounted for, as the weight of present authority points strongly to the unalterability of tin under similar circumstances.

Sir Charles Fox.

Sir Charles Fox, the distinguished civil engineer, died recently in England, aged 64 years. He was an assistant to the celebrated Robert Stephenson, by whom he was appointed assistant engineer of the London and Birmingham railway when that work was begun. Mr. Fox's greatest engineering work was the construction of the building for the Great Exhibition in Hyde Park, London, in 1851. He received the honor of knighthood in recognition of the genius and skill exhibited in this magnificent structure. He also re-constructed the same building for the Crystal Palace at Sydenham, and executed many extensive railway and other engineering works. He was the senior partner in the firm of Sir Charles Fox & Sons, civil engineers.

Hospital Hygiene.

Dr. Alphonse Guérin, an eminent surgeon of the Hotel Dieu in Paris, has recently presented to the French Academy of Sciences a remarkable memoir on the influence of atmospheric germs on surgical maladies, in which he strongly advocates tow dressings for wounds. He states that, when this material is packed upon the injured part, the pus is completely preserved from putrid fermentation. He uses the tow in brief as a filter for the air, which circulates freely through it, and in fact produces an arrangement precisely analogous to the cotton wool respirator mentioned by Professor Tyndall in his paper on haze and dust.

DECISIONS OF THE COURTS.

United States Circuit Court---Southern District of New York.

PATENT HAIR NET.—JOSEPH DALTON *vs.* ABRAHAM G. JENNINGS.

[In equity.—Before Blatchford, Judge.—Decided May 21, 1874.]

Blatchford, *Judge:*

This suit is brought on letters patent granted to the plaintiff March 5 1872, for an "Improvement in Ladies' Hair Nets." The specification says: The claim is a head or hair net, composed of a main set of meshes fabricated of coarse thread, combined with an auxiliary set or sets of meshes fabricated of fine thread, substantially as described.

The tenor of the specification and claim show that the intention was to have the claim cover broadly a head or hair net composed of a main set of meshes fabricated of coarse thread, combined with an auxiliary set or sets of meshes fabricated of fine thread, without reference to the degree of fineness of the finer threads, and without reference to the manner of tying the finer threads to the coarse threads. The history of the steps which led to the making, by the inventor, of the net described in the patent shows that he started with a net of large squares made by large threads and filled up partially the large squares by crossings of finer threads. But the net thus arrived at was not a different net from what would have resulted if he had taken a net of small squares, sufficiently small to keep short hairs from protruding, such small squares being formed by fine threads, and all the threads of the net being of uniform size, and had substituted for each alternate fine thread, in both directions, a coarse thread, so as to arrive at a net like the patented net. Now, such a head or hair net, of small squares sufficiently small to keep short hairs from protruding, such small squares being formed by threads which were so small as to be entitled to be called fine threads, and were at a certain and reasonable distance away invisible, all the threads of the net being of uniform size, existed prior to the plaintiff's invention. It is defendant's exhibit No. 10. In such a net, to substitute for each alternate fine thread, in both directions, a coarse thread, cannot be the production of a new article of manufacture. Such substitution produces the patented net. It may be new as a design, and may be entitled to be patented as a design; but it is not a new article of manufacture. The specification sets forth, as the advantages of the patented net, only the preventing of the protruding of short hairs and the invisibility of the fine threads. But any person has a right to make defendant's exhibit No. 10 of as fine threads as should be desirable, and to make it of uniform finer threads or of uniform coarser threads would involve no invention. As it stands, it will prevent short hairs from protruding. The substitution of alternate coarse threads in it for the fine threads has no effect one way or the other on the protruding of short hairs or on the invisibility of the fine threads. No point of advantage as between the patented net and defendant's exhibit No. 10 is or can be suggested, except as to mere ornament or taste or outline in pleasing the eye. The fabrics, as to utility, structure, inherent qualities, and mode of operation in use, are the same. The patented net, in view of the former net, has no patentability, if the claim of the patent is to be construed in the broad manner before suggested.

If the claim, to sustain it in view of the former net, is to be limited to a claim to the combination of two sets of threads when they are so connected with each other that either set can be entirely broken away without destroying the other, then the defendant has not infringed. The defendant's net, although it has a series of finer threads crossing each other between the coarse threads, so as to prevent short hairs from protruding, does not have its threads so connected that either set can be entirely broken away without destroying the other.

The bill must be dismissed with costs.

(*J. Van Santvoord* for the plaintiff.
A. V. Briesen for the defendant.)

NEW BOOKS AND PUBLICATIONS.

THE TUNNELS AND WATER SYSTEM OF CHICAGO—Under the Lake and Under the River. Illustrated. Chicago: J. M. Wing & Co.

This handsome volume gives a complete and interesting account of the extensive system of tunnels in Chicago, by which water supply and subaqueous communication is obtained in that enterprising city. It is written throughout in a loquacious, humorous style, and contains several engravings that are even more comic than the literature.

KINDERGARTEN TOYS, AND HOW TO USE THEM. A Practical Explanation of the First Six Gifts of Fröbel's Kindergarten. By Heinrich Hoffmann. New York: E. Steiger, 22 & 24 Frankfort street.

This book contains full explanations of the *kindergarten* apparatus, which, on account of its simplicity, gradual progressiveness, and accuracy, is the most effectual method of imparting instruction to very young children, and has the especial merit of being thoroughly amusing to the little pupil. The child's eye is taught to distinguish form, color and number, by playing with such toys as are usually given to the merest infant.

THE AMERICAN YACHT LIST FOR 1874, containing a Complete Register of the Yacht Clubs of the United States and Canada. Compiled by Niels Olsen, Steward of the New York Yacht Club. Price $1. New York: L. H. Biglow & Co., 13 William street.

In addition to the information specified in the above title, this well arranged volume contains illustrations of all the ensigns and signals of the various yacht clubs.

THE PRINCIPLES OF SCIENCE—A Treatise on Logic and Scientific Method. By W. Stanley Jevons, M.A., F.R.S., etc. Special American Edition. New York: Macmillan & Co.

In his "Scientific Use of the Imagination," Professor Tyndall has, in popular language, conveyed a clear idea of the mental processes by which the investigator is enabled to proceed from the known to the unknown. He briefly touches upon the course of reasoning which detects analogies leading to a great discovery, or upsetting, in the end, pre-existing and accepted theories; but he necessarily does not conduct us into the details, or trace, step by step, the general logical and systematic operation of the mind by which certain and absolute results are alone reached. This lacking need in our scientific knowledge, Professor Jevons has supplied in the work before us—a volume which should command the careful study of those whose object is that cardinal aspiration of the modern scientist—original research and discovery. The author describes his book as "a simple and general description of the devices by which exact measurement is effected, errors eliminated, a probable mean result attained, and the probable error of that mean ascertained." He illustrates the conditions and precautions requisite for accurate observation, for successful experiment, and for the sure detection of the quantitative laws of Nature. In a word, he tells us how to question Nature in order to obtain those responses which of all things are alone infallible.

A UNIVERSAL TABLE FOR EXCAVATIONS AND EMBANKMENTS, applicable to any Base or Slope Whatever; and the Calculations of All Solids to which the Prismoidal Formula is Applicable. By William Zimmerman, C. E.

This is a very elaborately calculated table of the measurement of earthwork, applicable to every possible configuration of cross section of cuttings and embankments. It is well illustrated with diagrams, showing its universal use for the work for which it is intended, and for which engineers and contractors will find it especially valuable.

The sixth volume of the new edition of the AMERICAN CYCLOPÆDIA, published by Messrs. D. Appleton & Co., of this city, has recently appeared. We know of no work in which there is a more copious supply of information, brought down to the latest dates, or in which the possessor can be more truly said to have placed at his disposal a digest of everything that has been written upon almost every conceivable subject. The volume before us is particularly rich in its scientific department. There are four astronomical papers by Professor Proctor, and a number of exhaustive chemical articles by Professor Joy; while the treatises on physical and medical topics are from the pens of Drs. Hogeboom, Clarke, Flint, Dalton and Edes, and Professors Abbé, Hunt, Kneeland and others. Count Pourtalès, of the Coast Survey, contributes a valuable account of deep sea dredging, in which is contained a *resume* of the most recent investigations of the ocean bed and its odd inhabitants. Volume VI., like its predecessors, is copiously illustrated with excellent engravings, a feature of much value, and tending to give additional interest to the subjects treated of in the text.

The July number of that admirable children's magazine, ST. NICHOLAS, is superlatively good. The literature for the youth of this country is, as a general rule, so much of the morbidly mawkish order—we know of no better term to express its nature—treats so much of those intensely well behaved children who are always doing such exasperatingly charitable and aggravatingly good actions—that we feel a genuine satisfaction in turning over the pages of a work that tells the youngsters stories which we know they will read and reread until the very paper becomes worn and limp with innumerable finger marks. While none believe in making piety and upright living more attractive to the children than ourselves, we have no patience with the trash which aims to convert a healthy, rosy-cheeked, earthly imp into an incipient theologian or a pocket model of sanctity whose joys are not of this world, and whose existence is mainly spent in "getting licked" and thereupon tearfully forgiving his aggressor. The issue of ST. NICHOLAS before us has an excellent story, by Bret Harte, about a juvenile bear, which will provoke many a hearty laugh, and to which Beard, the artist, contributes a sketch of the hero, drawn as only he can draw bears. Then there is a table of contents and a lot of pictures, which we cannot pretend to describe, but which are sure to delight the young ones, and the old ones for that matter, too. Besides, as if all this were not enough, ST. NICHOLAS proudly announces that, not content with swallowing "Our Young Folks" some time since, he has exercised his cannibalistic propensities on the "Children's Hour," and, in the future, will have a three-fold claim upon the notice of his juvenile readers. If we were a youngster, we think we should tease hard for the necessary three dollars for a year's subscription, and lose not a moment in forwarding the money to Messrs. Scribner & Co., at 654 Broadway, New York.

SCRIBNER'S MONTHLY, for July, opens with a continuation of Edgar King's Papers on the Great South, in which the history, resources, and enterprise of Missouri are described with considerable detail. Professor Hartt contributes a valuable article on "The Shakspeare Death Mask," which is copiously illustrated, and which gives many interesting facts regarding the existing and much disputed likeness of the great poet. More instalments of the serial stories, including Jules Verne's fanciful account of the Mysterious Island, a few choice poems, and other interesting matter, besides the usual Editorial Miscellany, complete a varied and excellent table of contents. Subscription $4 a year. Published by Scribner & Co., 654 Broadway, New York.

SCRIBNER'S MAGAZINE for July contains an excellent variety of contents, among them illustrations of the Heart of the Republic, which refer especially to the City of St. Louis, and include a view of the new bridge at that place.

GODEY'S MAGAZINE for July is as attractive as ever. This number is the first of the forty-fifth year of the work.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From May 22 to May 28, 1874, inclusive.

CARBURETTING AIR, ETC.—J. M. Cayce, Franklin, Tenn.
CAR COUPLING.—W. Todd, Portland, Me.
IRON AND STEEL MANUFACTURE.—E. Peckham, Antwerp, N. Y.
MOWER AND REAPER.—W. A. Wood, Albany, N. Y.
REDUCING IRON ORES, ETC.—N. W. Wheeler, New York city.
SPINNING AND WINDING FIBERS, ETC.—G. Draper *et al.*, Hopedale, Mass
STEEL SHOVELS, ETC.—T. J. Blake, Pittsburgh, Pa.
STRAW FABRICS, ETC.—N. A. Baldwin, Milford, Conn.
TOY.—W. W. Rose, New York city.
YEAST POWDER, ETC.—E. P. Eastwick, New York city.
WOOL CARD EVENER.—F. F. Burlock, Birmingham, Conn.

Recent American and Foreign Patents.

Improved Building Block.

Thomas B. Rhodes, Leetonia, O.—This invention relates to an improved building block formed of concrete or other material, which in its plastic condition may be molded into the required form, and will become sufficiently hard and durable for making permanent fireproof walls or structures. Hollow spaces extend through the blocks from bottom to top, to make hollow walls. The parts by which the two sides of the blocks are connected are arranged sufficiently distant from the ends to form grooves therein, in which tongues on other blocks will fit to lock the blocks firmly together. A groove may be formed in one end of a block and a tongue in the other. These grooves and tongues may be in dovetail form. Long binders of wood or iron, extending from end to end of a wall at the top, or from bottom to top, are used. The openings in the top blocks may be arranged so that hot air admitted to them may circulate throughout the spaces in all outside walls, and in partitions, if preferred, for heating the rooms. In laying up a wall, it is proposed to enclose each layer temporarily in a casing of wood, and pour in hot cement to flow into the interstices and fill them up and unite the blocks.

Improved Electrical Condenser.

Charles A. Browne and Isaac S. Browne, North Adams, Mass.—This invention relates to the construction of Leyden jars or condensers, composed of india rubber plates with embedded tin foil sheets; and it consists in so constructing the condenser in sections that, in case a rubber plate is ruptured by a spark, the damage can be repaired by simply readjusting the sections, or, at most, by the loss of a section only instead of the whole jar, as when all the plates are vulcanized together.

Improved Trunk.

William J. Large, South Brooklyn, N. Y.—To the till of the trunk are attached bars, which slide up and down in ways in the trunk body. By suitable mechanism, by raising the lid to open the trunk, the till will also be raised, giving convenient access to the interior. When the lid is raised, a slotted bar drops over a screw to support the said lid and the till. Arrangements are connected with the till to adapt the same for use as a writing desk.

Improved Street Car Awning.

Joseph T. Craw, Jersey City, N. J.—This invention has for its object to provide an improved awning for the end platforms of street cars, which may be extended to a greater or less extent as conditions require. The invention consists in an apron or curtain attached to a roller and to an adjustable or extensible frame, which are so connected by rack, bar, and pinion that the curtain is unwound from the roller when the frame is extended, and rewound thereon when the frame is retracted or drawn back to adapt the awning for varying conditions of the weather.

Improved Folding Chair.

Ephraim Tucker, Worcester, Mass.—This invention consists in combining angular plates and pivoted connecting straps with the posts, seat, and back of a folding chair.

Improved Base Burning Stove.

Howard Greentree, Baltimore, Md.—This invention consists in a firebox hearth made of two imperforate parts, the lower made in sliding sections, and in a correspondingly perforated flange and ring to admit air to the fuel for supporting combustion between the firebox and the shell of fire chamber.

Improved Egg Carrier.

William O. Strong, Ypsilanti, Mich.—This invention relates to forming the carrier of a slitted paper strip in such a manner that it is rendered more durable than other carriers of its class, the ends of the several interlocked parts or sections of the strip being joined together on the sides of the body of the carrier to prevent wear and protect the eggs from being broken by concussion.

Improved Upright Drilling Machine.

Frederick E. Reed, Worcester, Mass.—This invention is an improvement in the class of upright drilling machines in which a weight is employed to balance the spindle and its attached drill. The invention relates to prevention of backlash by means, chiefly, of a chain, a roll or cylinder, and adjusting screws; also to the arrangement for enabling the drill spindle to be quickly removed from or reinserted in the hole made by it, part of the same devices being employed for the purpose as are used for ordinary slow feeding of the drill.

Improved Hay and Cotton Press.

Micheal Mickelson, Ashland, Oregon, assignor to Orson A. Davis, same place. This invention relates to the combination of locking and releasing devices with the toothed bars and stirrups or pawls by which the follower is operated. To one of the side arms of the stirrups is pivoted a short lever, the inner end of which strikes against the other stirrup, raising said stirrup away from the teeth of the bar. As the stirrup is raised it strikes against the stop attached to the follow beam, and is stopped, which causes the said lever to raise the other stirrup, in which position the lever, stirrup, and stop lock themselves so that the follower may be raised freely. As the follower rises, a pin attached to the inner end of the lever strikes against a stop attached to the framework of the press, which disengages the lever and allows the stirrups to drop, ready to take hold of the teeth of the bars when the lever is again operated.

Improved Stove Pipe Elbow.

Samuel Smith, Brookiyn, N.Y.—This invention is an adjustable stovepipe elbow constructed of central and outermost rectangular sections, with overlapping intermediate sections, of which the outer sections are riveted to slotted connecting strips, and adjustable by a thumb screw to the central strip.

Improved Girder for Iron Bridges.

Cyrus W. Wheeler, Brownsville, Neb.—The object of this invention is to construct girders for arch and truss bridges which require less riveting. The invention consists of a tubular girder produced of two quadrantal flanged sections, riveted to a longitudinal strengthening piece and connected by a stiffening chord, and a quadrantal lower section of wrought iron.

Improved Preserving Apparatus.

John Peter Schmitz, San Francisco, Cal.—This invention comprises an improved tank having a transverse vertical slotted partition which may be readily closed after the vacuum has been created by the consumption of oxygen in the other or contiguous department, thus permanently excluding air. The burner to which the fluid is supplied is ignited by a taper or electric wire which is inserted through a slot in the end wall of the tank.

Improved Car Coupling.

Henry D. Goldsmith, New York city.—The adjacent drawheads of two contiguous cars have long transverse notches formed in them to receive the cross bars which are bolted to the framework of the cars, and with which the said drawheads are connected by rods which pass through the said bars, so as to support the drawheads and allow them to have a longitudinal play. One drawhead is slotted longitudinally to receive a pivoted coupling bar, the outer end of which is beveled off, and has a notch formed in its upper side to catch upon the catch plate of the other drawhead. The inner end of the coupling bar is made the heavier, so as to hold its outer end raised. The hight to which the outer end of the coupling bar rises is regulated by a set screw. The rear end of a lever is pivoted to the drawhead, and to its middle part is attached a chain which passes up through the platform and around guide pulleys. Its upper end is attached to the lower end of a pin attached to said platform. The chain is made of such a length as to prevent the forward end of the lever from dropping too low. The forward end of the lever is supported below the inner end of the coupling bar, so that, by pulling upon the chain, the said coupling bar is lowered to detach it from the catch plate of the drawhead. The chain is connected with a rod, that slides in keepers attached to the forward edge of the platform, so that, by pulling upon the rod, the cars may be uncoupled from the side of the track. The forward end of the second drawhead is beveled, and upon its lower side is formed a recess to receive the notched outer end of the coupling bar. To the inclined forward end of the same drawhead is secured a steel plate, the lower end of which is notched to receive the notched end of the coupling bar. A spring projects beneath the end of the coupling bar to prevent it from jarring off the catch plate.

Improved Beer Cooler.

Wenzel Toepfer, Milwaukee, Wis.—The floor and ends of the cooling pan are composed of metal plates with beveled edges and other plates with a beveled strip. The strips are arranged with their beveled edges reversely to the edges of the first plates, so that, when the latter are placed on the upper side of the second plates and pressed against the strips, they lock together and make tight joints. The plates and strips are bent up at the ends, where they extend the whole length of the pan to form the two sides. They are clamped together by a cleat fastened at one end to one plate, passing under the other plate to the other side, and entering a clip attached to the first plate, which holds it from springing away, while a key is driven in between its shoulder and a cleat riveted fast to the first plate.

Improved Car Coupling.

James Leith, Ridgway, Pa., assignor to himself and William T. Burdett, same place.—The drawheads are made U-shaped, and are secured to the cars in the ordinary way. To the inner surface of one side of each of the bumper heads is attached a bar which enters the mouth of the opposite bumper head. The forward ends of the bars are beveled off, and have hooks which catch upon square pins held out by springs. The pins pass down between two pairs of short cross bars formed upon the drawheads. To the pins are attached chains which pass through holes in the opposite sides of the drawheads, and with the middle part of which is connected the end of a lever. The latter is pivoted to the side of said drawhead, and its free end projects so as to pass along the side of the opposite drawhead as the cars are run together. Other levers are pivoted to the drawheads opposite the hooks, and are so arranged that, as the cars are run together, the first levers may pass between them and the sides of the drawheads. To the second levers are attached arms which, as the said levers are drawn inward, strike against the loops, the arms of which pass in through holes in the sides of the drawheads, so that the pins may be forced away from the hooks, uncoupling the cars. The same inward movement of the second lever of either drawhead also operates the first lever of the other drawhead, to withdraw the pin of said other drawhead, so that the coupling may be uncoupled by operating the second lever of either drawhead.

Improved Feed Pump for Steam Boilers.

Thomas Warswick, Guelph, Can.—This invention relates to means of connection between a rotary horizontal shaft and vertical reciprocating shaft or plunger, whereby the length of stroke of the latter may be varied with convenience and dispatch.

Improved Bridle Bit.

Andrew Jackson Slaughter, Okolona, Miss.—This invention relates to constructing a bridle bit with lever, so that great pressure can be exerted on the tongue and jaw of the animal without the power on his part of evading the pressure by opening his mouth. The invention consists in making the mouthpiece with a crook, so that it will always remain on the tongue, and the upright levers of such a shape that a great advantage of leverage is secured.

Improved Wheelwright Machine.

William R. Perry, Gaines, Pa.—An eccentric lever is connected with the wheel by means of two straps, a central bolt, and a fulcrum pin. The straps are provided with a series of holes, so that the device may be applied to wheels of different diameters. The straps turn on the pivot bolt, and the lever is carried around from one spoke to another. The felly is thus pressed to the spokes without bruising or battering it with a hammer, and a rapid and permanent manner.

Improved Mode of and Tool for Capping Cans.

Richard H. Smith, Baltimore, Md.—This invention is based in part on the principle of the compound blowpipe, air and gas being conducted to the device in separate tubes and commingled at a point contiguous to the copper. The latter is in the form of a sheet or thin plate, which is readily heated by the flame that impinges on it through a slot in the back of the holder, and it is adjusted downward and clamped as required by means of a screw. The copper holder is secured in a socket which is provided with trunnions, and may be clamped in any desired adjustment to hold the copper inclined at various angles to the center on which the brace revolves. The brace is of the form of that used by carpenters for holding boring bits, and is revolved to carry the copper over the seam or joint in which bits of solder have been previously placed.

Improved Machine for Grinding Lenses.

Frederick R. Sutton and William O. Sutton, Wellington, Ill.—The holder for the lens to be ground revolves in a horizontal plane on a vertical axis, and the grinder revolves in a vertical plane on a horizontal axis. The inner periphery of the grinder works in contact with the face of the lens for grinding convex lenses.

Improved Curtain Fastening.

Aaron T. Rice, Reaville, N. J.—This fastening is formed of annular metallic plates and a slitted elastic disk. Said plates have semi-circular notches in their inner edge to receive or fit the shank of the knob or button, and the disk is slitted diagonally from the lower side so that a triangular tongue is formed which passes behind the head of the knob or button, and assists in preventing the fastening from getting detached.

Improved Railway Car Wheel.

George W. Milltmore, Janesville, Wis.—This invention relates to wheels generally, but mainly car wheels, and consists in means for taking up the shock thereon, and of locking the bushing or journal box and its collar to the hub of the wheel.

Improved Photographic Printing Frame.

Isaac M. Van Wagner, Nyack, N.Y., and Ezra P. Griswold, New York city.—This invention relates to apparatus for printing photographic pictures, and consists in an adjustable vignetting attachment to the ordinary printing frame now in use, by means of which the light opening, by means of longitudinal and transverse or other movable slides, is adjusted to the picture on the negative. It also consists in a device for varying the distance and position of the light opening from the negative. It also consists in a contracting and expanding diaphragm for varying the form and size of the light opening.

Improved Buckle.

George L. Robinson, Waterbary, Conn.—This buckle consists of a staple-shaped plate, bearing two parallel bars made zigzag, which pass through a cross bar. This cross bar slides back and forth on the bars, and is held in position by the angles, and to it is attached a pin having a loop handle. The pin and handle revolve loosely on the cross bar. The bars are attached to a bail shaped wire. The pin has short bends in it, which fit over the wire when the buckle is attached to the fabric.

Improved Lawn Mower.

Sidney D. King, Middletown, N. Y.—This invention relates to a machine especially adapted for cutting high grass, and consists in two sets of revolving cutters, arranged in a frame in such a way that one set severs the upper portion of the high grass, and the second or rear set works close to the ground. The machine is also adapted for cutting short grass, like others of its class.

Improved Loom Picker Stick Check.

Benjamin Bury, Fall River, Mass.—This invention relates to looms for weaving cotton, and consists in a new and improved device for checking and stopping the picker staff. The check bar is passed between two cords, and the cord is twisted to any desired degree of tension, thereby forming a spring, the action of which is imparted to the picker staff by the bar.

Improved Sash Fastener.

Shepherd W. Reed, Waterloo, Iowa.—This consists of a sliding bolt which locks into recesses of the window frame, being operated by a pivoted latch with notches and a projecting pin or lug, and fastened to a slotted guide piece after the bolt is pushed forward.

Improved Fire Alarm.

Percy Albert Blake, Highbury, England.—This invention is an improvement in self-acting fire alarms, in which adjustable fuses are arranged to traverse the various rooms or parts of a building, and connect with an explosive cartridge or alarm bell, which will be exploded or rung to indicate the existence of a fire in any portion of the building. The invention relates specifically to so connecting a series of branch fuses with a main fuse that, while any one of the former may ignite the latter, the latter cannot ignite the former. Hence, when a fire breaks out, the contiguous branch fuses will unite the main fuse, which, while giving the alarm, will not ignite any other branch fuse.

Improved Temporary Binder.

William A. Harwood, Brooklyn, N.Y.—This is a little case of sheet metal for temporarily holding one or more paper fasteners to receive the papers. There is a spring presser on the top, for pressing down and holding the papers on the fasteners. The device is so contrived that the papers to be filed will be secured at the left hand corner only, whereby the separation of the papers for inspection in the file, also in the package when removed from the file and secured together by the fasteners, may be readily effected.

Improved Culinary Vessel.

Laurence P. Bodkin, Brooklyn, N. Y.—Upon the edge of the vessel is formed a lip, to serve as a spout, in which is a strainer, secured in place by a single screw. The cover has a loose flap which closes the spout aperture, but swings open when the vessel is tilted. The main portion of the cover is held in place by spring catches.

Improved Bed Bottom.

Jonathan V. Taylor, La Cygne, Kan.—This is a flexible bed bottom, which consists in cords attached to head and foot frames, composed of transverse bars connected by longitudinal arms. The end bars of said frames are provided with projecting journals, which are fitted in inclined grooves, so that when the bed bottom is depressed the end frames will turn or oscillate for causing the pressure to bear against the under side of the bottom. The central portion of the latter will thus be elevated, obtaining a taut surface.

Improved Loom Shuttle.

Norman A. Williams, Utica, N. Y.—This is an improved spring mechanism for holding the spindle either in the elevated position for receiving the bobbin or cop, or in the position for delivering the yarn in weaving, and at the same time allowing of moving the spindle readily from one position to the other.

Improved Pitman Connection.

James Timms, Malta, assignor to himself, Hugh M. Cochran, and Joseph F. Sonnastine, McConnellsville, Ohio.—This is an improved device for taking up wear and the consequent lost motion. The invention consists in the combination of the sleeve or bearing and the lock nuts with the head or lug of the sickle bar, and the pitman having a screw thread cut upon it. A sickle bar has a lug to receive a hook on the end of the pitman. Upon the lower part of the latter is placed a sleeve, upon which is formed a toe, which is recessed to fit upon the sickle bar head. The sleeve is held down by lock nuts, placed upon a screw thread cut upon the pitman. By this construction, by turning down the nuts, the wear will be taken up to prevent lost motion caused by the wear, so that the hook can be used until worn out.

Improved Sewing Machine Caster.

William J. C. Gaar, Whitesburgh, Ga.—There is a rock shaft on each end frame of the stand, near the bottom, at right angles to the treadle shaft, carrying a castor in the outer end of an arm near each end. This rock shaft is connected by another arm and a rod with a lever pivoted on the treadle next to the standard, so as to force the casters down and raise the stand upon them when the free end is pressed down by the foot or hand of the operator. When forced down, the lever drops under a stud catch on the standard, which holds down and keeps the standard mounted on the casters.

Improved Vehicle Spring.

Ambrose L. Davis and Levi A. Davis, Port Crane, N. Y.—Springs are attached to the toe of the pole and to the bolster, and receive the blocks and bars, to which the fifth wheel is attached, and upon which the wagon body rests, being confined by the king bolt. The springs act in connection with the other springs of the running gear, and add materially to the elasticity of the wagon body. The clip block, by means of which the ordinary springs are confined to the axle, has a clip which passes around the latter, through the block, and through the spring. The ends of the block extend from this clip in each direction, and each receives a clip for giving additional support to the spring.

Improved Strainer for Milk Pails.

Conrad Schambra, Wheeling, W. Va.—This invention consists of a strainer attachment to milk cans, adapted to serve in combination with a small cap for the cover for the pail, and also adapted for the attachment of a funnel for straining and discharging the milk into a vessel having a small neck. By this device the milk can be strained at the same time that it is received from the cow into the pail.

Improved Combined Blacking Box, Blacker and Polisher.

Anson L. Sonn, Baltimore, Md.—This invention consists in a peculiar mode of covering the blacking box and supporting the blacker upon the polisher, so that the whole may be conveniently carried in their trunks by travelers, and without the possibility of soiling their clothes.

Improved Fruit Box.

Edward Wilkins, Chestertown, Md.—This invention relates to modes of constructing fruit boxes so that they will be sufficiently strong and durable to bear the jars and jolts of transportation, the weight of the fruit, and the various manipulations through which they must necessarily pass, but, at the same time, be sufficiently cheap to admit of their transfer to the consumer with the fruit and without extra charge.

Processing Hermetically Sealed Cans of Fruit, etc.

Andrew K. Shriver, Baltimore, Md.—This invention relates to methods of processing hermetically sealed cans of fruit, fish, or vegetables, so as to preserve their peculiar flavors, and consists in immersing the tight vessel in water, and then applying superheated steam to the inside of the vessel.

Improved Bale Tie.

Finis L. Bates, Winona, Miss.—This bale tie is shaped in the form of the letter U, and has legs so arranged in diagonal position to the base that the tie rests thereon on the lower corners of the same. The upper diagonally opposite corner of each leg has a spur. The ends of the loop band are slipped over the legs of the tie by being placed parallel to the sides of the same, by which no resistance is offered. The end projections keep the bands in position on the tie, and prevent thereby the detaching of the same.

Improved Scraper Attachment to Blacking Brushes.

John M. Stamps, Washington, D. C.—This invention relates to means whereby an ordinary brush for blacking and polishing boots or shoes may be made more useful and desirable to the public. The invention consists in the peculiar shape of the scraper and the mode of applying it to the brushes so as to enable it to conveniently and readily eliminate every particle of dirt, especially between the upper and sole.

Improved Cooking Utensil.

Ira Dunham, Plattsburg, Mo.—This is a cooking utensil for broiling meats, roasting coffee, and other purposes, which is readily thrown open and held tightly closed during use. Two pans of equal size are pivoted together, facing each other, and closed by a longer handle with spring extension, which takes hold of the shorter handle, and holds the same in position by a sliding clasp link.

Improved Car Coupling.

William H. Hopper, Saginaw City, Mich.—This invention consists of a bumper head, to which is pivoted at one side a strong spring dog; at the other side is a vertical loop, with wedge-shaped or pointed front edge which enters between the rounded off side of the bumper head and the spring dog of the adjoining car, so as to be firmly locked between them. For the purpose of coupling with the common drawhead and link, the bumper head is provided with a horizontal slot for admitting the link, while the pivoted clevis is detached and thrown back in sideward position, and its pin fastening made available for coupling the entering link.

Improved Rope Drum for Windlasses.

John Knowlson, Jr., Troy, N. Y.—The drum is provided with a conical friction flange at each end, and arranged loosely on the shaft, so that the latter can turn without it; also so that it can slide lengthwise to some extent. A friction disk is keyed fast to the shaft. For clutching the drum to the shaft, suitable mechanism presses a loose disk against the drum and the latter against the friction disk.

Improved Suspension Lamp.

Riverius Marsh, New York city.—This invention is a plate made in any form to serve as a reflector to throw the rays of light downward. The plate is fastened to the shade by means of screws which pass through a vertical flange and enter a corrugation in the shade. The plate is suspended from lamp chains, so as to serve both as a reflector and connection between the lamp and shade, allowing either to be raised or lowered.

Improved Car Starter.

Carl Ludwig Praeger, Niles, Mich.—The draw rod, when strain is applied, pulls forward a traveling carriage which moves on the drawbar. Friction rollers on the side of the carriage pass under the inclined portion of the horizontal arm of a bell crank lever, to the vertical part of which arms are secured, which are thereby forced at an angle into the ground, so pushing the car ahead.

Improved Molder's Flask.

Isaac Mc Guire, Albany, N. Y.—The upper flask section or cope is provided at the bottom part with slide pieces worked by handles under the cope plates, so as to project when ramming the sand, separating the cope from the nowel, being withdrawn when taking off both flask sections from the molded sand. The bottom flask is rammed and prepared in the usual manner for the pattern. The cope is then placed on it, with the slides pushed forward, so as to project to the inside of the cope. The sand is then rammed in over the cope section, then detached from the bottom section, and turned over for taking the follower board. The molded sand is supported on the projecting part of the slide. The cope is then reset on the nowel, the slides are drawn back, and both sections of the flask are then detached from the mold.

Improved Whiffletree Staple.

Munson Hinman, Hallock, Ill.—The loop and the strap of the staple are cast of malleable iron, in one piece. In the end parts of the strap are holes to receive the bolts by which the staple is secured to the whiffletree

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H. S. can obtain Faraday's "Experimental Researches" by applying to the booksellers who advertise in our columns.—F. W. M. will find directions for gilding on p. 90, vol. 30. Copies of patents can be obtained at this office.—R. Y. M. will find a description of wooden railroads in the United States on p. 324, vol. 29.—J. W. had better send us his instrument for finding lead, silver, and gold beneath the surface of the earth.—J. L. S. will find a description of polish for shirts on p. 27, vol. 30. We do not answer business questions in this column.—B. D. T. will find the statistics of English patents on p. 273, vol. 29.—D. B. will find directions for making paper boats on p. 165, vol. 27.—C. C. A. can preserve eggs by the recipe given on p. 378, vol. 30.—C. C. is informed that one of the best practical works on the steam engine is Bourne's "Catechism."—J. V., who wishes to become a mechanical engineer, should read Mr. Clarke's paper on p. 8 of this issue.—C. E. D. will find a description of the dynamometer he requires on p. 7, vol. 31.—J. R. will find a recipe for a cement for alabaster (which will serve for glass and china) on p. 218, vol. 26.—J. C. C. is informed that wood rollers can be kept from checking by the process detailed on p. 283, vol. 30.—S. R. H. can prevent rust on steel tools by the recipe on p. 234, vol. 27.—H. W. can blue a gun barrel by following the directions on p. 10, vol. 25.—F. J. D. can drive away cockroaches by the means described on p. 107, vol. 30.—R. W. will find full directions for case hardening on p. 122, vol. 30.—O. P. will find a recipe for aquarium cement on p. 90, vol. 30.—J. H. T. should not believe the mineral rod men. There is no truth in any of their pretensions.—We are obliged for A. B.'s reply to the horse and man problem, which we had anticipated in our editorial pages last week.

W. T. R. asks: 1. How are the battery wires connected with an electromagnet, so as to make the armature vibrate as long as the current continues? I wish to attach one to a clock alarm. A. The armature is fastened to a brass rod, as in a telegraph relay; this arm or lever, with the aid of a spring, serves to hold the armature a short distance from the cores of the magnet when the current is not passing. The wire, as it leaves the magnet, is placed in metallic communication with this lever; the wire from the other pole of the battery is attached to a small brass standard, which is placed in such a position that when the current is not passing the spring attached to the small lever draws it back against the standard, thereby completing the circuit, charging the magnet, which in turn attracts the armature, thus breaking the circuit, when the whole operation is again and again repeated. 2. How many feet of No. 15 copper wire will it take to make an induction coil for an electromagnetic machine for medical purposes? What number of wire and what length is best for the primary coil? A. See p. 379, vol. 30.

A. W. says: Can I make cook stove patterns of some alloy, that will run perfectly in molds of plaster of Paris and wood? A. Try white metal as follows: 86 parts by weight of tin, 10 antimony, 3 zinc, 1 copper.

F. T. says: A gentleman having a spring some 60 rods from his house wished me to lay a pipe from it to supply his house and barn. I commenced at the spring to lay the pipe, not letting the end into the water until I had made all connections, and running it to the house with some 30 feet fall. I then carried it into the kitchen over the sink, 5 feet high, bending it in a semicircle and running down again through the floor underground, some 6 rods to the barn, sinking a barrel for it to discharge into after running through the house. On the pipe, 16 inches from the circle or bend, I put a cock to draw for the use of the kitchen, this being on the side next to the spring. But to my surprise, when placing the end of the pipe into the spring, the water would run past the cock which I had inserted below the bend, rise 16 inches higher, and run down the other side of the barn. This I could only remedy by placing a stop cock on the opposite side of the circle and shutting it every time I wished to draw from the faucet. Not one drop of water would come out of the faucet without this. A. Such an occurrence is very common. You have got a siphon there. You can readily fit a two-way cock for the house faucet, which will shut off the discharge into the barn, when opened into the kitchen.

A. B. asks: How is black copperplate printing ink made? A. Take linseed oil 1 pint, boil out of doors in a dry saucepan till it will ignite on applying lighted paper, let it burn 10 minutes, then put the lid on, and the flame will go out. Stir in ¾ oz. litharge. When cool, grind into a paste with lamp black, using a muller.

W. H. S. asks: 1. How can I make a white linen or cotton waterproof without covering the texture or discoloring the linen? What kind of varnish or other transparent substance will give linen adurable finishing polish after being thus treated? A. A good solorless varnish is made by dissolving 2½ ozs. shellac in a pint of rectified spirits of wine; boil for a few minutes with 5 ozs. well burnt and recently heated animal charcoal. Add more charcoal if necessary to make the varnish white. Filter through blotting paper. 2. How can I make an adhesive substance that will not discolor white linen? Try gum trugacanth mucilage, adding a few drops oil of cloves to prevent putrefaction.

C. D. R. asks: What are "bastard cut," "smooth cut," "superfine cut," and "dead smooth" files? A. Bastard cut files are coarse ones used for roughing work out. Second cut are for roughing out hard metal. Superfine cut are for making very smooth surfaces. Fine cut are for ordinary smooth surfaces. Dead smooth are for very fine surfaces to be highly polished, the latter saving much labor in polishing.

A. S. & Co. ask: How can we prepare sweet cider so that it will remain sweet for several months? Can it be so prepared that it will bear transportation without fermentation? We notice that cider will ferment in a short time, even in freezing weather, when agitated by the motion of the cars. A. Perhaps the best method is that of thoroughly charing the insides of the casks, and racking off the cider a number of times.

E. A. B. says: Some four years ago the ship Pomona was lying in Montreal deeply laden. Five or six strong tow boats tried for three days to tow her up, but were unsuccessful. One of the Allan steamships then took her in tow, as she was going up the current, and, unaided, walked her along without the slightest difficulty. The steamships always ascend the current (which runs at 10 knots) at half speed. The question is: Was not the extra weight of the steamship a power in the case? I should state that the aggregate steam power of the tugs was greater than that of the steamship. To simplify the case, cannot a man in a boat of 25x5 feet tow a boat of 12x4 feet with greater ease than he can in a 12x4 boat tow one of 25x5? I know by experience that he can do so, but I should like to know what law of force in motion governs the case. I want to know if inherent weight is not a power in the towage of smaller vessels in which weight is equally concentrated in proportion to the displacement of water? A. We think that the sole advantage possessed by the large steamer was in the fact that her screw, being more deeply immersed, was not working in such a swift current as the smaller ones, and acted more efficiently. There was no gain in the increased weight.

A. D. D. asks: How can I repolish surgical instruments after grinding them on a lead wheel with flour of emery? A. Nothing polishes any metal better than crocus cloth, used on the article until it is covered with a face of the metal itself. The more the crocus is used, the better it is for polishing.

G. A. A. asks: If my lightning rod is painted, does the paint lessen its usefulness as a conductor? A. No.

W. W. asks: 1. Is there any loss in reciprocating motion as compared with rotary motion? If so, how can an engine run half a mile and back in the same time with the same power that another can run a mile ahead? If this is not a fair illustration, will you please explain how it is? A. We do not understand what you mean. 2. Is it not possible that we may have a liquid fuel that will be as cheap and much more convenient than coal, even if it has to be procured from coal? A. It is possible.

H. E. S. says: I have a fish net made of cotton twine, which remains in fresh and sometimes muddy water for two or three months at a time; what should it be immersed in (so as not to lose its flexibility) to best preserve it from decay? A. Steep your net in melted paraffin.

G. R. E. asks: How can I melt white vulcanized rubber in order to make castings? A. You cannot melt such rubber satisfactorily. Dissolve it in naphtha or else use the pure gum rubber.

J. M. E. asks: What is the commercial importance of black lead? A. Largely used in the manufacture of crucibles, lead pencils, as a lubricant, stove polish, etc.

C. C. M. I. asks: 1. Do you know of a manure or fertilizer which is soluble in water and which is of advantage in growing tobacco? A. We have used sulphate of ammonia to stimulate growing plants, and very successfully. We should therefore suggest its employment for tobacco. Other soluble salts of ammonia would answer, but this has the advantage that it is contained in the ammoniacal liquor of gas works and can be obtained in large quantity if needed. 2. Can you give me a recipe for making an amalgam for an electric machine? A. Melt together in a crucible 2 drams of zinc and one of tin; when fused, pour them into a cold crucible containing 5 drams of mercury. The cushions should be rubbed with a mixture of tallow and beeswax before applying the amalgam. 3. Is it also necessary to have the plate for the machine entirely smooth around the edge? A. Not absolutely necessary. 4. What is the proper temperature of water for bathing? A. A little colder than the temperature of the body.

J. W. P. asks: Why is it that an explosion is liable to take place during the loading of a cannon, if the vent is not closed? A. Explosions of this kind are due to particles of ignited carbon remaining in the gun. The closing of the vent partially stops the supply of oxygen, and this hastens the extinguishing of the carbon. In cases where the firing is continuous and hasty, these premature explosions are liable to occur, even though the vent be closed.

T. J. H. says: 1. We have a tree, the first fork of which is six feet from the ground. As the diameter of that tree increases year after year, will the distance between the ground and said fork also increase or not? A. The increase is only by interstitial lateral growth. The distance from the ground remains precisely the same. 2. It is a settled fact that carrying Irish potatoes in the pantaloons pocket cures rheumatism. Why is this? Why do said potatoes, when so worn, become as hard as stones instead of decaying? A. Curious, if true. Warmth without dampness will gradually desiccate a tuber like a potato, until it becomes very hard. Warmth and moisture will cause decay, and it is to be hoped that these circumstances do not conspire in the case mentioned.

G. S. B. says: I have tried the recipe, given in your No. 20, for making French polish, namely, dissolving shellac and sandarac in naphtha, and I find that naphtha does not have the least effect on either. A. Take the best pure white shellac and dissolve in alcohol (fourth proof); add a little gum sandarac. The fineness of the polish depends entirely upon the manner and skill with which it is applied.

G. H. M. asks: 1. How can I prevent a teakettle from turning the water brown by rusting? A. Keep an oyster shell in the bottom of the kettle; and when water is wanted, pour off without agitating the vessel. Be careful also not to let the water stand in the vessel when not in use. 2. What is the weight of one cubic foot of air near the earth? A. 100 cubic inches of air, at 60° Fah. and 30 inches barometric pressure (which may be taken as expressing the mean average condition of the atmosphere at the earth's surface), is 31·074 grains. Hence a cubic foot under the same circumstances will weigh 536·05872 grains.

F. E. C. asks: What metal with which hydrogen gas comes in contact produces flame sufficient to ignite gas? A. Platinum in a state of fine division, when it is called platinum black or platinum sponge.

C. T. asks: 1. How is the paper for printing decalcomanie prepared? A. Treat it with albumen. 2. What can I use to make tin look a bright gold color? A. Varnish it with shellac.

G. R. asks: I am manufacturing an article of 100 parts copper and 60 parts zinc. It is just about the quality of brass I require, but it has the appearance of yellow brass. Is there not some metal which I could add to the mixture to give it a richer and more coppery color? A. There is no way except by increasing the percentage of copper.

H. H. H. A. asks: 1. What is a simple way to color or bronze a gun to keep it from rusting? A. Dissolve 2 parts of crystallized chloride of iron, 3 parts solid chloride of antimony, and 1 part of gallic acid in 4 or 5 parts of water. Apply to the gun barrel with a sponge. Let it dry in the air, and repeat the operation several times; then wash with water, dry, and rub with boiled linseed oil. The shade deepens according to the number of times the operation is repeated. 2. What material is the best for gun wads? A. A specially made felt is used for this purpose. 3. How can I make glycerin? A. See p. 347, vol. 30.

L. says: In your issue of March 28, you give a recipe for dissolving rubber in turpentine. I have tried it in turpentine, bisulphuret of carbon, ether, and benzine, hot and cold, in bath and without, and could never succeed. I send you a piece of the rubber. A. Your sample dissolves in all of these, and partially in naphtha and benzine.

C. S. asks: 1. How is milk brought into a state of fermentation? A. After the milk has curdled, add powdered chalk until all the lactic acid is taken up and repeat the operation as the fermentation proceeds. 2. How can butyric acid fermentation be stopped? A. Try powdered alum.

G. R. asks: How can I dissolve boracic acid so that it will remain in solution? I tried 1 part acid to 8 of boiling water, but it precipitated on cooling. A 100 ozs. of water at 75° Fah. will dissolve 13¾ ozs. of boracic acid. Your other queries were answered last week.

T. C. H. asks: In doing fine work such as engraving, will it be more injurious to the eyes to use spectacles of tolerably strong magnifying power, than an ordinary eye glass and stand, such as is generally used for that purpose? A. Whenever strong magnifying powers are used, the eyes require corresponding long periods of repose to prevent injury.

A. T. B. asks: How is phosphorus dissolved previous to being applied to the match? How are the matches dipped? Is there any danger in the process? A. The preparation is different according as they are chemical or lucifer matches. For chemical matches, put 40 grains of phosphorus in a wide-mouthed bottle. Add enough oil of turpentine to cover the phosphorus; then mix in 10 grains of flowers of sulphur. Put the bottle into hot water until the phosphorus is entirely dissolved; stop the mouth of the bottle with a cork, and well shake the whole until it has become cold; afterwards pour off the supernatant oil of turpentine. Into the mixture of phosphorus which remains in the bottle, dip the extremities of the matches; and after some time, when they have become dried, drop them into the following mixture: Dissolve 30 grains gum arabic in a small quantity of water; add to it 20 grains of chlorate of potash, and mix them intimately together; then add 10 grains of soot previously mixed with a few drops of spirits of wine. In about 20 hours, the matches will be perfectly dry, when they will ignite on rubbing them over a rough surface. For lucifer matches, use one third of phosphorus, and the remainder of gum arabic, water and coloring matter like minium or Prussian blue. Mix in a water bath and muller carefully. The dipping is performed in the following manner: The melted composition is spread upon a board covered with cloth or leather, and the workman alternately dips the two ends of the matches, that are fixed in a frame. The fumes are very poisonous.

H. L. E. says, in reply to P. S. S. who asked whether Cornell University is a good school for mechanical engineering: There is connected with Cornell an extensive mechanical and machinery department, fully equipped with some of the finest machinery and tools to be found in any shop in the country, and where instruction in practical mechanics is given by the most efficient professors. The study forms an important part of the course required of the student, and gives a proficient an opportunity to earn something towards his own support.

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 Color of Light. By M. O. N.

On Veaucellier's Parallel Motion. By S. N. M.

On the Transit of Venus. By R. D. W.

On Screw Propellers. By J. E. W.

On the Sun's Attraction. By C. T.

On the SCIENTIFIC AMERICAN. By K. M. J.

Also enquiries and answers from the following:

H. P.—T. J. W.—S. L.—J. C. C.—F. H. D.

Correspondents in different parts of the country ask: Who publishes a book on raising gold fish? Who sells a motor for light machinery, other than a steam engine? Who sells small engines for boats, so simple that an amateur can run them? Who makes adding machines? Who makes the best brick machine? Who has a patent apparatus or system for blasting rock? Who makes the best turbine water wheels? Who sells the best lathe for turning hammer handles? Who makes stump pullers? Who makes steam engines, as small as 2x3 inches in the cylinders? Who sells machines for forming and coating pills? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

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.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

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

[OFFICIAL.]

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Wagons, unloading header, H. Klehn 151,601
Washing machine, boiler, F. H. Biesecker 151,533
Watch regulator, J. W. Hurd 151,537
Watches, adjustable cap for, W. W. Stewart 151,516
Water from steam, separating, B. J. Hobson 151,664
Window sc[illegible], T. Kells 151,599
Wrench, Ulbinger & Hofliger 151,635
Wrench pi[illegible], J. B. Westwick 151,539

APPLICATIONS FOR EXTENSIONS.

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

29,968.—MOLDING METAL PIPES.—H. Parmelee. Aug. 19.
29,917.—SELF ACTING DRAWBRIDGES.—L. Schneider *et al.* August 19.
29,950.—MORTISING MACHINE.—H. C. Smith. August 19.
29,923.—PLANING MACHINE.—H. D. Stover. August 19.
30,030.—STEAM ENGINE.—W. Wells. August 26.

EXTENSIONS GRANTED.

28,238.—GRAIN BINDING MACHINE.—D. W. Ayres.
28,653.—MARKING CLOTH.—H. W. Fuller.

DESIGNS PATENTED.

7,463.—DRAWER PULL.—A. D. Judd, New Haven, Conn.
7,464.—WASH BASIN.—J. R. Lancaster, New York city.
7,465.—SINK.—J. R. Lancaster, New York city.
7,466.—WASH BASIN.—J. R. Lancaster, New York city.
7,467.—SHELF BRACKET.—A. H. Lowell, Manchester, N. H.
7,468.—STOVES.—J. S. Perry *et al.*, Albany, N. Y.
7,469.—CARPETING.—J. Fisher, Philadelphia, Pa.
7,470.—DRAWER PULL.—J. Girard, New Britain, Conn.
7,471 to 7,474.—CARPETS.—H. Kerr, Philadelphia, Pa.
7,475 & 7,476.—CARPETINGS.—H. S. Kerr, Philadelphia, Pa.
7,477 & 7,478.—CARPETS.—H. S. Kerr, Philadelphia, Pa.
7,479 & 7,480.—CARPETS.—W. Kerr, Philadelphia, Pa.
7,481.—IRON FENCES.—S. Turnbach, Bloomsburgh, Pa.
7,482.—CARPETS.—W. F. Walt, Auburn, N. Y.

TRADE MARKS REGISTERED.

1,811.—COLOR MORDANT.—Burgess *et al.*, Woonsocket, R. I.
1,812.—HAMS, ETC.—P. T. George & Co., Baltimore, Md.
1,813.—MEDICINE.—W. C. Hamilton & Co., Cincinnati, O.
1,814.—LIQUID POTASH.—Holman *et al.*, New York city.
1,815.—CIGARS, ETC.—T. H. Messenger & Co., N. Y. city.
1,816.—SOAPS.—S. W. McBride & Co., Chicago, Ill.
1,817.—SMOKED & OTHER MEATS.—I. Michener, Phila., Pa.
1,818.—CIGARS.—L. Moss, Chicago, Ill.
1,819.—KNIT GOODS.—Plainville M'f'g Co., Plainville, Ct.
1,820.—PLANTERS.—L. W. Warner & Co., New York city.

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On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA

MAY 26 to 29, 1874.

3,472.—W. H. Beckwith, Ottawa, Carleton, Ont. Improvements on heating, cooking, and ventilating apparatus, called "Beckwith's Heating, Cooking, and Ventilating Apparatus." May 26, 1874.

3,473.—S. S. Putnam, Boston, Suffolk county, Mass., U. S. Improvements on machines for making wrought nails, called "Putnam's *Wrought* Nail Machine." May 28, 1874.

3,474.—T. Foley, Brantford, Brant county, Ont. Apparatus and process for manufacturing extract for tanning and other purposes from hemlock, oak, and other bark and substances containing tannin, called "Foley's Non-Vacuum Apparatus and Process for Obtaining Bark Extract." May 28, 1874.

3,475.—S. P. Leake, London, Middlesex county, Ont. Improvements on bedsteads, called "Leake's Improved Bedstead." May 28, 1874.

3,476.—E. P. Morong, Boston, Suffolk county, Mass., U. S. Improvements on method of laying and preserving wood pavements, called "Morong's Method of Laying and Preserving Wood Pavements." May 28, 1874.

3,477.—E. Myers, New York city, U. S. Improvements on rotary pumps, called "Myer's Rotary Engine." May 28, 1874.

3,478.—M. Wainman, South Orillia, Simcoe county, Ont. Churning Machine, called "Weinman's Churning Machine." May 28, 1874.

3,479.—J. W. Elliot, Toronto, York county, Ont. Improvements in heating stoves, called "Elliot's Fuel Saver." May 28, 1874.

3,480.—J. Taylor, Hamilton, Wentworth county, Ont. Improvements on railway freight cars, called "Taylor's Improved Box Car." May 28, 1874.

3,481.—J. A. Moffat, Dundas, Wentworth county, Ont. Improvements in a machine for stoning cherries, called "Moffat's Improved Machine for Stoning Cherries." May 28, 1874.

3,482.—W. T. Kellogg, Troy, Rensselaer county, N. Y., U. S. Improvements on portable forges for blacksmiths, called "The Empire Fan Blowing Portable Forge." May 28, 1874.

3,483.—W. Quinlan, Mayfield, Santa Clara county, Cal., U. S. Improvements on a tripartite tie link for chains, called "Quinlan's Tripartite Tie Link for Chains." May 28, 1874.

3,484.—J. Bennett, Belleville, Ont. Improvements on a fanning mill and separator, called "Bennett's Improved Ockerman Fanning Mill and Separator." May 28, 1874.

3,485.—William W. Allmand, East Boston, Suffolk county, Mass., U. S. Improvements on valve refitting machines, called "Allmand's Valve Refitting Machine." May 28, 1874.

3,486.—C. Cole, Meriden, Sullivan county, N. H., U. S. Improvements on a machine for washing, called "C. Cole's Excelsior Washer." May 28, 1874.

3,487.—J. T. Cocking, Penzance, Cornwall county, Eng. Improvements in the manufacture of corsets or stays and other articles of wearing apparel, called "The Poro-Plastic Corset." May 28, 1874.

3,488.—G. N. Torrence, Philadelphia, Philadelphia county, Pa., U. S. Improvements on combined mattress and life preserver, called "Torrence's Life Saving Mattress." May 28, 1874.

3,489.—P. Cadell, Victoria, Vancouver's Island, British Columbia. Combination of machinery and apparatus for the extraction of gold from auriferous gravel materials, called "The American Gold Washing Sluice or Flume, with Power Sifting." May 28, 1874.

3,490.—J. B. Wills, Montreal, P. Q. Improvements on horseshoe nail machines, called "Wills' Improved Dodd Machine." May 28, 1874.

3,495.—G. W. McCready, Village Petitcodiac, Westmoreland county, N. B. Improvements on boring machines, called "The Victor Boring Machine." May 28, 1874.

3,497.—F. A. H. La Rue, Quebec, P. Q. Un nouveau et utile perfectionnement dans la concentration des pyrites de cuivre et autres pyrites. ("La Rue's Method and Process for Cleaning and Concentrating Copper and Other Pyrites.") May 29, 1874.

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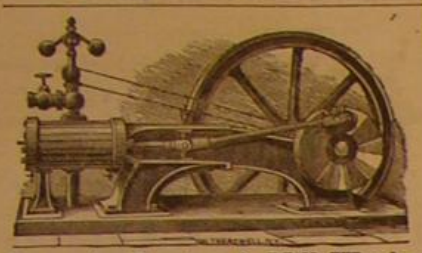


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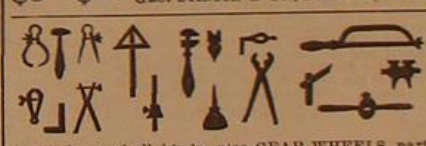
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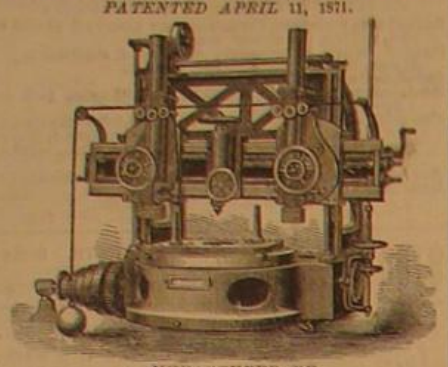
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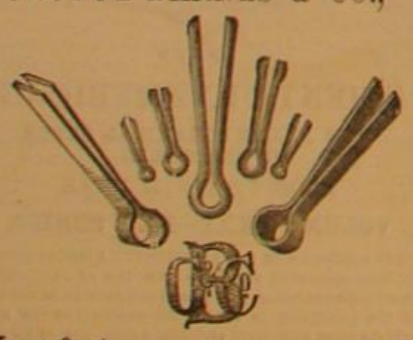
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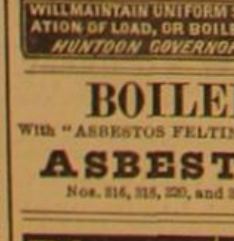
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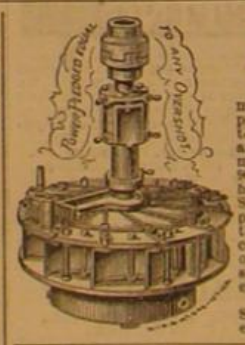
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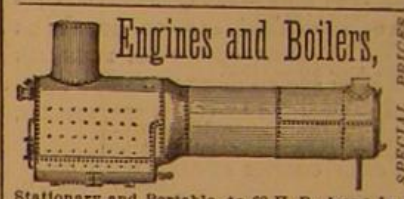
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SCIENTIFIC AMERICAN

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

Vol. XXXI.—No. 2. [NEW SERIES.] NEW YORK, JULY 11, 1874. $3 per Annum. IN ADVANCE.

BALANCED SCREW AND REVOLVING COTTON PRESS.

The several points of merit claimed for the improved cotton press herewith illustrated are simplicity of construction, rapidity, and reliability of action, and the saving in time of pressing effected. These, with other advantages below noted, combine to render the device suitable for employment by cotton raisers, or applicable to the pressing of tobacco, hay, hops, cloth, paper, hair, hemp, moss, cider, wine, rags, straw, and, in brief, to any operation where inventions of similar nature are now employed.

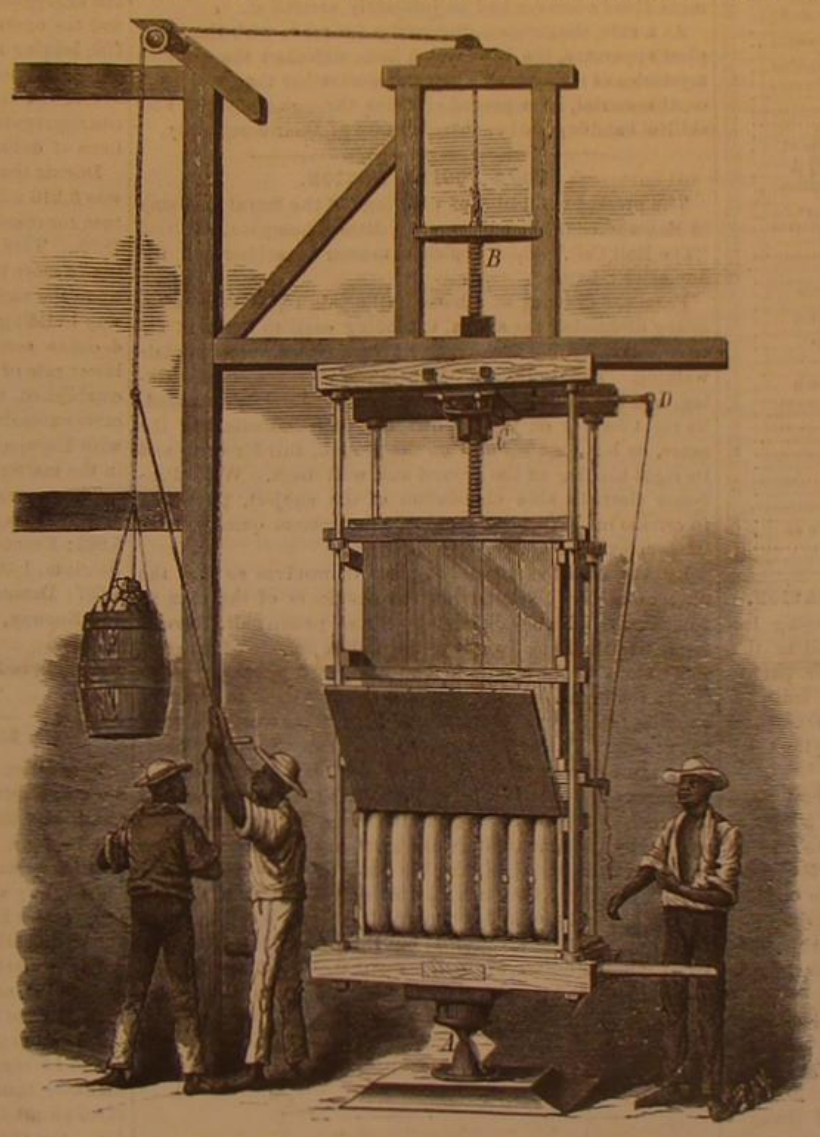
The apparatus, as shown in the illustration, revolves on the pivot, A. The screw, B, having a crosshead which travels in the guides on the upper part of the frame, extends down through a nut, C, on the revolving portion. To the upper portion of the screw is attached a cord which, passing over suitable pulleys, carries a barrel of stones or similar counterpoise.

The nut, C, is made in two sections which, by means of the lever attachment, D, may be closed together or opened at will. When the parts are closed and the lower portion of the press rotated on its pivot, by means of the handles shown, the screw, acting on the nut, is necessarily caused to travel downwards, so forcing down the follower and compressing the material. When the pressure is finished, instead of it being necessary to turn the press in the opposite direction, and so waste time in raising the screw to its former position, the sections of the nut are opened, releasing their engagement with the screw, which is then lifted bodily by pulling down on the counter weight, as represented in the figures on the left. It is claimed that, through the economy of time thus effected, one third more bales per day can be pressed. After the cotton box is filled, the follower block does not require to be turned down three or four feet before reaching the point at which pressure begins, but is lowered or dropped at once, so that the real work commences with the first revolution of the machine.

The press, if desired, can be run by steam power, a belt being placed on the drum under the cotton box. It can be located in the lint room or erected as shown in the engraving, by framing a supporting beam into the gin house and allowing the apparatus to stand near to and outside of the buildings. The frame is of iron or wood, as desired, is portable, and occupies no extra space. Five hundred pound bales are readily made with two hands, or any animal power may be applied if required.

By a slight change in the adjustment of the nut, the machine can be converted into a tramper press, the screw and follower being used to pound the lint in the box down into its place, thus obviating the injury to the health of the workers who enter the receptacle and tramp the material with their feet.

The invention was patented April 10, 1871, since which time it has been modified and improved in many particulars. It is now in successful use in many localities in the South, and gained a premium at the late St. Louis fair. The manufacturers state that other forms of the press, arranged so that the screw works upward, so that the bale may be removed from the top will shortly be offered. July and August being the months in which cotton presses are principally used, planters and others desiring further particulars regarding sale of State and county rights, or for presses, should lose no time in addressing J. H. Woolfolk, Box 295, Vicksburg, Miss. The special agent for Texas, Louisiana, Mississippi, and Alabama, is Dr. D. R. Lemman, New Orleans, La.



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More Machine Honesty.

The "knockdown" system, as the appropriating of fares collected by stage drivers and car conductors is termed, is not, it seems, peculiar to this country. The employees in the London street car lines have been resorting to the same means of increasing their wages. From the fact that people pay fare according to the distance they travel in most of the London conveyances, it will be seen that it is a very easy matter for the conductor to collect a certain sum for the longest ride, but to hand in the amount necessary to pay for the shortest, pocketing the difference.

Mr. Weir, has recently devised an apparatus which, the London *Times* says, works excellently, and which will probably come into general use in that city. A bronze door is placed across the entrance of the vehicle, so arranged that but one person can pass through at a time. Then in a small locked metal box is a registering apparatus which consists of a slip of paper which is pricked at the entry or exit of each passenger. The needle which makes the mark and the band of paper is set in motion by the opening of the door, so that each passenger is indicated by a separate puncture. In order to denote exactly how many people paying a certain fare are to be accounted for, at every station on the line at which a change in price is made a projection is fixed in between the tracks. Against this, as the car passes over, a small wheel connected with the registering mechanism by a pneumatic apparatus strikes, so that, by suitably moving the indicators, a blank space of some length is left after the last puncture denoting the lower fare. At the end of the journey, the slip of paper is removed, and gives the exact number of fares of every amount for which the conductor is responsible. The conductor is provided with a peculiar key in order to let himself out of the vehicle to make his collections, and an indicator marks each time that he does so. The above appears to be a rather complicated method of making conductors honest, but it may do for London.

The Spontaneous Combustion of Charcoal.

Professor F. Hargreaves states that the kinds of wood generally used for the manufacture of gunpowder charcoal are the black dogwood, the willow, and the alder. They are all well adapted for the manufacture of charcoal, although the dogwood is always used for the best sporting gunpowder. The wood is converted into charcoal by heating it in iron cylinders.

After the charcoal is taken from the cylinders, it is placed in iron coolers provided with tightly fitting lids, and allowed to stand for 14 hours, by which time it is generally quite cold, when it is sent to the charcoal mill to be ground, and afterwards to be mixed with the other ingredients for gunpowder.

But there are examples where the charcoal has spontaneously taken fire on the day after grinding. This is owing to the fact that charcoal absorbs mechanically within its pores a large quantity of oxygen gas from the atmosphere; and the condensation of all gases liberates heat, and, charcoal being a bad conductor, the heat cannot escape. The amount of oxygen absorbed by the charcoal varies with the degree of carbonization; the higher the heat, the more gases it will absorb.

The absorption with sticks of charcoal is not so quick as with ground charcoal: hence the spontaneous combustion of stick charcoal does not occur so often.

Fighting Fire with Explosives.

Western settlers, when a prairie is in flames, find that the only and best means of protecting menaced property is to plow up the ground around the latter for a width of several yards. Over this the fire cannot pass, for the simple reason that it finds nothing upon which to feed. The sole effective method by which the ravages of any great conflagration can be checked (and the truth was amply demonstrated in Boston and Chicago) consists in following the same plan; and in crowded cities, by destroying buildings adjacent to the burning locality, the latter can be entirely isolated from other portions, so that the fire may be confined to a limited area, on which may be concentrated the entire force of the extinguishing apparatus. The value of this heroic remedy is becoming widely recognized, and in this city a corps of sappers and miners has been organized, comprising fifty-six persons selected from the officers of the Fire Brigade, who are being regularly instructed in the use and nature of explosives, electric fuses, etc.

The first public experiments of the organization recently took place on Ward's Island, in the neighborhood of this city. A number of brick walls were erected, of various thickness, having a depth below the ground of one foot, and built upon a timber foundation. The first wall attacked was 20 inches thick, and the object of the experiment was to show the comparative effects of mining powder and dynamite suspended in cubical boxes against it. Fifty pounds of mining powder barely blackened the bricks, while six pounds of dynamite in a box 5 by 5 inches, cut a hole through the wall of about the size of the box. Then experiments followed in cutting down masonry varying in thickness from 8 to 36 inches, with cartridges containing from one to five pounds of dynamite, the effect being to divide the walls at the marked places with great accuracy. Floors were also torn up with the same powerful material, and finally seven walls were blown to fragments by a continuous line of cartridges arranged in rubber tubes and covered with bags of sand.

The trials were mainly very successful, and showed that by the use of explosives not only could whole buildings, during great fires, be quickly demolished, but, in smaller conflagrations, the dynamite cartridge could be advantageously used in gaining rapid access to edifices through walls. This proceeding now requires lengthy labor with axe and pick, the flames in the time thus lost often making serious headway.

The Solar Eclipse of April 16.

A total eclipse of the sun was observed by Mr. Stone, English Astronomer Royal at the Cape of Good Hope, on the 16th of April last. The line of totality passed over the southern extremity of Africa, beginning at Port Nolloth on the west coast of Cape Colony, somewhere about 250 miles from Cape Town, and took a curved path, with the convexity turned toward the north, ending at sunset about half way across.

The day was especially favorable for observation, and the sky was entirely free from clouds. Mr. Stone states that the rose-colored flames extended very nearly around the moon, although, of course, of unequal hights at different parts. The spectrum near the moon's limb was carefully examined in order to discover fresh lines, but none appeared, and hence there cannot be any medium capable of producing sensible absorption of light around the moon.

At the instant of totality the whole field appeared full of bright lines, all the principal Fraunhofer lines being reversed. Mr. Stone's observations tend to confirm those of the eclipses of 1869, 1870, and 1871, and their most important portion is that referring to the visibility of the Fraunhofer lines in the spectrum of the coronal atmosphere, showing thereby that that reflects the light of the photosphere.

A DEATH from hydrophobia recently occurred in Philadelphia about four months after the bite was given.

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..... $3 00
One copy, six months..... 1 50
CLUB RATES { Ten copies, one year, each $2 50..... 25 00
{ Over ten copies, same rate, each..... 2 50

VOLUME XXXI, No. 2. [NEW SERIES.] *Twenty-ninth Year.*

NEW YORK, SATURDAY, JULY 11, 1874.

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GOVERNMENT AID TO SCIENTIFIC INVESTIGATION.

Those who had the good fortune to hear the closing lecture of the series delivered by Professor Tyndall in this country will not soon forget the eloquent tribute he paid to scientific investigators, intent on the discovery of truth regardless of its bearing on practical ends, or the earnestness with which he insisted on the public duty of supplying them with means for their work.

The appeal was as plausible as eloquent. At first sight nothing would seem more reasonable than that the public at large, whose indebtedness to Science is so great, should do something towards supporting those who carry on the work; or that any means, which should honorably relieve original investigators of the daily drudgery of earning a living, and at the same time supply them with the fullest apparatus for their researches, would immensely increase their productions.

But when we remember that in every age there have been plenty of scientific men who have had at command all that money or position could give, yet have remained comparatively barren, while the great discoveries, more especially the original views opening up new lines of thought and giving new directions to human industry, have usually come from seemingly less favored workers, we cannot escape the suspicion that original thinking is quite as likely to be hindered as helped by easy circumstances. Besides, the best work in Science has rarely been done by men either dependent or very closely allied with the ruling clique of their day, freedom from class prejudice being an essential condition of independent thinking.

No doubt a good deal of honest work might be furthered by aiding the right men at the right time: but such men are rarely the ones that would be reached by public enactment, even if it were possible for them to maintain intellectual independence in connection with personal dependence. Radically new truths are inevitably unpopular, and none but popular men would derive much assistance from the public funds. The endowment of Science would therefore act very much as the endowment of religion has always done, by creating a class of nominal "leaders" whose instincts would be opposed to progress. Having risen to place and power by the advocacy of certain views, how could they give their countenance to men laboring to overthrow such views?

Run over the list of names—from Copernicus to Darwin—of those whose influence has been greatest on the progress of human thought. How long would their owners have been allowed to continue their work at public cost, in the face of popular clamor against their heresies? Had Professor Tyndall's plan been adopted a few hundred years ago, the world would still be flat, the center of the Universe, and only six thousand years old.

In applied Science, the case is equally strong. How long would Fulton have been allowed to squander public money in his "crazy" attempt to propel shipping against wind and tide with "boiled water"? Or Stephenson, in the equally wild project of drawing wagons across the land at the extravagant rate of twelve miles an hour? What administration could sustain the sarcasm of the opposition party after supplying Draper with money to waste in foolish experiments for painting with sunshine, or Morse with means to develop his impious scheme of annihilating time and space? What committee of wise men, having to render an account of their expenditures, would have dared to aid the experiments, of Goodyear in rubber, Young's attempt to make candles out of shale, Bessemer's scheme for making steel direct from the ore, or any one, in short, of the great achievements which, until the events proved their practicability, were accounted visionary, if not impossible, by practical men?

There is another fallacy underlying Professor Tyndall's proposal—one that he has strikingly exemplified in his own person quite recently—and that is the assumption that abundant and complicated apparatus is required for, or at least helpful in, the work of discovery. In some cases it may be; but ordinarily it is quite as apt to absorb the experimenter's attention so that he misses the point of the phenomena entirely. That was a brave array of steamers, fog whistles, artillery and the like, which Professor Tyndall took down to the coast to study the effects of different atmospheres on the transmission of sounds; but he had scarcely published the results of his costly observations when Professor Reynolds made known a few experiments with a hand bell which upset entirely the conclusions the government-aided observer had so jubilantly arrived at.

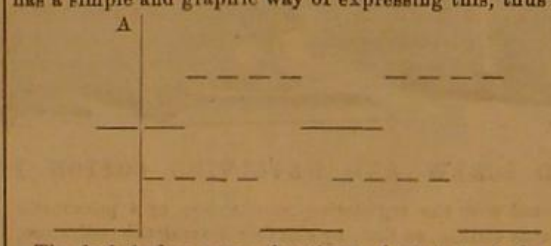
As a rule, the greatest discoveries are made with the simplest apparatus, the keys which have unlocked the grander mysteries of the Universe being mental rather than material: or, if material, have proved effective through simplicity and skillful handling rather than because of their complexity.

FOUR FOOTED MOTION.

The present exhibition of paintings of the Royal Academy in England contains a picture, by Miss Thompson, entitled "The Roll Call," which depicts a muster of soldiers on the day after a battle.

From the drawing of a horse in the painting, a very interesting discussion has arisen, extending even to eminent naturalists, regarding the motion of four footed animals while walking. The horse, in the picture, is represented walking, and has its left foreleg raised, bent, and nearly extended, its right foreleg on the ground and perpendicular to the same, its left hind leg also on the ground, full forward, and its right hindleg on the ground and well back. With Professor Garrod's able elucidation of the subject, published *in extenso* in *Nature*, as a guide, the problem quickly loses its perplexing features.

Let two men be supposed to place themselves so that the hinder one has his hands on the shoulders of the man in front, and that both walk in step—State's prison gait. Reverting this to the horse, we have the amble, a mode of progression natural to the giraffe, but only acquired by special training in the horse. Again, suppose the two men to put the opposite feet forward simultaneously, in other words, to walk out of step. This will exemplify the trot. Suppose, however, the two men to walk out of step; but instead of the diagonally opposite feet being set down at the same moment, imagine the first man to begin his step a little in advance, so that, by the time the forward man has got his right leg entirely raised, the rear man has just begun to lift his, although they keep the same number of steps. Then the sequence of steps would not be right front and left hind, left front and right hind, coupled; but right front, left hind, left front, right hind, separate and distinct. Professor Garrod has a simple and graphic way of expressing this, thus:



The dark dashes mean the times of contact of the right foot, the dotted lines same of the left foot. The two upper horizontal rows refer to the fore legs; the lower, to the hind. The dotted lines, beginning exactly where the continuous ones end—considered horizontally—indicate that one foot is lifted exactly when the other is put down.

From this it will be seen that, in walking, the horse never has more than two legs on the ground at a time. Draw a vertical line through any portion of the diagram, as at A, and it will be clear that only two of the horizontal foot lines are cut. The same line shows the picture referred to in the beginning to be correct, with the exception of one slight error. Following line A down, we find the first dotted line at the top, meaning the left fore foot, not cut; hence it is off the ground. The next line is divided squarely in the middle, and hence the right fore foot must be firmly planted. The dotted line below is just met at its beginning, consequently the left hind foot is about to commence its step; and the next line being at its rear end indicates that the right foot has just finished, and is being removed from the ground. If the reader will compare this with the foregoing description of the painting referred to, he will find that the correspondence is complete, excepting as regards the right hind foot, which, instead of being on the ground as represented, should, according to our diagram, be just leaving it. This also would be in accordance with the rule that no more than two legs can be down at a time, and thus the mistake which the artist makes in fixing three would be avoided.

We would commend the diagram herewith presented as a very simple guide for artists and draftsmen generally, as, by following its indication, they can hardly fail to depict the horse correctly. A general idea of the position of the animal being first settled upon, it is only necessary to draw perpendicular lines at various points, and try the results until a suitable *pose* is obtained. The figure very clearly solves a question over which many heads, wise and unwise, have often puzzled.

THE RAILWAYS OF THE UNITED STATES.

The seventh annual "Manual of Railways of the United States," by Henry V. Poor, 68 Broadway, New York, has just been published. It is a work of over eight hundred pages, and contains a large amount of carefully prepared information, including official particulars of all railways in operation, their extent, cost, capital, earnings, dividends, indebtedness, names of officers, directors, etc. The tabulated general statements concerning the American railway system afford valuable and instructive information.

The inauguration of railways in this country may be said to date from the year 1830, when railways were in operation to the extent of 23 miles. At the close of 1873 there were *seventy thousand, six hundred and fifty-one miles* of railway in operation. This great increase, during the brief time of forty-three years, is something marvelous to contemplate. The grand average cost is put down by Mr. Poor at $60,000 per mile, or upwards of four thousand millions of dollars in the aggregate. The total earnings were over $526,000,000, and the operating expenses 65 per cent thereof, or $342,600,000, leaving as net earnings the sum of $183,810,000, out of which interest on bonds and stock dividends were paid. The average of the latter were 3·45 per cent on the capital stock, the aggregate of which is one thousand nine hundred millions of dollars.

During the year 1873 the increase in railway construction was 3,916 miles, against 6,167 miles for 1872. The expenditure for construction in 1873 is less by 50 per cent than in 1872. This sudden great contraction in payments, amounting to more than $120,000,000, was disastrous in its effects upon the various branches of industry connected with railway building. But as soon as Congress shall fix upon some decisive settlement of the national finances, whereby a lower rate of interest for the American indebtedness can be established, then railway bonds will improve in value, and a more extensive construction may be expected. As compared with Europe, the United States are considerably in advance in the matter of railway mileage.

The aggregate of railways in 1873 in the various countries of Europe was as follows: Germany, 12,207 miles; Austria, 5,865; France, 10,333; Russia, 7,044; Great Britain, 15,814; Belgium, 1,201; Netherlands, 886; Switzerland, 820; Italy, 3,667; Denmark, 420; Spain, 3,401; Portugal, 453; Sweden and Norway, 1,049; Greece, 100

	Miles.	Population.
Railroads in 1873 in Europe.....	63,360	282,456,742.
" " United States....	70,650	40,232,000.

SOME OF THE USES OF PARAFFIN.

In addition to the properties which have brought it into such extensive use for illuminating purposes, paraffin has qualities which give it an exceedingly wide range of useful applications. White, clean, incorruptible, odorless, tasteless, plastic, water repellent, a non-conductor of electricity, and but slightly affected by most chemical agents: it needs only to be better known to become the most variously useful of the hydrocarbons.

For waterproofing fabrics for wearing apparel, military equipment, and the like, it is much better than rubber, since it is odorless and does not become sticky with heat. Among the most gratefully acknowledged of the many gifts sent out to Livingstone in the wilds of Africa, were boots and blankets thus prepared, the one enabling him to travel through mud, the other to sleep in it with comparative comfort. For the waterproofing of tent cloths, ground sheets for soldiers, and other articles of the sort, it has been found equally serviceable.

A more generally useful application of paraffin is for the lining of casks and other wooden vessels, to keep them sweet and to prevent either the absorption of their contents by the wood or their escape through the pores. Already it has been largely applied to beer barrels, wine casks, and other vessels of the kind, with the happiest results. It keeps them from becoming musty and foul; and still more, by filling the pores and joints of the staves, it prevents the escape of the life of the liquor, carbonic acid gas. Water buckets, butter firkins, and other wooden articles of domestic use might be similarly treated; and as the material is cheap, easily obtained, and easily applied, it can be tried on as large or small a scale as one may feel disposed.

Being indifferent to most chemicals, paraffin serves the same purpose equally well in the laboratory of the chemist and chemical manufacturer. In the manufacture of gun cotton, for example, wooden tanks lined with paraffin have been used for holding the mixture of concentrated sulphuric and nitric acids employed in that process, the protection of the wood being complete and lasting. Wooden boxes, protected in the same way, have been similarly employed in the construction of voltaic batteries. As a non conductor of electricity, paraffin is further useful, as an insulator, for which it is now extensively employed in electric telegraphy; also in connection with batteries for medical use, especially as an acid-proof coating to insulated conducting wires. In surgery, it has been found an excellent material for covering for splints in cases of fracture.

Those troubled with loosely fitting plates of artificial teeth, owing to absorption of the gums, can easily remedy the defect by dropping upon the plate a little melted paraffin, from

a lighted candle or otherwise, replacing the plate while the paraffin is yet warm. Being clean, tasteless, plastic at a low temperature, and unaffected by saliva, this substance will be found much superior to wax or any other material for the use, a few drops rightly placed making a perfect fit with a plate otherwise unwearable.

In the laundry, paraffin rubbed on the hot flat iron imparts a beautiful gloss to starched goods, greatly lightens the labor of ironing, and leaves no greasy stain. For this use it is much superior to spermaceti. Friction matches are now prepared with paraffin in place of the sulphur formerly employed; it burns without odor and goes out instantly, greatly reducing the dangers of accidental fires. Dissolved in naphtha, paraffin has been applied with excellent effect to decaying brick and stone work, filling the pores of the brick or stone and putting a stop to the destructive action of the weather. Fine wood work exposed to the elements might be protected in the same way. Heated with sulphur to a moderately high temperature, paraffin is decomposed, with the evolution of abundance of sulphuretted hydrogen. A steady and copious flow of this indispensable reagent in the laboratory is thus easily and cheaply obtained.

REFRIGERATING MIXTURES AND THEIR PHYSIOLOGICAL EFFECTS.

All solid bodies when becoming liquid, all liquids when assuming a gaseous state, absorb heat. The chemical compounds known as refrigerating mixtures are based on one or the other of these changes of condition. The Carré ice machine, it will be remembered, operates through the liquefaction of ammoniacal gas and the return of the same to a gaseous condition. At the moment of vaporization of the liquid, a lowering of temperature takes place, sufficient to cause the formation of considerable quantities of ice. Hydrated sulphate of soda and hydrochloric acid, and ordinary ice and salt, are examples of freezing mixtures, of which perhaps a score more could be cited, the effects of all of which are well known to chemists.

There is one of this class of compounds, which, although not a stranger to the chemical laboratory, has recently been found to possess greater frigorific capabilities than any other mixture yet discovered. We allude to ice and sulphuric acid, into the properties of which M. Berthelot, of the French Academy of Sciences, has recently made some interesting investigations.

It is well known that, in winter, crystals of hydrated sulphuric acid ($S^2O^4, H^2O + H^2O$) are easily obtained. These M. Berthelot mingles with ice, and he calculates the resultant cooling, first from the ice liquefied, and second by the acid also liquefying and the disengagement of heat due to its mingling with the water. On using 1·7 ounces of acid and 4·5 ounces of water, the investigator calculates the fall in temperature to be 125·6° Fah. If the mixture be made, not at the ordinary temperature, but at say 68° Fah., the mercury should fall fully 140°, so that at the end of the experiment the thermometer will mark —112° Fah. These are calculated results, but M. Berthelot is of opinion that, according to his theory, he will be able to reach —148° Fah., and perhaps absolute zero, about —516° Fah.

Substances when brought to such extremely low temperatures act very energetically as a rule upon the body. Solidified carbonic acid at a temperature of —111·6° produces serious burns when compressed between the fingers, injuring the skin in a manner similar to a red hot iron. Late discovery has, however, found that this frigorific effect varies strangely with the nature of the cold object which is brought in contact with the skin or mucous membrane. Melsens, a well known Belgian chemist, has recently called the attention of the Academy of Sciences of Belgium to the fact that brandy, frozen to a temperature of from 22° to 31° below zero Fah., by means of a mixture of ice and chloride of calcium, can be eaten with impunity and possesses a flavor superior to that of the liquor in its ordinary state. The temperature of any alcoholic beverage may thus be reduced without the material hurting the tongue. A wooden spoon must be used, as a metal one burns the mouth very quickly. The investigator says that not until the liquor is cooled to 76° below zero is any sensation of cold experienced; and it has been eaten at —95°, causing no more uneasiness to the eater than a mouthful of rather hot soup. It is remarkable that brandy at 95° placed on the arm, makes only a slight irritation, while ether paste or solid carbonic acid burns briskly.

The only explanation which seems plausible regarding these exceptional conditions would appear to be that the alcohols, when thus rendered extremely cold, remain enveloped in a certain quantity of vapor which hinders their contact with the organs, in like manner as a layer of steam prevents the contact of a drop of water with a heated plate. M. Melsens is, we understand, prosecuting further investigations, the results of which will doubtless throw more light on the curious phenomena.

PROGRESS OF THE FIRELESS LOCOMOTIVE.

On the New Orleans and Carrolton Railway, they employ the new fireless locomotives to draw the cars from Napoleon avenue to Carrolton, 3½ miles. From Napoleon avenue to Canal street, in center of New Orleans, horses are still in use.

The company are now running eighteen of the fireless locomotives, with much success and economy. General G. T. Beauregard is the president of the company. The fireless locomotive has been heretofore illustrated and described in the SCIENTIFIC AMERICAN, having been used to some extent in this vicinity. It is now employed in Brooklyn, N. Y., on the East New York & Canarsie railway. It consists of a hot water tank, which is charged with very highly heated water at the starting station, and the steam which rises from the water is used to drive the engine in the usual manner. No fire is required in connection with the locomotive, but it depends solely for its power on the supply of hot water with which it was originally charged. The object is to provide a substitute for horses in the propulsion of street cars, and to get rid of the gas and other objectionable features of the ordinary steam locomotives. The fireless locomotives of the New Orleans and Carrolton Railway Company have each a pair of 4½ inch cylinders and 11 inch stroke, fitted with link motions and slide throttles. Each machine has one hot water tank 3 feet in diameter and 6 feet long, steam dome 12 inches in diameter and 18 inches high. The tanks are so thoroughly jacketed, with felting, asbestos composition, and wood, that they only lose 3 pounds of steam pressure per hour from radiation. A locomotive charged with hot water at 6 A. M., and left standing until 9 P. M., 15 hours, will then yield steam pressure sufficient to move half a mile or more.

The water is supplied to the tanks of the locomotives from stationary boilers located at Carrolton, and each machine makes a round trip of seven miles upon one charge of hot water. One minute is required to charge each locomotive. The water is supplied at a temperature of 375° Fah., which produces a steam pressure of about 175 pounds to the inch at starting, which becomes reduced, by the time the machine has run 7 miles, to from 40 to 50 pounds. The charging boilers are arranged in two batteries of two boilers each, and these boilers are 26 feet long and 3 feet diameter, built of the best materials. Two boilers only are required for use at once. These fireless locomotives, as substitutes for horses, are found to effect a saving of $4 a day for each street passenger car. The new machines are easily worked, and give much satisfaction. The engineer who works the locomotive is also conductor of the car. He simply stands at one end of the car, with one hand on the throttle lever and the other on the brake. The patent fare boxes are used to receive the fares. The fireless locomotives draw their cars at the rate of 8 or 9 miles per hour.

NEW LAW CONCERNING COPYRIGHTS FOR LABELS.

Heretofore it has been the practice, under the copyright law, to grant certificates of copyrights to every applicant on furnishing a printed copy of the title of his book, work, or print of any sort; and under this practice it has become customary for medicine dealers and others to file in the titles of labels used upon bottles and other articles of merchandize. This has proved to be a very convenient and economical method of obtaining a registration, though it was not considered to be of much value. At its recent session, Congress passed an amendment to the copyright law which changes the place of registration for labels from the Library of Congress to the Patent Office; and raises the official fees on label copyrights from one dollar up to six dollars. The immediate effect of this increase of price will be to reduce the number of copyrights taken; while another feature of the bill, that which provides that the Commissioner of Patents shall only grant copyrights for labels that are not trade marks, will doubtless serve to introduce official red-tapeism, vexation and delay into the business of obtaining copyrights, from which it has heretofore been free.

This last provision of the bill appears to authorize the Commissioner to refuse copyright for a label, provided that officer takes a notion that such label is a trade mark. If held to be a trademark, the applicant must pay $25 in order to apply for trademark registration; and the application for a trademark will be then officially examined, subject to the usual liabilities of rejection.

The examinations and opinions of the Patent Office in respect to trademarks or copyrights are not what the people require. They want a simple, quick, and free method of obtaining registration for labels and patterns of every kind, with liberty to contest before the courts, in the usual manner, all issues pertaining to infringements. This is also what is necessary in respect to patents. When will our legislators learn that the true and proper way to encourage authors and inventors, thereby promoting the progress of useful arts, is to make the matter of registration simple and easy, instead of surrounding it with the perplexities and expenses of official inquisitions?

The new law goes into effect August 1st. The following is the text of the bill:

A BILL TO AMEND THE LAW RELATING TO PATENTS, TRADE MARKS, AND COPYRIGHTS.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That no person shall maintain an action for the infringement of his copyright, unless he shall give notice thereof by inserting in the several copies of every edition published, on the title page or page immediately following, if it be a book; or if a map, chart, musical composition, print, cut, engraving, photograph, painting, drawing, chromo, statue, statuary, or model or design intended to be perfected and completed as a work of fine arts, by inscribing upon some visible portion thereof, or of the substance on which the same shall be mounted, the following words, namely: "Entered according to the Act of Congress, in the year ——, by A. B., in the office of the Librarian of Congress, at Washington;" or, at his option, the word "copyright," together with the year the copyright was entered, and the name of the party by whom it was taken out, thus, "copyright, 18—, by A. B."

Sec. 2. That for recording and certifying any instrument of writing for the assignment of a copyright, the Librarian of Congress shall receive from the persons to whom the service is rendered, one dollar; and for every copy of an assignment, one dollar; said fee to cover in either case a certificate of the record, under seal of the Librarian of Congress; and all fees to be received shall be paid into the Treasury of the United States.

Sec. 3. That in the construction of this act the words engraving, cut, and print shall be applied only to pictorial illustrations or works connected with the fine arts; and no prints or labels designed to be used for any other articles of manufacture shall be entered under the copyright law, but may be registered in the Patent Office; and the Commissioner of Patents is hereby charged with the supervision and control of the entry or registry of such prints or labels, in conformity with the regulations provided by law as to copyright of prints, except that there shall be paid for recording the title of any print or label not a trade mark six dollars; which shall cover the expense of furnishing a copy of the record, under the seal of the Commissioner of Patents, to the party entering the same.

Sec. 4. That all laws and parts of laws inconsistent with the foregoing provisions be, and the same are hereby, repealed.

SCIENTIFIC AND PRACTICAL INFORMATION.

NEW MEAT PRESERVING PROCESS.

M. Sacc has obtained excellent results by using acetate of soda in powdered form. The meat is placed in a barrel and the acetate placed in, when it is left for forty-eight hours. Thus prepared, the meat, it is said, will keep for any length of time, and may be prepared for cooking by soaking for 12 hours in water, to every quart of which a quarter of an ounce of sal ammoniac is added.

NEW RELATIONS OF PLANETARY ORBITS.

Professor Daniel Kirkwood announces the discovery of some remarkable relations of the asteroid orbits to those of the larger planets. Near the close of the last century, Laplace noticed a relation between the mean motions of Jupiter's first three satellites; and from the results obtained by that astronomer, it occurred to Professor Kirkwood that similar relations might probably be found in the zone of minor planets interior to the great masses of Jupiter and Saturn. The investigation has led to interesting discoveries, which the author promises shall soon be published in full. As specimens of the correlations detected, he states the following:

1. Five times the mean motion of Concordia *minus* nineteen times that of Jupiter, *plus* fourteen times that of Saturn, equals zero. 2. Five times the mean longitude of Concordia *minus* nineteen times that of Jupiter, *plus* fourteen times that of Saturn, is equal to a semi-circumference, or one hundred and eighty degrees.

These discoveries, while tending to throw light upon the genesis of the solar system, may, according to Professor Kirkwood, be explained by the nebular hypothesis of Laplace or equally well by the accretion theory advocated by Proctor, so that they do not tend to confirm the comparative truth of either supposition.

CURIOUS EXPERIMENT IN ELECTRO CAPILLARITY.

M. Bécquerel notes another interesting experiment in electro-capillarity. A tube of glass is closed at one of its extremities by a membrane of collodion. With the tube is placed some sulphate of copper, and it is plunged in monosulphide of sodium. Crystallized copper is deposited within the tube, and sulphide of copper outside. Eventually the membrane becomes dissolved and disappears, but without interruption to the phenomena of deposit. The crystaline crust takes the place of the collodion without interrupting the functions. It becomes constantly thicker, metallic copper continuing to form on one side, and the sulphide on the other. It is suggested that this experiment may be of importance from a geological or mineralogical point of view.

REFLECTING POWER OF FLAME.

Recent experiments by M. Sorel prove that carbon retains its reflecting capacity even at the highest temperatures. A sunbeam becomes reflected by diffusion and is polarized in exactly the same manner, whether it falls upon a brilliant flame or upon smoke.

A SIMPLE METHOD OF REMOVING THE TEETH OF CHILDREN.

The operation consists in simply slipping a rubber ring over the tooth and forcing it gently under the edge of the gum. The patient is then dismissed and told not to remove the appendage, which in a few days loosens the tooth and causes it to fall out. Grown children, who shrink from the shock and pain of the dental nippers, may also have their teeth removed by means of the rubber, which is a mild form of treatment.

ADULTERATION IN INDIA RUBBER.

The *Bulletin Thérapeutique* says that, in order to use old and worn out pieces of india rubber scraps left from factories, manufacturers having easy consciences wash the material first in a solution of subcarbonate of soda or potash, and then, when dry, pulverize between cylinders. This powder, placed layer by layer between sheets of new rubber and heated to a certain degree, forms a homogeneous mass, in which the fraud cannot be detected. The mixture is, however, weak in tenacity and elasticity, and is unfit for surgical use, while dangerous for belting or other industrial employments.

STRENGTH OF GLASS TUBES.

M. Cailletet has found that a tube of thin glass, 20½ inches in length and ¼ of an inch in diameter, was crushed by an exterior pressure of 1,155 lbs. to the square inch, while similar tubes were burst by an interior pressure one half less. In making use of very thick glass, capable of resisting a pressure of four or five hundred atmospheres, he found the glass to sustain no permanent change of form. Upon this fact, he proposes the construction of a very sensitive and very simple manometer.

THE roadway of the great steel bridge over the Mississippi is finished and a train has passed over it. The formal opening of the structure will take place on July 4.

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THE EFFECT OF AIR PRESSURE ON ANIMAL LIFE.

In our issue of June 20 we described the important discoveries recently made by M. Bert, in relation to the influence which modifications in barometric pressure exercise upon the phenomena of life. M. Bert's investigations have necessarily been directed to two diametrically opposite conditions, the diminution of pressure and the augmentation of the same; and in our former article we explained the results obtained by researches conducted under the first mentioned circumstances. From an industrial point of view, the examination of the effects of compressed air upon the system, which we now propose to follow, is especially interesting because of the many cases, as in bridge building, diving, etc., in which workmen are obliged to labor in such an atmosphere.

A careful distinction, M. Bert says, must be made between the effects of the mere compression itself and those of a sudden decompression. To illustrate the influence of the latter proceeding upon animals, the apparatus shown in Fig. 1 was constructed. This was a large cylinder of sheet steel into which air was forced by the pump, C, actuated by the gearing at A. At D a worm coil was placed in cold water in order to refrigerate the air, and at E a recipient for the condensed moisture in the blast. *b* is a manometer, and *c* a large valve which, on being opened, allows the compressed air to escape, producing a sudden decompression within the cylinder.

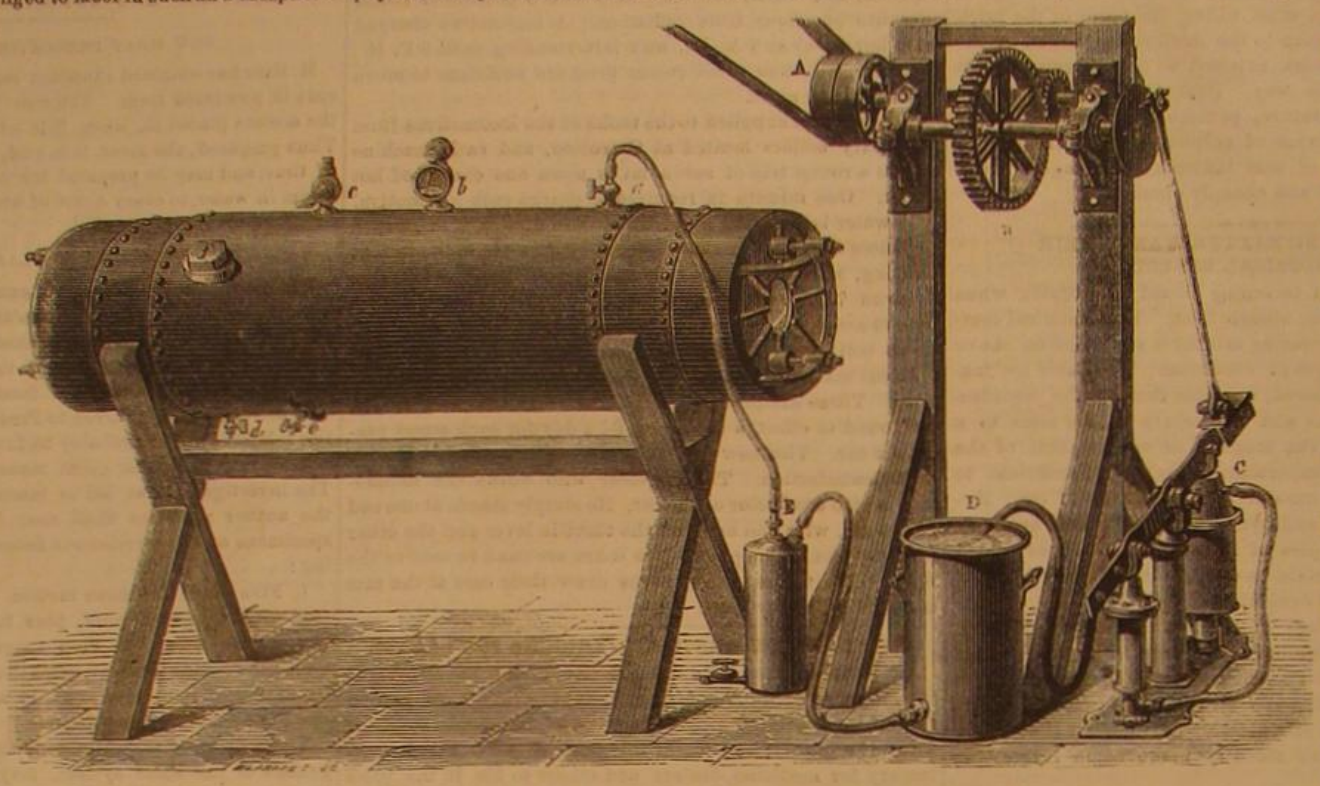


Fig. 1.—APPRATUS FOR SHOWING THE EFFECTS OF COMPRESSED AIR.

Inside the last mentioned receptacle a dog was placed, and air forced in to a pressure of eight atmospheres. After maintaining this pressure for three or four minutes, the escape cock was opened, allowing equilibrium with the exterior air. The animal was then removed, but exhibited no distress, running about the laboratory as if perfectly uninjured. In a short time, however, its motions became feeble, its hind portions appeared to be paralyzed and dragged upon the floor, then the other members became similarly affected, and respiration ceased. On opening the body the vessels were found filled with a mixture of gas and blood, and the heart contained clots. The gas, on examination, proved to be nitrogen with a small admixture of carbonic acid.

From this experiment M. Bert concludes that, under the influence of compression, the nitrogen of the air becomes dissolved in the blood in increasing proportions, just as carbonic acid becomes taken up in water in making the so called soda water. On suddenly removing the compressing force, the gas passes to a free state, its bubbles become more numerous, rendering the blood foamy, obstructing the circulation, causing paralysis, and finally death. Nor is the blood alone thus charged with the gas, for the latter penetrates to every humor of the body, even to the tissues, the interior of the eyes, and the liquid which bathes the spinal marrow.

When the pressure is at about seven atmospheres, the results are not so grave. A paralysis of the posterior portions and often sharp pain ensue, but the effects may be passing. If, however, the pressure be stronger, the gas is disengaged so suddenly that death is instantaneous. Thus an explanation is found for the serious maladies which have attacked laborers working in compressed air, and for the paralysis which frequently happens when the pressure is above three and a half atmospheres.

Passing from these results of sudden decompression and compression, we are led to consider those due to compression itself. To this end M. Bert has devised another apparatus, shown in Fig. 2, which consists of a cylinder capable of withstanding twenty-five atmospheres, a bag containing oxygen, a compressing pump, and pipes enveloping the latter, so as to cover it with a current of water. A bird was placed in the cylinder, and air forced in to ten atmospheres, without appreciable effect. When, however, for air, oxygen was substituted, the animal was taken with strong convulsions, and quickly died. To obtain the same result with air, twenty-five atmospheres' pressure was required. Conversely, however, if air at the above pressure was used, deprived in great measure of its oxygen, it became harmless. These experiments, exactly counter to those described in our previous article, tend more conclusively to show that mortal convulsions are due to the tension of the oxygen and not to the degree of physical compression, and that oxygen, in certain quantities, acts as a violent poison, similar in effect to strychnine and like substances, which excite the spinal nerves.

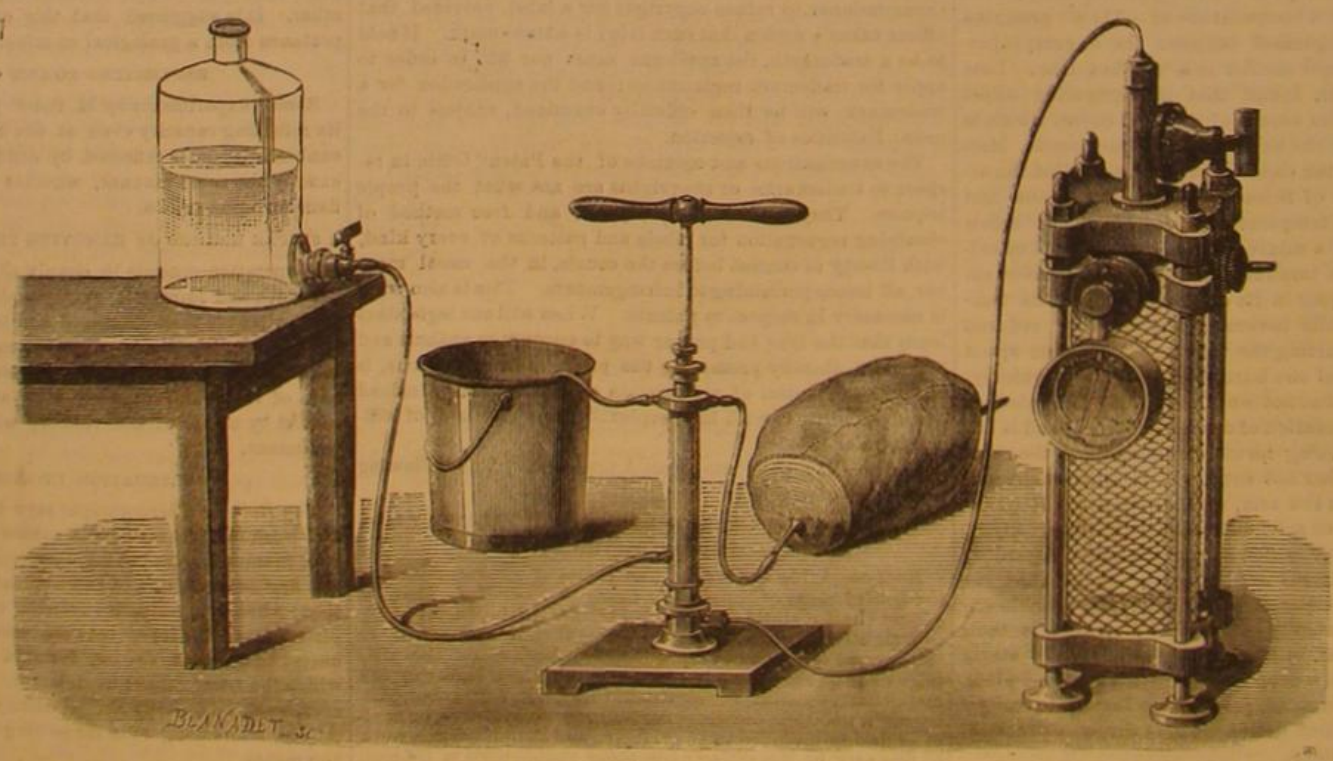


Fig. 2.—APPRATUS FOR SHOWING THE EFFECTS OF OXYGEN AND AIR.

This is not because the quantity of oxygen undergoes a notable augmentation in the blood, for M. Bert's analyses have shown that, from the normal pressure, but little more than 1 volume of oxygen to 100 volumes of blood is added by each additional atmosphere of compression. Hence the first cause of the deadly effect does not lie in alterations of the blood. Nor, in fact, are the results only observable upon larger animals; not only are creatures, both cold and warm blooded, having diffused nervous systems, as articulates or mollusks, thus affected, but even the vegetables do not escape. The terrible action controls microscopic animalculæ, infusoria, and the *mucedinæ*, which cause certain fermentations. The effect is only explained by the supposition that the oxygen acts upon the elementary particles of the body so as to arrest or modify injuriously the chemical functions of which they are the agents. Hence the general accidents, convulsions, and death.

It would seem that the phenomena produced by overdoses of oxygen would consist in strong oxidations; that the tissues of the body, in other words, would be burnt up. Strange to say, just the reverse takes place. Animals become rapidly cooler, and produce little carbonic acid and urea; and, in brief, oxygen in excess arrests oxidation.

The practical industrial utilization of M. Bert's discoveries readily suggests itself. Divers, it has been noticed, experience pains in the chest when some 160 feet beneath the surface, and the same sensations are felt by laborers working under a pressure of five atmospheres. These troubles are incontrovertibly due to an excess of oxygen, and it only remains to supply air poor in that gas. The mechanical arrangements to this end are easily constructed for caissons and fixed structures, but some ingenuity will be needed to devise apparatus for divers who work under constantly changing pressures. Hydrogen or nitrogen could be used to dilute the air.

The author deduces from his investigations a number of interesting conclusions regarding the past and present conditions of life upon the earth, which may be briefly summarized as follows:

1. Temperature being left out of consideration, there is for animals and vegetables upon high mountains an impassable limit, which varies with the species. This is one of the causes of geographical distribution governed by latitude. 2. There would exist a like limit at shallow depths in the water of the ocean, if the same contained oxygen and nitrogen in solution, according to Dalton's law. A stream of air rushing from the bottom would extinguish all life met on its upward course. The varying richness in oxygen of the different currents, at different depths, has perhaps some influence on submarine geographical distribution. 3. At primitive geological epochs, when the pressure of our atmosphere was much stronger than it now is, the conditions of life were very different from those at present; and if, as is asserted by geologists, our atmosphere, by the cooling of the interior of the earth, tends to penetrate into the substance of the latter, then we are approaching a condition when beings like ourselves will be suffocated, exactly as we now are at very high elevations. 4. It is wrong to teach that vegetables appeared upon the globe before the animals, in order to purify the air of its carbonic acid. Germination, of mold even, cannot take place in air sufficiently charged with carbonic acid to be mortal to warm-blooded animals. 5. It is equally erroneous that, for some such similar reason, reptiles first appeared, or that they could breathe air which warm blooded animals could not. The exact reverse is the case, as the reptiles fear carbonic acid, more than the birds, and much more than the mammifers.

Finally, the gist of M. Bert's investigations may be thus briefly summed up:

1. Modifications in the manometric pressure of air act but in proportion to the tension of the oxygen contained in the latter. 2. Above the normal pressure there is an increasing tendency to poisoning by oxygen, characterized by the determination of inter organic oxidations, which may be opposed by employing deoxygenized air.

THE Society of Arts offers the gold medal or 20 guineas ($100) for an improved lamp for illuminating railway carriages. It must be capable of supplying a clear, steady, durable, and safe light. Specimen models, suitable for testing, must be sent in not later than November 1, which in effect means that they must be at the Society's house, London, on or before Saturday, October 31.

LUTECINE OR PARIS METAL.—MM. Le Mat, Picard, and Bloch give the following proportions for this alloy: Copper 800, nickel 160, tin 20, cobalt 10, iron 5, zinc 5. Total 1,000.

IMPROVED STEAM ENGINE.

The novel form of steam engine herewith illustrated operates upon the compound principle; but instead of having its high and low pressure cylinders separate, the former is placed within the latter. The smaller cylinder, into which live steam is admitted, constitutes also the piston head, and is moved both by the entering steam reacting against an auxiliary stationary piston placed within, and also by the expansive force of the steam which is used in the previous stroke, which is allowed to pass into the outer and larger cylinder. This will be rendered clear by the following detailed description of the engravings.

A is the small cylinder which constitutes the piston head of the engine, and which is closed at both ends, and travels in the large cylinder. It connects with the piston rod, passing through the right hand end of the latter, as shown. B is the auxiliary piston, which is perfectly motionless, and is secured to a hollow rod which is fastened, as shown, in the cylinder head, and connects with the pipe, C, through which the steam enters, as indicated by the arrow.

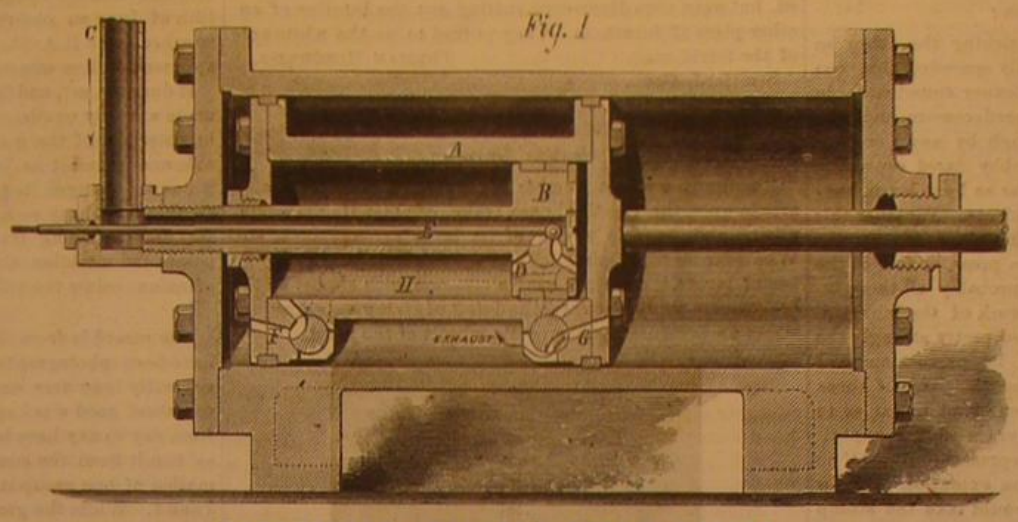


Fig. 1

DAVENPORT'S IMPROVED STEAM ENGINE.

The head of the auxiliary piston is hollow; and leading out at each end of it are ports, D, which are provided with a rocker valve, to which is attached the operating rod, E, extending out through and beyond the piston rod. At each end of the bore of the cylinder, A, and underneath, are passages, F and G, leading to rotary valves, from which pass other conduits through the next adjacent end plate and opening into the main cylinder. Each of the rotary valves is so constructed that, when either is in the position shown on the left, it will open communication between the port, F, and the adjacent passage, the two forming a bent or V shaped conduit. When resolved in another position, the valve will, as represented on the right, close the port, G, and establish communication, by means of the other passage, through from the main cylinder to the annular space around the head, A, and between the flanges of the latter.

The two valves just described have bent arms, H, extending from them, as shown in dotted lines, Fig. 1, and in the transverse section, Fig. 2. These arms are connected by a rod jointed to both. Another arm, I, Fig. 2, is attached to the inner end of a shaft, which shaft is arranged within the exhaust passage leading out of the main cylinder. The object of this shaft and bent arm mechanism is to trip each of the valves connected with the arms, H, at the proper time, which it is caused to do by suitable apparatus operated by the engine in connection with the exterior crank. Similarly the rod, E, moving the rocker valve on the auxiliary piston, is also properly actuated to travel back and forth as is necessary.

The operation of the machine may now be readily followed. Steam being admitted into the small cylinder or piston head, A, the latter will be drawn in one direction lengthwise the large cylinder. On the head arriving at the end of such movement, the valves are tripped so as to open communication between the space that receives the live steam and that part of

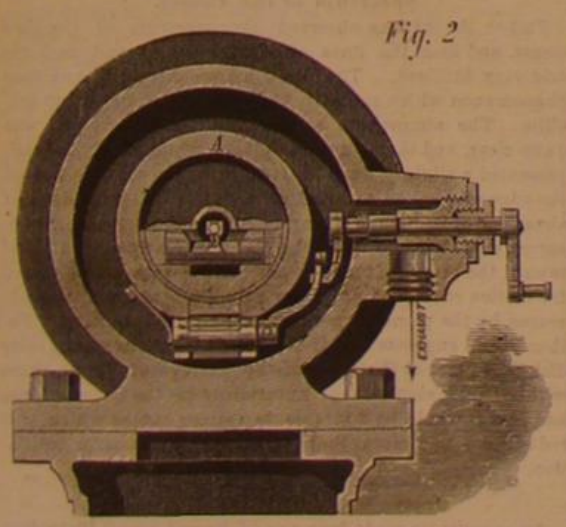


Fig. 2

the main cylinder next adjacent to the end of the same toward which the piston head has advanced. It will be observed that in Fig. 1 the head has just finished its stroke to the left, so that, as above stated, the valve connecting with the port, F, has opened a way through the latter and into the large cylinder. At the same time the rocker valve in the auxiliary piston is tripped so as to cut off admission of steam to the space into which the steam first entered, and to allow the steam to operate from the reverse side of the piston. This is clearly shown in the engraving. The head will now travel to the right, impelled not only by the action of the second quantity of steam but by the pressure of the first amount expansively in its rear.

The first quantity of steam, on escaping from the head into the main cylinder will expand in both while the former is in motion, and, by pressing against the outer surface of one end of said head, will there exert a greater amount of force than it will on the stationary piston, B. Hence it is the excess of pressure which operates to drive the head.

The space in front of the latter, it may be supposed, contains steam used expansively in a previous stroke. This must be withdrawn from the front of the head and exhausted, an operation accomplished by the valve, in the passage, G, becoming placed as shown in Fig. 1, thereby establishing connection with the right hand or forward portion of the cylinder and the annular space around the head, which, as represented in Fig. 2, connects directly with the exhaust port.

Among the other advantages claimed by the inventor, for this machine, over the ordinary compound engine, is a smaller loss by radiation. The heat radiating from the steam entering the hollow piston rod aids in keeping the outer cylinder warm, while, by jacketing the latter, there would be comparatively little waste of steam due to condensation. The short passages and easy connection to the crank obviate the use of double crank and connecting rods, saving not only the wear and tear necessary to overcome back pressure in the smaller cylinder, but also the extra expense of construction. The invention can be applied to any ordinary engine by removing the cylinder and substituting the one described.

Patented January 1, 1867. Further particulars may be obtained from the inventor, Mr. S. F. Davenport, Hallowell, Me.

THE GRAVITATION COMPASS.

A new mariner's compass, remarkably devoid of complication in its various parts, has recently been invented by the Earl of Caithness, F.R.S., of London, and patented in the United States. The ordinary compass is mounted upon gimbals, that is to say, upon two axes at right angles to each other, for the purpose of allowing the compass box the power of swinging freely in all directions, the necessary result being that the bottom of the compass box is kept, by the force of gravitation, parallel, to a great extent, to the plane of the horizon, while its mountings move in various directions, as influenced by the motion of the ship.



The essential feature of the Caithness compass is that, instead of its being mounted upon gimbals, it is mounted upon the top of a pendulum, which swings in a ball and socket joint. The gimbals of the ordinary compass are intended to give the compass box the power of moving in a true circle; but they do not absolutely give that power, and never can, since there are two points in the performance of the circle, in which there is a slight catch, which tends to make the box oscillate, first to the right and then to the left, or *vice versâ*, as the case may be.

The new Caithness compass consists of a ball close underneath the compass box, working in a socket fixed at the top of a conical support. The pendulum is about two feet in length, and is attached to the small ball, which has thus the power of giving a perfect rotation. It works in a perfect circle, and it does not matter how much the ship rolls. The Earl of Caithness calls it the gravitation compass, because the pendulum always points to the center of the earth. He says that it will bear very great rolling and pitching of the vessel—in fact a roll of more than thirty degrees.

In the course of a voyage across the Atlantic, made about the middle of October last, in the Java (Captain Martin), by the Earl of Caithness, he tried experiments with the compass on a large scale, the result being that the maximum vibration of the compass card was about a quarter of a point, while heavy standard compasses on board gave much larger vibrations.—*The Engineer.*

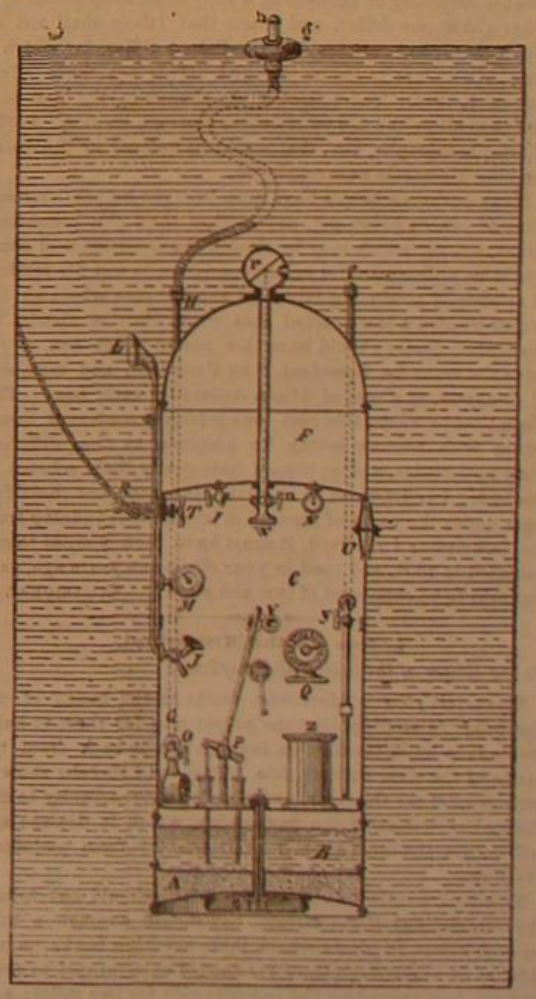
M. Neyreneuf has ascertained by experiments that negative electricity attracts flame, which positive electricity repels.

A NAVIGABLE DIVING BELL.

M. Toselli, an ingenious Italian inventor, has lately devised a novel diving bell, an engraving of which we present herewith, by means of which he can proceed to the bottom and rise at will, and travel around while submerged, or at the surface, with perfect safety. He has already descended several times to the bottom of the Bay of Naples, a depth of 234 feet, and finds the device admirably adapted for submarine exploration, for coral or pearl fishery, or for the clearing of sunken ships.

As shown in the illustration, the apparatus is a kind of turret divided into four compartments. The bottom division, A, contains lead, and serves to hold the bell in vertical position. B can be filled with water by opening a cock communicating from without, or may be rendered entirely empty by aid of the pump. Consequently this chamber serves to augment or diminish the weight of the machine and to determine its up and down travel, serving the same purpose as the natatory vessels in fish. In the large compartment, C, the operator and the observer are stationed; and finally, F is a reservoir, into which air is compressed in a quantity sufficient to last during the time which the bell is to be submerged. I is a cock which admits air from this chamber into the main compartment. G is the pipe for carrying off the foul atmosphere, which communicates with the tube, H, and a float, *g*. The latter has a valve, *h*, to prevent entrance of water. The bell has a rudder and a screw, not shown in the illustration, the screw being worked by a hand crank by one man, and driving the machine at the rate of about 25 feet per minute.

M is the manometer, which indicates exterior pressure, and hence the depth of submersion. N is another manometer, which shows the pressure of condensed air in the chamber, F. R is a life line connecting the bell with the ship. This contains a wire by means of which telegraphic despatches may be sent to the instrument, Q. U is the manhole, allowing access to the interior of the machine and closed with a double door. V are heavy glass deadlights, and Z is a seat.



The ingenuity of the inventor will be made apparent by considering the simple way in which M. Toselli avoids the dangers common to machines of this class. Thus, should the tube, H, which carries off foul air, break or choke, water would be pumped immediately out of B, the bell would ascend, and meanwhile the bad atmosphere would be allowed to escape through the extra pipe, *f*. In case the electric wire in the life line should part, preventing the passage of signals, the machine would again ascend and communicate with the vessel through the speaking trumpet, L J. If the line remained intact, the bell could be instantly hauled to the surface by those on the ship, in case of a breakage of the hydraulic pump, on signal being transmitted. If pump, wire, and life line should all break down at once, then the operator would unscrew a nut and free the lead underneath, when he would immediately ascend to the surface. Finally, if by

some extraordinary circumstance the ship should break the line and lose sight of the bell, or if the vessel itself should sink, the operator would first, by unscrewing a nut within, cast his bell loose from the life line, and would then ascend. As soon as he reached the surface, he would be enabled to view his surroundings by means of a camera obscura at *r;* and by revolving the same by its tube, W, he could sweep the entire horizon. Lastly, having determined his course, he could proceed in the proper direction by means of his screw and rudder.

Correspondence.

Notes from Washington, D. C.

To the Editor of the Scientific American:

Congress has adjourned without enriching the lobby so much as usual. In fact it is generally conceded that our Solons have left Washington with cleaner consciences, in this respect, than any of their recent predecessors, and that there never were fewer jobs put through by any Congress for many years past. The patent lobby fared especially badly, not a single extension case, so far as I can learn, having passed, notwithstanding all their efforts. Whether this is owing to a slight spasm of returning public virtue, the approaching elections, the efforts of the press, or fear of the Grangers, is more than I can tell; but probably all these influences had their effects, and so the work of the lobbyists went for naught, although they mustered pretty strongly the last days of the session, trying, both by persuasions and threats, to forward their respective schemes. One of these —a second George Francis Train—even went so far as to threaten the Senators and Representatives with the opposition of the Internationals, of which he represented himself as a high officer, if they did not pass the extension case for which he was working, and that he would take the stump against the members of the committees on patents, if his efforts failed. Of course the Senators were immensely frightened at this fearful threat, but somehow they yet live, and have gone home without helping the client of Train *secundus.*

The bill to reorganize the Patent Office also failed, and a bill, introduced a few days since by Mr. Conger, amending Sections 23, 25, 33, 53, and 64 of the Act of 1870, as a substitute for the first bill, likewise failed to pass. The only act completed, so far as I can find, relating to the Patent Office, is one introduced by Mr. Wadleigh, which allows the usual sentence indicating that a work is copyrighted to be substituted by the words "Copyrighted, 18—, by A. B.," fixes the fees for recording or furnishing a copy of an assignment of a copyright at one dollar, and enacts that labels shall not be copyrighted, but registered at the Patent Office, for which a fee of six dollars is to be charged. This act takes effect August 1, 1874. The object of the change in the first section is to allow the use of the short sentence on small works of art, photographs, etc., that would be defaced by the use of the long rigmarole now employed.

Many curious schemes have been brought before Congress, some of which never got any further than the committee rooms, among which may be classed the application of some would be philosopher for an appropriation to test his method of artificially producing rain; and another case where an inventor wanted a law enacted that every election district in the United States should have his patent ballot box, to receive the votes for President, Vice President, and members of Congress, at a cost of fifteen dollars for each box. The committee to whom this case was referred contented themselves with recommending its adoption to the different State authorities, and so nipped this pretty little scheme in the bud. I endeavored to find out this patent, but could find none under the name of reputed inventor; but judging from the description I received, it must have been similar to one patented in 1858, and used in your city some years ago, as it was said to be composed of iron and glass. OCCASIONAL.

Levees on the Mississippi.

To the Editor of the Scientific American:

Please tell your readers who reside on the banks of the the lower Mississippi that the proper way for them to build levees is to build them on an average a mile back from the banks of the river on each side. They will thereby show a little respect for the river, and give it an opportunity to discharge the waters of the vast valley which it drains; and will secure the remainder of their country from periodical overflow.

This line, a mile back from the river, should not follow the meanderings of the stream, but should average a mile on each side. In places where there are high banks on one side, as at Vicksburgh, the river should be permitted to overflow the low ground on the opposite side for two miles; and if, for any other reason, as at New Orleans, it would be impracticable to permit the river to overflow on both sides, a similar space on the opposite side should be left for the river to spread itself a little whenever it might have business of importance to transact.

Sioux Rapids, Iowa. W. T. CROZIER.

White Ants.

To the Editor of the Scientific American:

The white ants of the torrid zone are somewhat smaller than the large black ants, which are sometimes troublesome here and are rather voracious, eating their way through a wooden box to obtain sugar, of which they are very fond, and of which they will consume a large quantity.

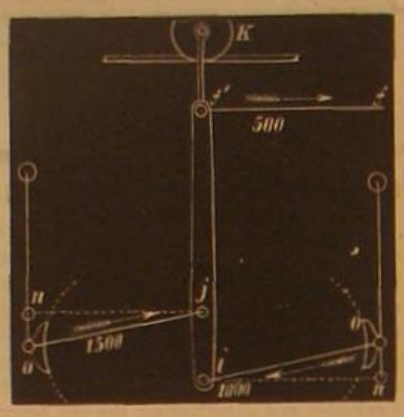
But the white ants of the torrid zone throw the black ones entirely in the shade as regards voracity. Pernambuco (South America) is on about the 8th southern parallel; and the inhabitants build houses and make furniture of the native wood, which is hard and heavy, and proof against these ants. In one instance, a family moved from the South to Pernambuco, taking their household *goods* with them. Among the rest was a mahogany bureau with white wood inside work, as usual. This bureau, containing linen and cotton goods, was placed in a room but little used, and was not visited for some days. The lady of the house unlocked an upper drawer, and to her astonishment the front piece, of mahogony, fell to the floor, and on looking in she discovered that the inside work was nearly all eaten out, and her goods were in one common mass, resting on the floor, in a mixed condition but otherwise uninjured. The depredators had departed, but were soon discovered cutting out the interior of another piece of furniture. They proved to be the white ants of the torrid zone. TRUMAN HOTCHKISS.

Stratford, Conn.

The Westinghouse Brake.

To the Editor of the Scientific American:

I notice in a recent number of *Engineering* an illustrated article upon the Westinghouse brake, commending the simplicity and equable action of its lever arrangement, etc. Whatever merit, of simplicity or otherwise, there is in its use of levers, it certainly has (in common with almost all the brakes now applied to cars) the defect of giving very unequal stress or pressure upon opposite wheels of the truck.



Let *k f j i* represent the lever that operates the brake blocks, *o*. I use the delineation and letters employed in the article referred to. The lever is held up by a pulley at *k*, which travels back and forth on a rod, as shown. Power is applied to the lever at the point, *f'*, through the medium of the rod, *f' f*, in the direction indicated by the arrow, one pair of the brake blocks being operated by the rod connected to the lever, at *j*, and the other pair by the rod connected at *i*, the pull being in the direction indicated by the arrows, and the leverage three to one, that is to say, the distance from *i* to *j* is one fourth of the distance from *i* to *k*. Hence a pull of 500 lbs., applied to the rod, *f' f*, will cause a pull of 1,500 lbs. upon *j*, and a pull of only 1,000 lbs. on the rod *i*.

This unequal stress upon the brake blocks may not be a very serious matter, but it is a universal characteristic of the lever arrangement now applied to car brakes. The fault might be easily mended by connecting the rod, *j*, to the suspending bar of the brake blocks a little above the usual point, and the rod, *i*, a little below the usual point, as at *n*.

Worcester, Mass. F. G. WOODWARD.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M.M.

Positions of Planets for July, 1874.

Mercury.

At this time, June 20th, Mercury can be beautifully seen after sunset, below Venus, and a little further north.

On the 27th of June, Mercury will be at its greatest elongation, east of the sun. July 1, Mercury sets at 9 P. M. July 31, Mercury sets at 6h. 25m. P. M.

Venus.

Venus, which has been so beautiful all through the month of June, increases in apparent diameter, but sets a little earlier in July.

July 1, Venus rises at 7h. 11m. A. M., and sets at 9h. 33m. P. M. On the 31st, Venus rises at 8h. 17m. A.M., and sets at 9h. 00m. P. M.

Mars.

Mars is very unfavorably situated. It rises early in the morning, and sets at 7h. 42m. P. M., or nearly with the sun, on July 1. On July 31, Mars rises at 4h. 14m. A. M., and sets before 7 in the evening.

Jupiter.

Jupiter's diameter is becoming perceptibly less, and it sets before midnight. It comes to the meridian, the position best adapted to good observation, in the afternoon, so that we have only a few hours of darkness in which to watch its changes.

July 1, Jupiter rises at 10h. 51m. A. M., and sets at 11h. 15m. P. M. On the 31st, Jupiter rises at 9h. 15m. A. M., and sets at 9h. 26m. P. M.

Saturn.

The month of July is the best of the year for observations on Saturn; and although Saturn is very low in altitude, it will be an interesting object.

July 1, Saturn rises at 9h. 29m. P.M., and sets at 7h. 21m. A. M. July 31, Saturn rises at 8h. 25m., P. M., and sets at 5h. 12m. A. M. It is among the small stars of *Capricornus.* Saturn does not attain an altitude of more than 31° during the month.

Uranus.

Uranus rises in the morning and sets early in the evening, and is therefore not well situated for observation.

Neptune.

This planet can be seen only by means of a good telescope. It crosses the meridian in the morning at 7h. 15m. on the 1st, at an altitude of 58°.

The Comet.

Clouds have prevented good observations upon the comet. It is bright enough to be seen very easily with the naked eye, and with an opera glass is a beautiful object. On the 13th of June an observation, made during partially cloudy weather, gave R.A. 7h. 4m. ±, Dec. + 69°. At that time its apparent motion was very slow.

It does not set, and is very readily found. On the 13th it made a nearly equilateral triangle with the pole star and the brighter star of the pointers. The same position would enable one to find it as late as the 18th of June, and probably it has not changed its position very much. To the eye, it is an elongated hazy star. With a glass, the nebulous center and the streaming train are very interesting objects. It passes the meridian at present (June 21) at 1h. 20m. in the morning, below the pole.

Sun Spots.

The record is from May 15 to June 16. Fourteen views have been photographed during this interval. Spots have generally been very small, only two groups appearing which contained good sized spots. In some instances the changes from day to day have been very marked; in others, only such as result from the sun's revolution on its axis. The daily motion of one group is shown for five days, from May 27 to June 1. While the group as a whole remained recognizable, there was a decided change in the arrangement of the constituent spots. Faculæ have been unusually extensive and are beautifully marked in one of our pictures which happened to be very clear. The same picture also shows the mottling of the sun's surface, which is usually shown when both the weather and photography are good. Very bright faculæ accompanied a group which was near the eastern limb on June 15. They were less prominent on the next day as the group was more distant from the limb.

Barometer and Thermometer.

The meteorological journal from May 17 to June 20 gives the highest barometer, June 15, 30·27; the lowest barometer, June 1, 29·58; the highest thermometer, June 9, at 2 P. M., 86°; the lowest thermometer, May 20 and May 22, at 7 A. M., 50·5°.

Amount of Rain.

The rain which fell between the evening of May 17 and the afternoon of May 18 amounted to 0·28 inches.

The rain which fell during May 20 amounted to 0·17 inches.

The rain which fell during May 25 amounted to 0·43 inches.

The rain which fell during the night of May 31 and the morning of June 1 amounted to 0·45 inches.

The rain which fell during the night of June 3 amounted to 0·16 inches.

The rain which fell during the afternoon of June 12 amounted to 0·45 inches.

Spectrum of the Comet.

Father Secchi has observed the spectrum of Coggia's comet, and finds the lines of carbonic oxide and carbonic acid very brilliant. The same astronomer notes a curious phenomenon which recently happened in Jupiter's first satellite. The atmosphere at the time of observation was quite clear, and the disk of the planet, while plainly defined, presented a slightly wavy surface. As the satellite neared the edge of Jupiter, and had advanced so that a distance of about one of its diameters separated it from the same, the observer was surprised to see the disk apparently extend itself toward the satellite, touch it, and then retract. This to and fro motion continued until the satellite was completely obscured by the planet, a period of four or five minutes. Father Secchi suggests that if similar undulations of the solar disk take place at the time of the passage of Venus, there will be strong elements of uncertainty in the observations, and that it would be desirable to employ means which will reduce to a minimum these effects of atmospheric oscillation.

Fatty Matters in Cast Iron.

An experiment made long ago by Proust revealed the fact that fatty matters can be extracted from cast iron when the latter is dissolved in certain acids. M. Cloez has recently separated these materials in a pure state, and their analysis reveals the interesting fact that they consist of carburets of hydrogen of the series $C^{2n} H^{2n}$, and present all the terms thereof at least from C^6H^6 (propylene) to $C^{16}H^{16}$. This is a veritable organic synthesis, realized by the aid of substances purely mineral, and is susceptible consequently of important applications. In the *Science Record* for 1873 will be found an account of the extraction of similar matters from meteoric iron.

THE Sandy Hook boiler experiments, which have been suspended since December last, will be resumed about the beginning of August. The recording instruments used last year were found to vary considerably in the forms made by different makers, and careful tests are now being conducted in order to ensure absolute uniformity and correctness of indications.

PRACTICAL MECHANISM.

NUMBER IV.

BY JOSHUA ROSE.

SCREW CUTTING TOOLS.

Lathe tools for cutting screws have necessarily, from the nature of their duty, a comparatively broad cutting surface, rendering them very subject to spring. Those used for V threads, being ground to fit the V of the thread, are, in consequence, weak and liable to break, to avoid which they should only be given enough bottom rake to well clear the thread, and top rake sufficient to make them cut clean. They are used at a slow rate of cutting speed, and may therefore be lowered to a straw-colored temper (as reducing the temper strengthens a tool). Firmness and strength are of great importance to this class of tool, so that it should be fastened with the cutting edge as near to the tool post as is convenient.

For use on wrought iron, it is sometimes given side rake; but this is not a necessity and is of doubtful utility, because the advantage gained by its tendency to assist in feeding itself is quite counterbalanced by its increased liability to break at the point. It should always be placed to cut at the center of the work. For use on brass, it must be ground on the top face to an inclined plane, of which the cutting point is the depressed end, that is to say, it must have negative top rake.

For cutting square threads, the tool shown in Fig. 14, with the sides ground away beneath sufficiently to well clear the sides of the thread, is used.

If the pitch of the screw to be cut is very coarse, a tool nearly one half of the width of the space between one thread and the next should be employed, so as to avoid the spring which a tool of the full width would undergo. After taking several cuts, the tool must be moved laterally to the amount of its width, and cuts taken off as before until the tool has cut somewhat deeper than it did before being moved, when it must be placed back again into its first position, and the process repeated until the required depth of thread is attained.

Fig. 24.

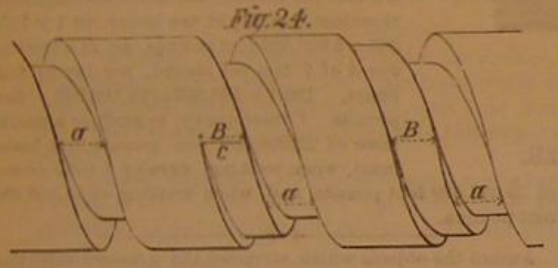


Fig. 24 represents a thread or screw during the above described process of cutting. *a a a* is the groove or space taken out by the cuts before the tool was moved; B B represents the first cut taken after it was moved; *c* is the point to which the cut, B, is supposed (for the purpose of this illustration) to have traveled.

The tool used having been a little less than one half the proper width of the space of the thread, it becomes evident that the thread will be left with rather more than its proper thickness, which is done to allow finishing cuts to be taken upon its sides, for which purpose the side tool (given in Fig. 22) is brought into requisition, care being taken that it is placed true, so as to cut both sides of the thread of an equal angle to the center line of the screw.

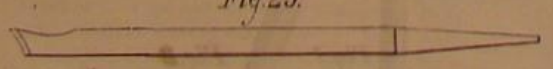
In cutting V threads of a coarse pitch, the tool may be made less in width than the required space between the threads demands, so that it may be moved a little laterally in order to take a cut off one side of the thread only at a time, by which means a heavier cut may be taken with less liability for the tool to spring in; but the finishing cut is better if taken by a tool of the full width or shape of the thread.

The most accurate method of cutting small V threads is to use a stout chaser fastened in the tool post, and then feed it with the screw-cutting gear of the lathe, the same as with a common screw cutting tool. Such a chaser should be made hollow in the length of the tooth, possess a minimum of top rake, and be placed to cut at the center of the work; and it should be so placed in the tool post that the teeth stand exactly parallel to the line of the cut.

CHASERS.

An outside chaser for cutting wrought iron by hand should be made hollow in the length of the tooth, and have top

Fig. 25.



rake, as shown in Fig. 25, to enable it to cut easily; for the strain required to bend the shaving out of the straight line will hold the teeth to their cut. Top rake may, in fact, be applied to such an extent that the chaser will cut well of itself without having any force applied to it except sufficient to keep it level, but if made so keen, it soon loses its edge and is very apt to break. The bottom edge of the teeth is rounded off so that the chaser will slide easily along the rest. It is an error to make this tool very thick. For cutting 14 threads to an inch, the chaser should be one quarter of an inch thick; and for cutting 8 to an inch, the thickness should be five sixteenths of an inch, so that the fulcrum off which the teeth take their cuts may be close to the cuts, in which case the chaser will be steadier and more under control. The leading tooth should always be a full one and come just level with the edge. When finishing the thread being cut, hold the chaser horizontally, or it will, in consequence of the top rake, cut a thread deeper than itself. For use in the tool post, with the rest fed by the proper gear for the pitch, less top rake is required, and the thickness must be much increased to gain strength and avoid spring; for the fulcrum off which the tool thus used takes its cut is at the point *a*, described in Fig. 11, instead of being directly beneath the cut, as in the case of a hand chaser.

An inside chaser, that is, one for cutting threads in a hole or bore, should be, if to be used for cutting a right handed thread, cut off a left-handed hub, otherwise the chaser will have its thread sloping in the opposite direction to the thread to be cut, as may be demonstrated by placing an inside and outside chaser (both having been cut off the same hub) together, when it will be seen that the teeth of one will not fit in the teeth of the other, as they should do; the cause being that, after an inside chaser is cut by the hub, it has to be turned around to be placed in a position to cut, which turning reverses the direction in which its teeth slant.

All chasers should be tempered to a brown color and be used at a slow rate of cutting speed.

TOOL STEEL.

The cutting tools for all machines should be made of hammered (which is tougher and of finer grain then rolled) steel. Even in a bar of hammered steel, the corners, from receiving the most effect from the action of the hammer, are of better quality (that is, more refined) than the rest of the bar. This fact is clearly demonstrated in the manufacture of the celebrated Damascus swords and gun barrels, in which the square bars of metal are, after being hammered, twisted and then hammered square again; the twisting process is then repeated, and the bar again forged square, the whole operation being repeated until the body of the entire bar is completely intersected with metal which has, at some time during the forging process, formed the corners of a square. The effect of this treatment becomes apparent upon immersing the metal in acid, which will eat away those parts which have not formed a corner at some stage of the process of manufacture, more rapidly than the rest of the metal, and that to such a degree as to give to the whole the appearance of having been engraved, thus evidencing that the parts that have received the most hammering are of finer quality than the rest of the bar.

For cutting tools, it is highly necessary to gain every attainable superiority in the steel; and if we cannot take three months of time to prepare bars for this special purpose (as they do in the above process), we can at least employ well hammered steel, and thus secure the best known practicable results.

The test of tool steel is the speed at which it will cut and the length of time it will last without being ground, concerning which it is difficult to get data, unless by actual experiment with different kinds of steel upon work of the same diameter and texture of metal, because the cutting speed employed by workmen varies as much as 8 feet per minute upon the same diameter of work. The proper cutting speed for work is, however, to be hereafter treated upon, hence nothing further upon the subject need be now said. The use of more than one kind of tool steel in a workshop should always be avoided, because different kinds of steel require different treatment, both in forging and hardening; and when more than one kind is in use in the shop, the whole of them are liable (from not noticing the particular brand) to wrong treatment.

Mushet's "special tool steel" makes an excellent tool for roughing work out on the lathe or planer, and will undoubtedly stand a higher rate of cutting speed than other steel. Its peculiarity is that it is hard of itself, and therefore requires no hardening. Immersing it in water when it is heated causes it to crack. The advantages claimed for it are its high rate of cutting speed, and that it is easily ground, since it will not soften by heating during the operation. It is, on the other hand, difficult to forge in consequence of its excessive hardening even when heated; it must not be forged at so great or so low a temperature as other steel, or it will crack; and as it is not adapted for general tool purposes, its disadvantages, independent of its increased cost, render its introduction into the general machine shop unadvisable.

FORGING TOOLS.

In forging a tool, it should be formed in as few heats as possible, for steel deteriorates by repeated heating, unless it is well hammered at each heat; and if the tool has a narrow edge, care should also be taken to hammer it on that edge before the metal has lost much of its heat, and to strike it more lightly as it gets cooler, for striking a narrow surface of steel when it is somewhat cool has the same injurious effect upon it as striking it endwise of the grain (which is termed upsetting it), destroying its cutting value and strength.

In using American chrome steel, be careful to forge it according to the directions supplied by its manufacturers, its treatment being almost the opposite for that applicable to English tool steel, the former requiring to be heated to a much higher temperature for forging, and to a less temperature for hardening, than the latter.

TOOL HARDENING.

The degree to which a tool may be hardened is dependent in a great measure upon its shape. Stout tools, such as are shown in Fig. 6, may be made as hard as fire and water will make them; so also may the tools presented in Figs. 8, 9, 18, 19, 20, and 23; while slight tools, such as are given in Figs. 14 and 22, should be lowered in temper to a light straw color, which leaves them stronger than they would be if hardened right out, that is, made to a moderate red heat and quenched in the water, without being taken out until quite cold.

The practice of lowering stout tools to a straw color is sometimes resorted to, but it is certainly an error, for it is undoubtedly advantageous to make the tool as hard as it can be made, so long as it will bear the strain of the cut, which is possible and easy of accomplishment with Jessop's, Moss', Sanderson's, or other similar grades of tool steel.

If a tool so hardened is found to break, it is in consequence either of its being bad steel or else it has been heated to too great a temperature in the process of forging or hardening, unless it has been given too much rake for the duty to which it has been allotted. Tool steel may be forged at such a temperature that it is not positively burned, and yet has lost part of its virtue; and while under such circumstances it would break if hardened right out, it will cut and stand moderately well if the temper be lowered to a straw color.

This is simply sacrificing the degree of hardness to cover the blunder committed by overheating, and it is from such causes that the variation of cutting speed employed by mechanics arises; for a youth who has learned his trade in a shop where the tools were overheated, and consequently underhardened, settles down to the rate of cutting speed attainable under those circumstances and adheres to it; while he who has been accustomed to the use of tools properly forged and hardened right out, upon entering another shop where the tools are overheated in forging and underhardened to compensate for it, finding he cannot get the cutting speed up to his customary rate, breaks off the tool point to see if it has been burned, and, finding that the grain of the metal does not appear granulated, sparkling, and coarse, as it would do if positively burned, condemns the quality of the steel.

The grain of properly forged and hardened tool steel appears, when fractured, close and fine, and of a dull, whitish tint, the fracture being even on its surface.

American chrome tool steel may be made unusually hard by using very clean water and adding a piece of fuller's earth and a piece of common soda, each of the size of a hazel nut, to a pailful of water.

In all cases where a tool can be ground to sharpen it, it should be hardened before grinding, for steel hardened with the forged skin on is stronger and better than that in which the skin is removed before hardening. Heat the tool the distance that it is necessary to harden it, and plunge it into the water suddenly to the distance it requires hardening; and if it is intended to harden it right out, hold it still a moment, then dip it a little deeper, and withdraw it again to the amount of the last dipping, repeating this latter operation until the tool is cold; for by this means the junction of the hard and soft steel in the tool is graduated and not sharply defined, the result being that the tool is less liable to fracture either in hardening or in using. If the tool to be hardened has a thick part to it, let that part enter the water first and immerse the tool slowly, so that it will be cooled as nearly equally as possible and thus be prevented from cracking in hardening.

Tools heated by charcoal are much superior to those heated by common coal, and need not be made quite so hot to harden. To harden steel, never get it hot enough to cause it to scale. Thin pieces of steel, and taps, dies, reamers, drifts, and similarly shaped tools, should be dipped endways; for if dipped otherwise, they are sure to warp in hardening. Very slight tools may be prevented from cracking by making the water quite warm before immersing them, and then holding them still in the water; in fact, all water for hardening purposes should have the chill off it by heating, before being used, or the articles hardened in it are very liable to crack. If the article requires to be hardened all over, immerse it (suspended on a wire hook) so that the water may have free and equal access to the whole surface of the steel, which is not possible with tongs in consequence of their jaws covering part of the steel.

The best method of lowering the temper of taps, reamers, or other round steel is to heat a tube in the fire and hold the article in the center of the tube; and it is well to let the tube be rather shorter than the tap or reamer, so that the end, which is made square for the wrench to fit, may be kept longer in the tube than the rest of the tool so as to make it rather softer. The tool should be revolved slowly in the tube to make the temper even. Care should be taken not to make the tube too hot; for the more slowly a tool is lowered, the more even the temper will be.

Flat pieces of steel, as dies, etc., should be lowered (that is tempered) by placing them on a piece of heated iron and turning them over and over to temper them evenly.

The colors produced upon the surface of a piece of hardened steel by lowering it are from very light straw, deepening successively as it lowers, to yellow, bright brown, purple, and blue. As a general rule, tools which are stout and easy to make and to grind should be hardened right out. Those slight in proportion to the strain placed upon them should be tempered to a brown. All screw-cutting tools, such as taps, dies, etc., also reamers, flat cutters, revolving cutters, and spring tools, should be tempered to a brown color; drills should be tempered to a bright purple, and chipping chisels to a blue.

RAILWAY OR SEA ALARM.—Air is compressed in a cylindrical reservoir from which a tube conveys it to three organ pipes (giving *do*, *mi*, *sol*), which can be sounded separately or together. In fog the *do* is sounded; and whenever an engine driver hears it in an advancing train, he sounds his *mi*, then the other driver sounds his *mi* if he is on the right line, then both sound *sol*.

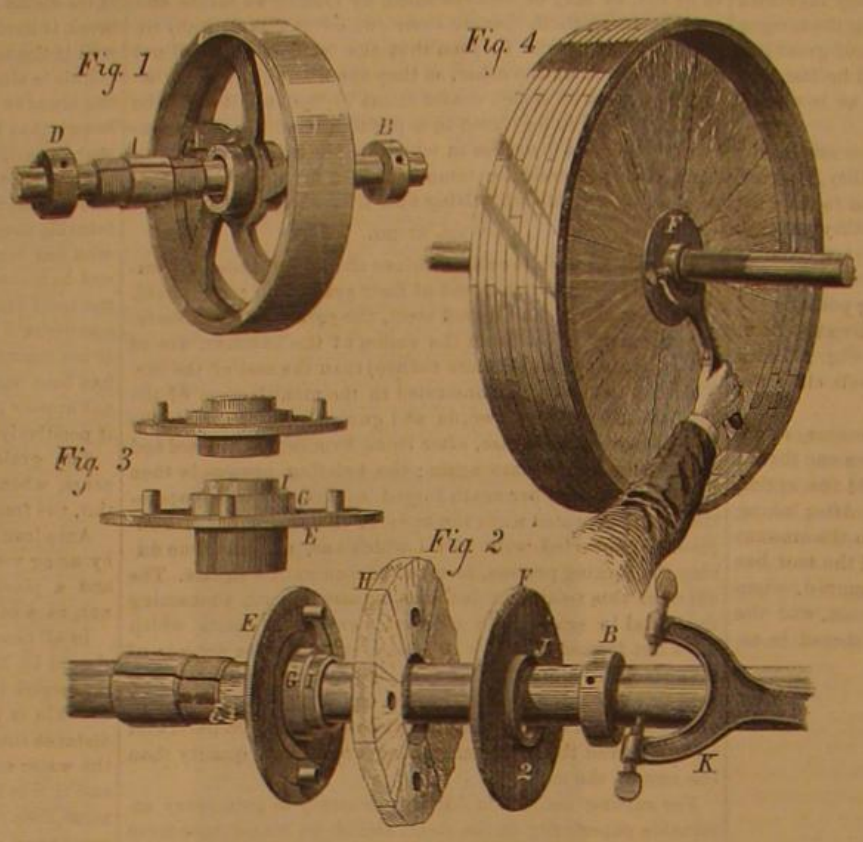
COMPOSITION FOR THE DESTRUCTION OF BUGS AND THEIR EGGS, FLEAS, ETC.—This mixture, which has been patented in France, consists of 80 parts of bisulphide of carbon and 20 parts of essence of petroleum.—*M. Dord.*

TAPER SLEEVE PULLEY AND WHEEL FASTENER.

Our engraving illustrates a simple device for fastening pulleys and wheels upon shafts, perfectly concentrically with the latter. It possesses the merit of simplicity, and seems to be a valuable improvement, equally as well adapted for wooden pulleys as for those of metal. We also represent the improved wood and iron pulley, obtained by the use of the fastener and its attachments.

The appliance is shown in connection with a metal pulley in Fig. 1. A is the holder, made of truncated conical form, with a cylindrical bore and split open from end to end. This travels upon the shaft and extends through the hub in the opposite side of which it is met by a nut, B, which screws upon the thread cut on the smaller end, C, of the sleeve. The nut draws the holder as far into the hub as possible, besides contracting it against the shaft, thus securing it to the latter as well as to the hub, and thereby fastening both hub and shaft tightly together. The hub is bored slightly tapering to fit the holder. As the pulley in Fig. 1 is supposed to be a very heavy one, the larger extremity of holder, A, has a right hand screw thread, and is provided with a nut, D, fitting the same. The object of the latter is to crowd the pulley off the sleeve without necessitating the use of a hammer or sledge. In moderately heavy and light pulleys, this last mentioned thread and nut are dispensed with (see Fig. 2), a few blows on the hub with a wooden mallet being sufficient to start the wheel off the sleeve in case it should stick after loosening the nut, B.

Where the device is to be used in connection with a wooden pulley or with one having no hub, an artificial hub is made by means of a pair of annular plates, E and F, Figs. 2, 3, and 4. The shoulder, G, on plate, E, is the centering shoulder or bearing on which the web of the pulley, shown (with the outer portion broken away) at H, fits. This shoulder is of the same size or diameter in all sizes of flanges, or for large and small shafts. This will be evident from Fig. 3, which also shows that where greater power is necessary a corresponding bearing for the sleeve is given in the length of the hub.



TAPER SLEEVE PULLEY AND WHEEL FASTENER.

The portion, I, Fig. 2, is a centering shoulder for the aperture or female flange, J, and projects far enough through the web of the wooden pulley to enter the latter. The parts being brought together, the nut is set up on the holder, as already described, by means of the wrench, K. This instrument, it will be seen, is adjustable through the whole range of ordinary line shafting. The final operation of setting up, with the wooden pulley in position, is represented in Fig. 4. The pulley consists of eight segmental pieces, in each of which the grain of the wood is in a radial line from center to circumference. In smaller pulleys the flanges have only two pins; but in larger ones, four of the latter, as shown in Fig. 3, are employed. That the irons may be absolutely interchangeable, the same number of holes is bored in all wooden parts, whether all are to be used or not. The pulley, thus made of wood and iron, is claimed to combine the maximum of strength with the minimum of weight. There are no keys or key seats to mar the hubs or shafting, no set screws; while the pulley is readily detached and applied to another shaft when desired.

Patented through the Scientific American Patent Agency, by Augustus Newell, of Chicago, Ill., Feb. 6, 1872. For further particulars address the manufacturers, A. B. Cook & Co., corner 13th and Peach streets, Erie, Pa. [See advertisement on another page.]

A NEW WATER PITCHER.

Unsightly spots and wet places are often made upon tables



upon which pitchers of drinking water are placed, owing to the water, dripping from the spout, condensing on the cold exterior and running down, or becoming accidentally spilled in filling glasses.

The device herewith illustrated consists in forming around the base of the pitcher a gutter or channel, A, which communicates with a cup at B, in which a sponge is kept. The latter not only catches the water which may drip from the spout above, but also takes up such as may flow down the sides and accumulate in the gutter. When the sponge becomes soaked it is simply necessary to remove it, squeeze it dry, and replace it. From its position, it is always handy to absorb water which may be accidentally spilled, thus saving the employment of napkins for that purpose. If desired at any time, the sponge can be entirely removed and the pitcher used as an ordinary similar vessel. The gutter below gives it an enlarged base, and thus, in a measure, lessens the danger of upsetting. The invention might also be applied to receptacles for chemical solutions, the spilling of which would cause stains or corrosions.

Patented through the Scientific American Patent Agency, April 28, 1874. For further particulars address the inventor, Mr. J. B. Cox, Mount Laurel, Burlington county, N. J.

Sea Weeds.

At this season, when many of our readers are looking for health and recreation at the seaside, a few hints may be found useful concerning the gathering and preservation of *algæ* or seaweeds. They rank among the most beautiful natural objects, while the work of collection and mounting are delightful occupations for the leisure hour.

The best time to collect is when the tide has just commenced to flow, after the lowest ebb, as the seaweeds are then floated in, in good condition. All specimens should be either red, green, purple, black, or olive; no others are worth preservation.

Mounting is done by immersing a piece of paper just below the surface of the water, and supporting it by the left hand; the alga is then placed on the paper and kept in its place by the left thumb, while the right hand is employed in spreading out the branches with a bone knitting needle or a camel's hair pencil. If the branches are too numerous, which will be readily ascertained by lifting the specimen out of the water for a moment, pruning should be freely resorted to, as much of its beauty will depend upon the distinctness of the branching. Pruning is best performed by cutting off erect and alternate branches, by means of a sharp-pointed pair of scissors, close to their junction with the main stem.

When the specimen is laid out, the paper should be raised gradually in a slightly sloping direction, care being taken to prevent the branches from running together. The delicate species are much improved in appearance by re-immersing their extremities before entirely withdrawing them from the water. The papers should then be laid flat upon coarse bibulous paper, only long enough to absorb superfluous moisture. If placed in an oblique direction, the branches are liable to run together.

They should be then removed and placed upon a sheet of thick white blotting paper, and a piece of washed and pressed calico placed over each specimen, and then another layer of thin blotting paper above the calico. Several of these layers are pressed in the ordinary way, light pressure only being used at first. The papers, but not the calico, may be removed in six hours, and afterwards changed every twenty-four hours until dry. If the calico be not washed, it frequently adheres to the algæ, and if the calico be wrinkled it produces corresponding marks on the paper.

The most convenient sizes of paper to use are those made by cutting a sheet of paper, of demy size, into 16, 12, or 4 equal pieces. Ordinary drawing paper answers the purpose very well. For the herbarium, each species should be mounted on a separate sheet of demy or cartridge size. Toned paper shows off the specimens well, a neutral tint answering best for the olive, pink for the red, and green for the green series.

Equine Mechanics.

From recent calculations by H. Fritz, of Zurich, Switzerland, it appears that the useful work performed, per day of ten hours, at speeds of from 2·9 to 9·7 feet per second, for horses attached to agricultural implements, is as follows: Single horse to mower, 27,334,000 foot pounds; two horses to mower (each), 17,496,000 foot pounds; same to combined reaper and mower, 23,760,000 foot pounds; single horse to reaper without automatic binder, 30,132,000 foot pounds; two horses to similar implement, 20,979,000 foot pounds; and finally, two horses to reaper with automatic binder, 23,960,750 foot pounds. This, on the average, gives about 23,000,000 foot pounds to the horse, or some 638 foot pounds per second.

The fact of the animal's gait, it appears, must also be taken into consideration, as, at a walk, the body is supported always by at least two members, while, at a trot or gallop, there is an instant when the horse is suspended in the air, to accomplish which the entire weight must be overcome. M. Sanson, who has also lately carried on some investigations into the subject, says that, in order to gallop or trot, the animal develops an average energy of about 0·1 the weight of its body; while it walks, this is reduced to 0·05. On weighing over a thousand horses, the above author finds that the average weight of animals, varying from 4·8 to 5·4 feet in hight, is about 1,201·2 pounds. Hence the necessary effort for a horse to displace his own weight, at a walk, is 1201·2 × ·05 = 60·1 lbs.; at a trot, 1,201·2 × 0·1 = 120·1 lbs. At an average walking speed of 3·2 feet per second, the horse accomplishes, therefore, per day of ten hours, 60·1 × 115,200 = 6,923,520 foot pounds, or, at a trotting speed of 7 feet per second, per day of four hours, 120·1 × 100,800 = 22,106,080 foot pounds. Consequently, to produce a useful labor of 23,000,000 foot pounds, the horse must, when walking, develop a total power of 29,523,520 foot pounds, and, when trotting, of 35,106,680 foot pounds.

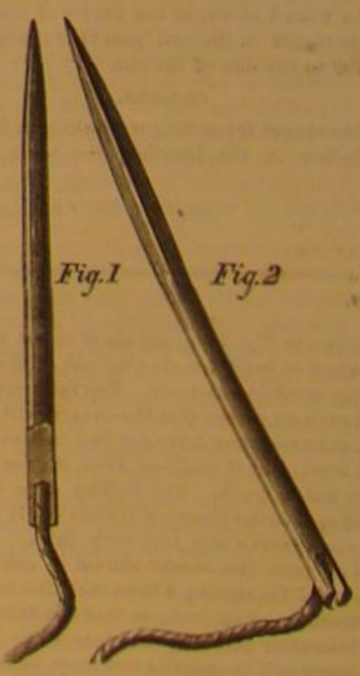
AMONG the objects which attracted the greatest attention at a recent soirée of the Civil Engineers, London, was the Whitworth steel cylinder cover for Her Majesty's ship Rover, having a diameter of 6 feet 4 inches, a depth of 4 feet 9¼ inches, and a thickness of 1¼ inches. Its weight is three tuns, and tensile strength 44 tuns to the square inch, the elongation of the metal extending to 27 per cent before breaking.

A NOVEL NEEDLE.

The novelty in the needle represented in our illustration consists in a hole drilled longitudinally into the head of the implement for a distance of about one quarter of an inch. The interior of this orifice is screw-threaded, so that a wire, sinew, or thread may be screwed into the hole, and thus securely attached in the manner shown in Fig. 1. For heavy work, such as sewing canvas or leather, where a palm thimble is used, the usual ears may be formed on the end of the needle, as in Fig. 2, to prevent the thread from cutting.

For surgeons' use, this invention is claimed to be especially valuable, as it allows of the employment of a smaller needle and of a single thread, thus avoiding the pain often caused to the patient, through the enlarging of the orifice made by the needle, by the passage of the double strand. The finest silk thread, we are informed, may be used, with no other preparation than waxing the end.

Patented March 31, 1874. For further particulars address



Mrs. Ella N. Gaillard, care of H. S. Abbot, 7 and G streets, Washington, D. C.

VARIOUS METHODS OF COOLING AIR.

Ice, as a refrigerant, might either be placed within or without the ducts that bring in fresh air. In the first case, generally preferred by the inventors, it melts, and afterwards evaporates in the fresh air. The cold resulting from the fusion and warming of the water produced not being more than a sixth of that due to evaporation, it therefore follows that the amount of moisture introduced into the air is about one seventh—nearly as much as that of evaporation alone.

In the apparatus shown in Fig. 1, the air conduit, C C, passes through a casing, A B, formed of a double lining. The interior space, D, surrounding the air conduit, contains ice. The next space, B, is filled with a non-conductor of cold. A tap, R, lets off the water formed by the melting of the ice into a receiver, M. The air conduit, C C, is fitted with mechanical fly wings, *a b*, which increase the contact of the air with the sides refrigerated by the ice. These metal fly wings are fixed to a vertical axis, and in successive rows,

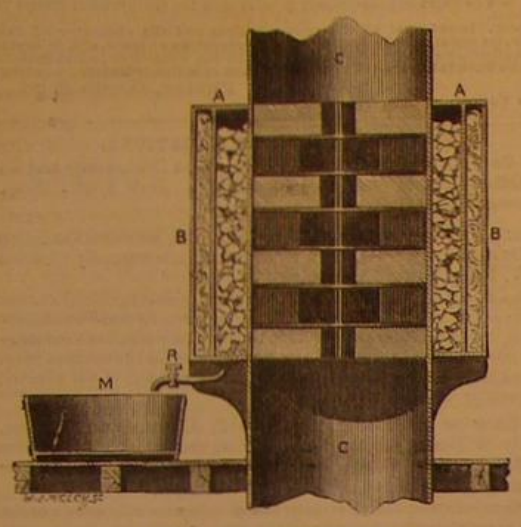


FIG. 1.—ICE REFRIGERATOR.

but in different planes, which multiplies the surface over which the air has to pass. This contrivance, which manifests ingenious details of construction, may have been applied with success, but it is far from being sufficiently inexpensive.

By causing currents of air to pass through vaults built at a depth of six or eight feet below the surface, they will be perceptibly cooled in summer if they are of any considerable length.

In ascending to the attics of dwelling houses, the immoderate heat developed by the sun's rays is very perceptible, especially in cases where the roofs are covered with metallic substances. Now, the question is, how to turn the heat to account for the introduction of pure air. The mode of doing so is very simple. A ventilating chimney is placed on the top of the building, to which abut side props, forming a double ceiling, and having communication by vents in the cornices. The fresh air coming from the cellars enters the room by hollow pil-

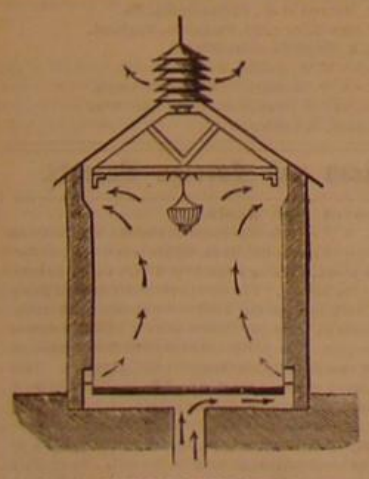


FIG. 2.—VENTILATING CHIMNEY.

lars or vertical props, according to circumstances; and at night, the natural heat of the sun not being available, artificial heat is employed.

Another method is the imitation of the effect of rain; it is susceptible of being used almost directly to most edifices and dwellings. Water applied in the morning and during the heat of the day not only obviates the heating of roofs, but, as long as the temperature of the water is less than that of the air, it can maintain the interior walls at a temperature far inferior to the latter, and it cools the air ascending to the attics.

COOLING THE AIR BY MEANS OF AMMONIA VAPOR.

The apparatus represented in Fig. 3 is intended to produce a cooling of the air. It is composed of a chimney, A A, the hight of which is variable, at the top of which is vertically placed the tubular generator, B, containing a solution of liquefied ammonia to the line, *b b*. This perfectly isolated receiver is in direct communication with the serpentine condenser, E, by the two pipes, F, G; the receiver, E, is also perfectly isolated. Around the serpentine circulates well water. No matter what the temperature may be outside the apparatus, it is evident that the interior pressure would be superior to that of the atmosphere; the ammonia would therefore vaporize as well in the chamber, *b b n n*, as in the tube, *m m m*. The gaseous current being thus formed, sweeping through the interior atmosphere of the tubes and serpentines, would carry before it the air, which would be expelled by turning the tap, *l*. By means of an india rubber pipe placed upon the nozzle of this tap, this current would be

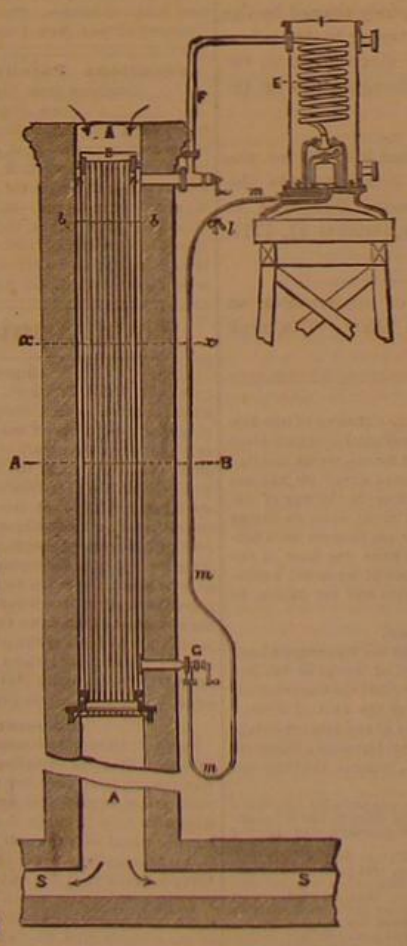


FIG. 3.—AMMONIA REFRIGERATOR.

received in a vase containing water. The air would escape, the ammonia would remain in the water, and, when the absorption was complete and no more bubbles were formed on the surface, it would be seen that all the air had escaped; it would then be necessary to close the tap, *l*. This being done, nothing would remain in the interior but the liquefied ammonia, the vapor of which, immediately attaining the maximum of tension, would at once fill the space left empty by the expelled air. If, then, by any accident, the temperature of the generator, B, became higher than that of the condenser, E, vapor would at once be formed in the receiver, B, which would proceed to condensation in the receiver, E, until the balance of temperature was restored. This action would be all the more rapid in proportion to the rapidity with which the vapor is induced in the vacuum; and would be also in proportion to the condensation. Thence there would be a relation between the force of the condensing action in E, the promptitude of vaporization in B, and the energy of refrigeration of the body passing in the tubes, *x x*, and round the casing, B. Now, this body is no other than the atmospheric air freely entering at the orifice, A, and penetrating the tubes, *x x*, drawn by the increase of density communicated to it by refrigeration, and causing it to descend the chimney. If the surfaces are sufficient the temperature will remain equal between B and E; therefore if the water which reaches the condenser is at 50° Fah., the air which emerges at the lower part will have that temperature; descending the chimney, A A, this air passes by the conduits, S S, to freely distribute itself in the localities where it is necessary to produce a cooler atmosphere. This arrangement is ingeniously conceived but complicated.

COOLING THE AIR BY MEANS OF WATER VAPOR.

An apparatus, upon which has been bestowed the name of hydro-atmospheric condenser, has lately been devised by MM. Nézeraux and Garlandat. It is composed of two distinct parts, the condenser, A, properly so called, and the refrigerator, B; the condenser is a series of tubes assembled between two plates, forming part of a cylindrical casing hermetically closed, a pump which serves at once for circulation and evacuation, and a chimney, K, by which the air, saturated with water, escapes (Fig. 5). The refrigerator is formed of a metal plate pierced with holes of small diame-

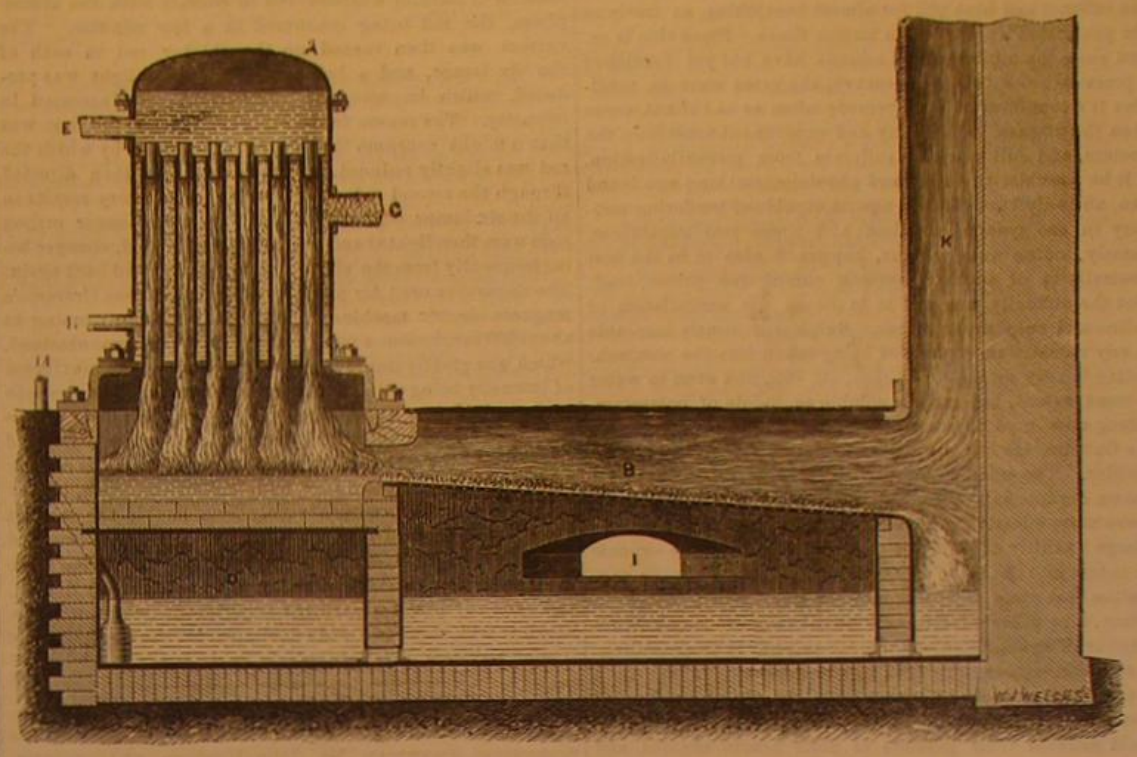


FIG. 4.—AIR REFRIGERATOR.

ter, and of a ventilator, the current of which passes through the orifice, I. The steam escaping from the cylinder penetrates to C, disperses through the space between the tubes, condenses itself by contact, and produces a vacuum. The water, which has just condensed the steam, passes above the perforated plate, B, upon which a current of air is continually in action from above and beneath, which divides the water and instantly cools it; it falls into the tank, D, whence it is pumped by means of the tube, M, and brought back by E; thence it passes uniformly through all the tubes over the whole extent of the refrigerating surface by means of little fluted plugs, or similar contrivances, at the base of the apparatus at H, by means of a pump, to be restored to the feeding tank. Applied to ordinary condensers, the refrigerator effects a considerable economy of water, and produces other

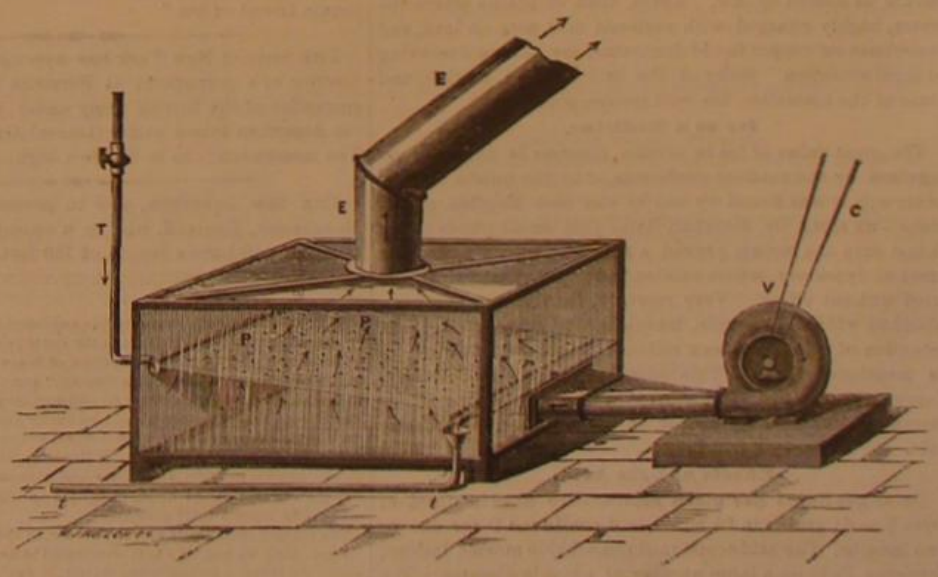


FIG. 5.—VENTILATING APPARATUS.

advantages, which it is unnecessary to mention here, not concerning the subject under consideration.

If the steam boiler and steam be suppressed in this apparatus, and the perforated metallic plate and ventilator be only retained, the apparatus shown in Fig. 5 is made.

Through the perforated plate, either of metal or some other material, P, from beneath to above, the ventilator, V, set in motion by the hand, or, in the case of a more considerable application, by some mechanical motor, keeps up a current of air which passes through the numerous holes of the plate. Above this plate cold water is introduced by the pipe, T, furnished with a regulating tap; the water passes into a water pipe, whence it issues in a uniform manner over the plate, which is slanted in such a manner that the thickness of water shall not exceed certain limits; in some cases ice or chemical solutions, as those of phenic acid, may be substituted, according to the application of the apparatus. The pressure exercised by the propelled air suffices to maintain the water on the surface of the plate, and prevents it passing to the lower part. The water flows slowly on to the plate, and, after having passed over and given its coolness to the air which pene-

trates it, finally reaches the other pipe, by which it runs to the issue at *f*; in most cases this water is again useful for other purposes. As to the cooled air, it penetrates into the upper part of the apparatus, escaping by the tube, E, and reaches the places where it is wanted.

MEDICAL NOTES.

An Antidote for Mercury and Lead Wanted.

It is well known that the doctors of the regular or allopathic school insist on the free use of mercury, especially in secondary syphilis, that dreadful scourge of civilized countries. Many of our Western and Southern doctors pour in the calomel and blue pill for almost everything, as freely as the profession used to do in former times. Since this is so, and since the other medical schools have not yet furnished a practical substitute for mercury, the great want in medicine is a counteractor for a remedy often as bad if not worse than the disease. Chemistry and experiment must help the doctors, and still more the sufferers from mercurialization, if it be possible. Chemists and physiologists long ago found two, and only two, efficient agents, capable of rendering mercury in the system harmless; and these two substances, namely, iodine and sulphur, happened also to be the best neutralizers of another common cumulative poison, lead. But the difficulty was and is to cause the assimilation of iodine and sulphur, or either. Sulphur is nearly insoluble in any menstruum capable of being taken into the stomach. Iodine is very soluble in alcohol, oil, etc., and even in water to some extent, but largely soluble as iodide of potassium, a drug now used to excess. Unfortunately this iodide, also the tincture, are but slightly assimilated, passing off by the bladder. The small amount of iodine contained in that well known organic substance, cod liver oil, would be likely to prove more effective as an antidote to lead and mercury than a large quantity of iodide of potassium, because the organic oil enters into the blood and tissues. We put forth the suggestion that some vegetable may be found which is rich in iodine, also other plants, and harmless ones, may contain sulphur in an assimilable shape, for sulphur is an exceedingly common element of organisms in general. If we could have strong extracts of such plants, the object spoken of would be accomplished. In that case, our calomel givers could salivate their patients to their hearts' content, and have them live through a dozen courses of mercury, a matter of profit and pleasure to every regular doctor.

Thousands of cases of chronic rheumatism, as well as consumption and other fatal diseases, have been traced to the use of mercury. Lead poisoning has become alarmingly prevalent of late years, producing colic, constipation, hardened liver, neuralgia, nervous dyspepsia, and paralysis, which sometimes attacks people even in the prime of life. We will not discuss the question of lead in water pipes farther than to observe that every decent chemist knows that pure water acts on lead with astonishing quickness. To have water pipes, as used at present, coated internally with a sulphide or sulphate seems to be the only good practical preventive of lead poisoning. But in the case of lead pipes kept for weeks in hogsheads and barrels of ale and cider, there the solubility is certain and its effects destructive or pernicious to no small degree. Such dangerous nuisances should be abated by law. Again, soda fountains where the water, highly charged with carbonic acid, acts on lead, and sometimes on copper in old fountains, are things deserving of legal attention. Many of the hair dyes in market, and some of the cosmetics, are well proven poisons.

Ice as a Medicine.

The great value of ice in certain diseases is not fully recognized by the medical profession, or by the public. Many years ago, it was found by one of the best English physicians—we think Dr. Marshall Hall—that small pieces of ice thrust into the rectum proved a safe and speedy remedy in cases of dysentery, where opiates and sugar of lead had been tried without effect. Very recently, that distressing complaint to which old people, travelers, and others are liable, retention of urine, has been relieved by the same use of ice as mentioned above. This plan is due to M. Cazenave. Common experience has shown that the swallowing of ice instead of ice water by people, in hot weather, is perfectly safe.

Effects of Uric Acid.

Dr. Gigot-Suard has given uric acid to dogs in doses of from 3 to 61 grains in 24 hours, and continued it for one or two months. The acid occasioned remarkable morbid lesions, throwing light on a large number of chronic diseases. The alkalinity of the serum of the blood was often diminished, and it contained crystals of the acid and urate of soda. The organs and tissues upon which uric acid exerted its action are, in order of frequency: the skin, mucous membranes and their glands, the lungs, kidneys, liver, pancreas, brain, lymphatic glands, articulations, spleen, envelopes of the spinal cord and heart. Various forms of disease appeared in all these parts. Cancerous and tuberculous degeneration was produced several times in the lymphatic glands. These experiments are very interesting, and may lead to a more accurate view of the cause and cure of consumption and several other grave diseases.

The New Electric Light.

On the evening of the 5th of May, some interesting experiments with MM. Ladygin and Kosloff's electric light were conducted at the engineering works of Messrs. Warner, Euston Road, London. To obviate the difficulty of carbon being consumed when burnt in contact with oxygen, M. Ladygin placed sticks of carbon in a closed glass chamber filled with a gas not containing oxygen; but owing to the use of metallic connections, the carbon was subject to fracture. M. Kosloff succeeded in overcoming the difficulties by using a special metal of which he forms the holders for the carbon rods, and these are placed in the closed glass chamber.

The lamps which were experimented with were nine in number, six of them having two carbon rods, either of which could be placed in connection with the current of electricity. The carbon rods were all ¼ of an inch in length, and one in each lamp was $\frac{1}{12}$ of an inch in thickness, the others being a trifle less in thickness. The other three lamps contained each a carbon rod, three inches in length, $\frac{1}{12}$ of an inch thick, and also connected with the main current. The first experiment consists in burning a carbon rod in contact with the atmosphere, the rod being consumed in a few minutes. The current was then turned on the thicker rod in each of the six lamps, and a brilliant and steady light was produced, which improved as the current was increased in intensity. The reason for lighting the thicker rod first was that it might consume the oxygen in the lamp, by which the rod was slightly reduced. The current was then directed through the second rod with equally satisfactory results in all the six lamps. The three lamps with the longer carbon rods were then lighted and successfully exhibited, changes being frequently from the six to the three lamps and back again. The apparatus used for producing the current was Gramme's magneto electric machine. With the machine running at about 200 revolutions a minute, a moderate light was obtained, which was greatly improved at 300 revolutions, the maximum of intensity being obtained at 450 revolutions. The strength of the light depends upon three things—on the power of the machine and the number of its revolutions, on the length and thickness of the carbon rods, and on the quality of the carbon. The experiments showed that, with the same strength, of current and the same number of revolutions, double the amount of light was obtained with three long carbon rods as compared with the six short ones. The experiments demonstrated satisfactorily the fact that the electric current could be subdivided, and hence, if practice confirms experiment, which it is believed it will, there is a wide field open for the application of Kosloff's system.—*Telegraphic Journal.*

An Unfortunate Discoverer.

W. T. writes to say: "In No. 24 of Volume XXX of the SCIENTIFIC AMERICAN, Mr. John Hepburn, of Gloucester, N. J., states, in his communication on zodiacal light, that he was the discoverer of the glacial epoch theory, which Professor Agassiz only proved to be true. I do not deny that Mr. Hepburn discovered that theory; but it is a fact that Agassiz adopted it from Karl Schimper, the late brother of the African traveler Schimper, who was released by the English-Abyssinian war. Karl died in February, 1868, in Schwetzingen, near Heidelberg, Germany, of dropsy and of the ill treatment by a malicious neighbor. Schimper mentioned this fact to me, and complained that all his discoveries had been stolen from him, and he had no power to defend himself against the lions of Science. In fact, they left him nothing but his law of the position of leaves. When he was dead, a valuable collection of stones, curiously shaped by the action of water, was destroyed. He was trying to find a law for such shapes; but he never told me more about it, for fear I would misuse the information, although I was an intimate friend of his."

THE State of New York has appropriated $50,000 for the erection of a monument at Saratoga to commemorate the surrender of the British army under General Burgoyne to the American forces under General Gates, October 17, 1777. The monument is to be 230 feet high.

THE new aquarium, now in process of construction at Manchester, England, will be a splendid affair. The tank frontage will have a length of 750 feet.

To our Friends and the Public:

After the full statement heretofore published of the difficulty of our firm with the Customs authorities, and the subsequent exhaustive examination of the whole matter by the Committee of Ways and Means, which resulted in the entire remodeling of the "Moiety" and "Seizure Acts," we had not supposed it would be necessary to add anything further in the way of explanation. But in the brutal and cowardly attack made upon us during the closing hours of Congress by General Butler, certain charges were preferred by him in his character as a Representative, upon the floor of the House, against our firm, so definite and with so much of apparent authority that we feel called upon, in justice to ourselves and the public, to make once more a brief statement.

The charges specifically preferred were, in the main,

First. That we had, as a firm, attempted to defraud the Government and evade the revenue by importing metals, in the form of works of art and statuary. In reply to this it is only necessary to say, that the importations to which General Butler referred were made before the firm of Phelps, Dodge & Co. came into existence, and before any one of the present or late members of the firm became connected with the metal importing business; the senior member of the firm, William E. Dodge, being at the time engaged in the drygoods business.

Second. That in the tariff act of April, 1864, which temporarily increased the rates of duty on imports *fifty* per cent, "Mr. Dodge went to the Treasury and had a comma taken out of one place and put in another, and thereby cleared $2,250,000."

The exact facts in respect to this charge are as follows: In the very full revision of the tariff, as embodied in the act of June, 1864 (and not the act of April, 1864, so specifically mentioned by General Butler), it was decided by both Houses of Congress, after full discussion, that an increase of duties on tin and terne plates would imperil the large industries already taxed under the internal revenue in which tin was used for the packing of fruits, fish, and vegetables, meats, and the like, and so tend to reduce, rather than increase, the receipts of the Treasury. At the same time it was decided to increase the duty on sheet iron, galvanized with an admixture of tin, which article had been imported under the name of "tin plates galvanized," and so definitely and distinctly named in connection with and at the same rate as "galvanized iron" in every successive tariff since 1857. The bill was passed on the 30th of June, and went into operation immediately. On examining its provisions, we found that while the duty on "tin and terne plates" remained unchanged at twenty-five per cent *ad valorem*, the addition of a comma after the word "plates," in the clause "tin plates galvanized," rendered the whole paragraph ambiguous if not absurd, and apparently imposed a new duty of 2½ cents per pound, an increase of one hundred per cent on existing duties. Seeing how impossible it would be to enter our invoices at two conflicting rates for one and the same article, we applied at once to the Collector for a decision in respect to the course to be followed. The Collector saw the difficulty, and referred us to Mr. Fessenden, then in New York, and just appointed Secretary of the Treasury. We called upon him, and he immediately stated to us and to the Collector that he had been chairman of the Senate Committee, and also of the Conference Committee which had charge of the tariff bill in question; that he fully remembered the discussion as to tin plate, in which he had taken part; that the full sense of both committees had been that tin plates should remain at 25 per cent *ad valorem*; that the "comma" had evidently been added by mistake in the haste of engrossing, and could not be considered as the true interpretation of the law.

He accordingly ordered the Collector to pass the goods at 25 per cent, and stated that, on his return to Washington, he would issue a special order making the construction official; and this he did under date of July 23d, after taking full time for consideration and consultation with his former colleagues in Congress and the experts of the Treasury Department. As finally interpreted by Mr. Fessenden, moreover, the law was not in our direct favor; but, on the contrary, had the technical error been allowed to stand and to entail a very excessive increase of duties, the advance in the price of stock on hand would have yielded to us, in common with all other importers and dealers, a very considerable profit. The facts, therefore, were exactly the reverse of those stated by General Butler.

Third. General Butler states that, in our large and complicated business, every invoice brought day by day by us to the Custom House, was wrongly stated, and that we were consciously and continually guilty of fraud.

General Butler *knows* this to be untrue. He *knows*, on the contrary (for as the paid attorney of the informer, he has given attention to the subject), that, after a most careful and merciless examination of some thousands of our invoices by Jayne and his experts, aided by our own clerks *bribed* to injure their employers, with the full use of our books and papers, there were found only some fifty that could in any way be made the subject of controversy; and that in the case of some of these, of from twenty to thirty thousand dollars each, the utmost possible loss to the Government could not have been in excess of 80 cents to one dollar per invoice. And furthermore, that the total loss claimed by the Government on all the invoices was only about $1,600, out of an importation of some $40,000,000, and covering the space of five years.

We believe General Butler further knows, but willfully conceals the fact, that the same error and misunderstanding of the intricate law which compelled us, under severe penalties, to invoice our goods both at cost price and at market price, led us, in the case of a great number of importations, to invoice their value above cost, and so resulted in a gain to the revenue and a loss to ourselves immensely greater than the Government claims to have lost.

Finally. Looking at all the circumstances and the character of this speech, its constant falsifications and perversions of truth, and its brutal personalities, we are quite willing to leave the verdict as to its effect, to any who have fairly looked into the matters of which it treats.

PHELPS, DODGE & CO.

New York, June 26th, 1874.

NEW BOOKS AND PUBLICATIONS.

THE BROOKLYN COUNCIL OF 1874. With Documents and an Official Report of the Proceedings. New York: Woolworth & Graham.

SIXTH ANNUAL REPORT ON THE NOXIOUS, BENEFICIAL, AND OTHER INSECTS OF THE STATE OF MISSOURI. By Charles V. Riley, State Entomologist.

This is a document to be read attentively by the scientist, naturalist, and the farmer; and its value is not confined to the enterprising State which publishes it. Professor Riley has a profound and minutely accurate knowledge of the interesting and complicated science to which his life has been devoted; and his reports are part of the contemporary history of our country, and should be circulated everywhere.

THE LAW OF DESIGN PATENTS, with Digests and Treatise. By William Edgar Simonds, Counsellor at Law. Price $4.50. New York: Baker, Voorhis & Co., 66 Nassau street.

The Supreme Court having recently passed somewhat fully upon a design patent cause, the author has deemed the present a fit opportunity to collate cases on the subject of design patents, and to present them digested and supplemented with deductive comments in the volume above named. The *status* of these patents has heretofore not been unattended with doubts; and hence the present work, aiming as it does to cover the entire field, and to give a clear comprehension of the decisions of the courts on the subject, will doubtless meet with a ready welcome at the hands of the profession.

OLD AND NEW. The July number of this admirable magazine, edited by Edward E. Hale, opens a new volume, the tenth. For vigorous thought, entertaining and useful contents, the magazine has no superior. $4 a year. Boston: Roberts Brothers.

TROW'S NEW YORK CITY DIRECTORY FOR 1874-75 gives some interesting statistical information regarding the increase in population of the metropolis. Last year, the number of names contained was 228,161—this year it is 229,503. Estimating each name as the representative of five persons, an augmentation of 7,000 in population is indicated. The volume contains a newly engraved and excellent map of the city, including the two new wards recently added. The arrangement of names, etc., is the same as in former years, and there is a very large number of advertisements of prominent business houses. Published by the Trow City Directory Company, 11 University Place, New York. Price six dollars.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From June 2 to June 10, 1874, inclusive.

CAR TRUCK AND AXLE BOX.—A. Higley, Cleveland, Ohio.
CLOTHES WRINGER.—T. G. Corliss, New York city.
FOLDING BEDSTEAD.—E. E. Everitt *et al.*, Philadelphia, Pa.
HARNESS.—I. M. Singer (of New York city), Paignton, England.
MAKING PAPER BOXES.—H. R. Heyl, Philadelphia, Pa.
MAKING STENCH TRAPS, ETC.—W. A. Butler, New York city.
MAKING WHITE LEAD, ETC.—A. P. Meylert, New Britain, Conn.
MILLSTONE DRESSING MACHINE.—S. Dean *et al.*, La Crosse, Wis.
SCREW NUT.—W. M. Van Anden, Brooklyn, N. Y.

Recent American and Foreign Patents.

Improved Car Replacer.

John R. Wilds, Brooklyn, N. Y.—This ingenious invention is something which is much needed upon city horse car lines, where it is a daily occurrence for cars to run off the track, causing vexatious delays to the passengers and very severe work to the horses. The device is simply an iron plate grooved beneath to fit the rail, and having flanges to secure it thereto. From the middle of the replacer an irregular shaped groove inclines downward to the rail in each direction. The plate extends over the outside of the rail, and has two oblique channels which intersect the grooves. This part of the replacer is supported on the pavement. The channels extend from the center of the replacer, and incline downward in each direction so as to terminate at the bottom outside of the "tread" of the rail, to receive the flange of the wheel of the displaced car, and to conduct it up to the center, and then down the longitudinal groove to the rail. By slightly modifying the form of the grooves and flanges on the under side to fit it to the rail, the displaced wheel between the rails may be replaced in the same manner. The invention may be applied to the rails of either horse car roads or to the T rails of locomotive roads.

Improved Watchmaker's Tool.

Julius F. Young, Owatonna, Minn.—The object of this invention is to furnish means for reducing the tension and elasticity of hair springs of watches, so as to vary the time or action of the watch movement from fast to slow, as may be desired. There is an adjustable rest, which is designed to hold between it and a stationary stand any diameter of watch balance wheel with the hair spring and parts connected therewith. This rest is adjusted by a finger screw. The balance wheel with the hair spring being thus confined, the end of the hair spring is taken hold of with a pair of pliers and is gently drawn along under spring clamps which are screwed down. These hold the hair spring flat to the bed, so that, with a scraper of any suitable kind, the hair spring may be reduced so as to alter the running of the watch from five minutes to an hour and a half in twenty-four hours. When the clamps are raised, the hair spring is allowed to slip back by its own tension, so as to assume its former diameter, and is readily recoiled.

Improved Hog Trap.

James M. Overshiner and George M. Overshiner, Elwood, Ind.—This is an improved trap for catching and holding hogs. In using the trap, the end is opened; and the hog being driven into the trap, the lower end of a lever is moved outward to open a space large enough for the passage of the hog's head. As the hog attempts to escape, the lower end of the lever is moved inward, clasping the hog's neck and holding him securely, a pawl locking said lever in place. The hog can now be conveniently operated upon as desired, there being suitable devices for placing the animal in proper position.

Improved Standard for Vehicles.

James J. Martin, Houston, Tex.—This is a stanchion pivoted in a strong metal box adapted to be fastened to the side of the platform of the car. The box is open at the top and at one end, so that the stanchion can be turned down on its pivot by the side of the platform to be out of the way. A spring is arranged in each box to so act on the stanchion as to hold it in the upright position; also to hold it when down. The invention also consists of a metal bar on the inside of the stanchion, extending from the platform nearly to the top, and having a screw bolt at each end passing through for clamping side boards to the stanchion when a temporary box is wanted for the platform. This bar draws back into a groove in the side of the post, flush with the surface, when it is not to be used.

Improved Thill Coupling.

Eli Quaintance and Remus D. Hale, Transitville, Ind.—This invention consists in a peculiar mode of supporting the shafts so that the end projection of the plates shall enter and be embedded in the rubber spring. It also consists in a novel mode of holding the rubber by a tongue projecting from the cross bar of axle clip. The ends of a T journal pin form journals in jaws. One jaw of each pair is slotted from the top to the journal hole. Iron plates, when the tongue or shafts are turned to an upright position, will pass through the slots and allow the tongue or shafts to be detached. Between the jaws and back of the journal pins are pieces of india rubber which are for the purpose of preventing rattling, and are held in place by means of the tongues of the clip bars and narrow ribs on the back side of the T journal pins. When the tongue or shafts are in use, it is impossible for them to become detached. By raising them to an upright position they are disconnected in a moment.

Improved Saw Set.

Sylvanus Bartlett, Westport, N. H.—The saw set is of the usual shape and material. A U-shaped gage piece is applied around the rear and sides of the anvil, adjusted by a screw bolt and set nut, and is fixed firmly in position by a set screw, so that the sidewise projecting front ends of the gage move forward or backward along the fore end of anvil and hammer till the gage is set to the exact length of the teeth of the saw required to be set.

Improved Railway Rail Joint.

Anson B. Johnson, Washington, assignor to L. Johnson, Vincennes, Ind.—The ends of the rails are curved outwardly, and in the space thus formed is placed a metallic tongue. The latter has central projecting shoulders which form a support for the top part of the rails. The top part of the tongue forms a continuous connection with the top part of the rails, and allows the smooth passage of the car wheels, without battering or otherwise injuring the rails. The rails, tongue, and base plate are firmly fastened to the crosstie by spikes placed into grooves of the base flanges of the rails and tongue, in the usual manner, passing through perforations of the base plate.

Improved Washing Machine.

James L. Austin, Little Rock, Ark.—In using the machine, the driving roller is raised out of the suds box by means of levers, and the clothes to be washed are spread upon the exposed part of an endless apron. The roller is then lowered upon them, and as it is revolved the clothes are carried between aprons and two other sets of rollers. The clothes are made to pass beneath the driving roller, and are again carried in between the endless aprons, and will thus continue to circulate until thoroughly cleansed.

Improved Combined Lamp Collar and Shade Holder.

George W. Hadfield, Brooklyn, N. Y.—The collar is applied in the usual way. The shade holder is affixed by supports to a base ring, which is made of such a size as to fit upon the collar. Upon the outer surface of the latter is formed a screw thread, into which fits the screw thread cut upon the inner surface of the base ring of the shade holder. By this means the shade holder will be firmly and securely connected with the lamp in such a way as to be entirely independent of the burner, and allow the burner and chimney to be conveniently attached and detached and replaced with new ones without disturbing the shade holder.

Improved Clothes Frame.

Lafayette Magee, Olean, N. Y.—This invention consists of clothes racks adapted to be suspended from a vertical wall, and composed of a series of parallel bars joined by horizontal rods. The two clothes-suspending frames may be set in an inclined position, the upper and overhanging frame being supported on the lower one, and both folding together when not in use.

Improved Hat Ironing Machine.

Antoine Giraux, Orange, and Louis Drovon, Newark, N. J.—This invention consists of irons suspended from balance levers by flexible joints, and of levers arranged on swinging supports in such a manner that the labor of presenting and holding the irons to the work is materially lessened, and the irons can be applied and the pressure regulated to better advantage.

Improved Mitten.

John L. Whitten and J. Hermon Whitten, Burlington, Vt.—The essential feature of this invention is in so cutting the parts as to form the mitten or glove without a seam on the palm or inner side of the thumb, and so as to bring the seam on the outside of the finger, and above the ball of the thumb.

Improved Safety Guard Watch Chain.

Robert A. Johnson, New York city.—This is a useful device for connecting a watch with a guard or chain in such a way that the watch cannot be detached by twisting off the ring from the stem. It consists of a short extra chain, one end of which is attached to the guard near the ring, and its other end is secured to the stem. By this construction, should a pickpocket get hold of the watch and twist off the stem ring, the safety chain will still hold the watch securely connected with the guard, so that it cannot be carried off. This will prove of value to people who are obliged to do much traveling in New York street cars.

Improved Sewing Machine Treadle.

Daniel E. Lillis, Jackson, Mich.—A movable footboard is attached to a cranked rod, so as to shift on it crosswise the length of a slot, in which is a binding screw for holding it in any adjustment. Guide rods attached to the footboard slide thereon. The adjustment is made to allow the operator to so place his feet upon the board as to work it either by a swinging leg movement or by an ankle movement.

Improved Medicine Dropper.

Dennis Warner, London, O.—A rubber bulb clasps the neck of the bottle with its open end, and has a discharge tube placed at one side and near the front end. The latter has walls parallel on the inner side throughout its length, the end being a flat surface or a little concave, and at a right angle to the axis of the bulb. The device drops by pressure, the same sized tube and caliber dropping equally well all degree of fluidity, from sirups to ether and chloroform; it also enables the operator to time the frequency of the drops, so as to make an accurate count.

Improved Excavator.

Ignacio Arcos, San Antonio, Texas.—This invention consists in a scoop suspended in adjustable supports by chains to a crank axle provided with arms, to the extremities of which are attached ropes that are wound around a windlass. Said scoop is raised or lowered through the agency of the arms attached to the crank axle in connection with the ropes and windlass, and the apparatus, as thus described, is supported upon wheels provided with shafts.

Improved Apparatus for Steaming Grain.

William C. Knox and Josiah N. Knox, Evansville, Ind.—In this device, the wheat is subjected to the action of steam as it passes downward through a cylinder. In the latter is first a hopper, then a conical plate, apex upward, then another hopper, another plate, and so on, through and over which portions the grain passes, alternately contracting and expanding in its flow. In the tube which supports the conical plates are made apertures through which steam is conducted to the interior of the cylinder.

Improved Candlestick for Christmas Trees.

George W. Reessing, Chicago, Ill.—This is a candlestick, the socket of which is composed of a coil and the fastening device of a stem, the latter being arranged to cross the space at the bottom of the coil, to form a support for the candle.

Improved Miner's Candle Holder.

Nells Larsen, Mill City, Col. Ter.—A pin is riveted in one end of a bow spring, and passes through the other extremity so that the spring can spread or move outward freely. An elongated curved end of the spring forms a socket for the candle. Working on the pin, in similar manner to the blades of a penknife, are a hook, an awl, and a blade, so that the miner is thus provided with a convenient combination instrument.

Improved Miter Box.

Calendar Potter, Bloomsburgh, Pa.—The object of this invention is to construct a miter machine which may readily be set to any desired angle for cutting the molding accurately and quickly with a hand saw, and without loss of time. The invention consists of a pivoted saw guide, which is made reversible by a lever arrangement on the bottom of the bed plate, while a second lever connection, operated from the opposite side, adjusts the stops which define the angle of the saw guide with the central axis for cutting the miters.

Improved Pump.

William Urquhart and John U. Livingston, West Hoboken, N. J.—The pumps may be double or single acting and of any approved kind; but it is essential that they all connect alike with the suction and discharge pipes. They are seated on a plate, which bolts to standards, and has a slot through which a suction pipe projects; also branches connecting the suction with the outside pumps, fastening them by a washer and nut applied to the suction from below.

Improved Can for Cooling Milk during Transportation.

George W. Fiuke, Mount Pleasant, Iowa.—This is an improvement on a milk can patented by the same inventor, March 3, 1874, No. 148,114, by which the ice chamber may be made in smaller size, saving space in shipping the cans, and also the ice consumed be considerably economized. The improvement consists in providing the ice chamber of the milk can with an inside lining of wood at the side wall, top, and bottom of the same, with the exception of the portion of the main can inside of the ice chamber. The inclined false bottom is grooved at the under side for conducting the melted water to the exit opening of the true bottom.

Improved Inking Apparatus.

Gilbert E. Jones, New York city.—This improvement consists in the combination of one or more movable blades with the duck roller. Foreign substances, which find their way into the ink fountain, are apt to collect on the under side of the knife and form pads which press against the roller and wipe off the ink from the surface thereof. The effect of the movement of the blades added between the roller and knife is to dislodge the pads before mentioned, thus insuring the supply of an even film of ink to the roller.

Improved Churn Dasher.

John E. Shelton, Hickman's Mills, Mo.—To a short vertical tube are secured two parallel disks, in which are formed numerous small square holes. The outer edges of the disks are connected by short vertical bars. To the center of these and to the tube are pivoted horizontal radial rods, to which are secured plates, which are made of such a size as to turn freely between the disks. The latter are also perforated. By this means the milk is finely divided, and is thrown into numerous currents and counter currents, bringing the butter in a very short time.

Improved Illuminating Roof Plate.

Niels Poulson, New York city.—This invention is an improvement in illuminating plates for roofing purposes, and consists in providing the shanks of the bull's eyes with lugs inclined upon their upper side, to adapt them to be firmly clamped to a metallic plate in openings in which they are inserted.

Improved Egg Carrier.

William O. Strong, Ypsilanti, Mich.—Egg carriers formed of slitted and interlocked paper strips soon become useless in consequence of the projecting ends of the strips becoming broken. And when the slits of each strip are on one side thereof, instead of being alternately arranged, it is impossible to raise the carriers from the trays in which they rest without disconnecting all or part of the strips. To remedy these and other objections, the inventor connects the projecting ends of the strips to the side of the exterior cross strips by means of linen, muslin, or other suitable fabric.

Improved Plow.

Julius Hartmann, Gilman's Point, Ky.—The moldboards are hinged to the share, which is narrow and nearly vertical. When the share is turned to one side or the other, the moldboards are thereby adjusted at different angles, one to act as a landside, the other to turn the furrow like an ordinary moldboard. These parts are secured in any adjustment by means of a lever and notched arc bar.

Improved Composition for Emery Wheels and Whetstones.

Isaac Butterfield, Weissport, Pa.—This invention consists in the combination of the ashes of bark with a cutting grit and cementing material, in the manufacture of emery wheels and whetstones for the purpose of forming a stone of efficient cutting power, the friable ash performing the mechanical function of falling out of the interstices as the stone wears away, and thus leaving exposed a sharp cutting surface.

Improved Rub Roll for Condenser Cards.

Alonzo Heaps, Darby, Pa., assignor to himself and Enos Verlenden, same place.—This invention consists of a tube having the feather or spline formed on it, and so constructed that it fits on the spindle of the rub roller nicely. It is secured by a nut or other means, so that it can be readily taken off and another put on. A new feather can also be put on when the old one is worn out, without disturbing the spindle.

Improved Hay Cart.

John Rumrill, Salina, Kan.—This invention relates to means whereby hay, after having been cured in winnow, may be raked and carried to the stack by one continuous operation, thereby greatly lessening the usual labor and the customary waste by hauling it or by dragging it with horses and circumjacent ropes or chains.

Improved Railroad Bed.

George Potts, Unionport, O.—This invention consists in a continuous elastic bed for a railroad rail, which dispenses with all ordinary forms of fastenings for the same, and allows it free vertical movement. To this end, the iron rails rest lengthwise on wooden sleepers, and are secured by chairs which are bent inward at the top to form flanges that bear on the base of the rail. Thus the rail is confined only between the top of the chairs and the wooden sleepers.

Improved Car Coupling.

Martin Kurtzeman, Crestine, O.—This invention relates to that class of car couplings wherein the coupling pin is held up by a slide until the drawheads of two cars come into collision, and are automatically coupled, the object being to relieve car couplers from the usual peril of their occupation. The invention consists in an uncoupler of a very peculiar construction, and which seems admirably adapted to accomplish its purpose.

Improved Screw Plate.

George D. Dean, New York city, assignor to Frank G. Green, same place.—The object of this invention is to furnish a convenient and efficient means for cutting screw threads on gas pipes, in the operation of putting such pipes into buildings. The invention consists in a screw or die plate, in which are combined all the standard sizes and threads used for the purpose, with a guide for each die, the dies and guide holes being arranged in a convenient and compact form.

Improved Whiffletree.

Harvey M. Kelley, Irving, Ill.—A strong ring fits upon the end of the whiffletree, and has an eye formed upon the one side to receive a hook. Upon the forward and back sides of the ring are formed straps extending along and fitting upon the whiffletree, which have upon their ends inwardly projecting prongs, which enter the wood and prevent the clip from being drawn off. A band is slipped upon the whiffletree, and is designed to fit closely upon it near the ends of the straps and closely confine the same in place. It is secured in place by a screw. The eye of the hook is made open, and with its ends tapering and overlapping each other. The ring eye, and straps are cast of malleable iron, in one piece.

Improved Corn and Cotton Planter.

William H. Griffith, Jones' Mill, Tex., assignor to himself and M. J. Strickland, same place.—The corn part and the cotton part of the hopper are separated by a partition. In the cotton hopper there are two saws on a horizontal shaft, over and partly in the discharge throat, for forcing the cotton seed through and preventing the throat from clogging. By the side of these saws is a spiked conical block, also on the shaft, to work the cotton seed down to the saws. This shaft has a pulley outside of the hopper, on which a belt works from a pulley on the drum shaft, to turn said shaft.

Improved Planter, Cultivator, and Stalk Chopper.

John L. McCaleb, Atascosa, Tex.—In the middle part of the axle is formed a bow, so that it may readily pass over tall plants without breaking or injuring them. Beams are secured to the axle and pass back parallel with each other, and at right angles with the axle for a short distance, and are then bent outward at an obtuse angle. The rear parts are held by an arch, in the top of which the handles are inserted. The rear parts of the handles are held at the proper elevation by a U-shaped brace, the bow of which is secured to the arch. The furrow is opened to receive the seed by the plows, which are bolted to standards which swing upon the axle and the inclination of which, and consequently the depth to which the plows enter the ground, may be regulated at will. In adjusting the machine for use as a cultivator, the furrowing plows, the shafts and hoppers, and their attachments, are detached, and three or more standards, provided with suitable plows, are placed upon each of the beams. To the rear ends of the beams are detachably attached standards, having outwardly projecting journals formed upon their lower ends to receive the small wheels by which the rear parts of the machine are supported.

Improved Horse Power—Improved Baling Press.

Peter K. Dederick, Albany, N. Y.—The first is an improvement on an invention patented by the same inventor, June 25, 1872, which was a plan for arranging the shipping connections within a hollow journal, on which revolves the large drive wheel, having the drum arranged under it. The bore of said wheel was made large and fitted on a hollow stationary center or journal. In the present invention the same plan is made available for, further simplifying such machines, and economizing space by greatly enlarging the central opening or the hollow stationary center circle, so that the drum itself is placed within the hollow journal, and the hight of the machine thus materially lessened. Hence, the invention consists of a stationary circle or hollow center within which the drum is located, and which forms the journal for the wheel. The same inventor has also devised an improved baling press, which is particularly adapted to baling cotton, in consequence of the pressed material being open to receive the cloth after passing from the press box. The cotton is deposited into a hopper, whence it falls of its own gravity into a press box and is forced against a head by a plunger, which is operated by an eccentric through a connecting pitman. Any cotton overlapping the plunger is folded down by a roller suspended by springs in the end of the hopper, and passes behind shoulders, which may be formed with teeth, which prevent its return. This operation is repeated until the bale is built up in sections, having all of its sides clear of all obstructions for putting on the cloth. The bale, after being tied off, is removed by slacking back on the friction head, which is then placed against the front of the press box, ready for the next operation.

Improved Seed Planter.

John Johnson, of Ferry, and Luther W. Ingram and John Harper, of Naples, Ill.—This invention improves the construction of the seed planter for which letters patent No. 28,490 were issued to John Johnson, May 29, 1860. The front frame consists of two cross bars, connected near their ends by two longitudinal braces, to the ends of the former of which runners are bolted. The lower parts of the latter are recessed to receive rotary cutters, which cut through roots, sods, and other obstructions, and thus prevent the seed-dropping device from catching upon them. Upon the runners are formed double share plows, by which the furrow is opened to receive the seed, which is introduced through a vertical hole in said runners. The seed then falls upon the wide flat part of the furrow before any soil can fall in. The upper parts of the runners are recessed to receive hoppers, which are pivoted by a rod screwed into the runner. The upper end of the rod passes to the dropper's seat, and is secured by a nut. By suitable mechanism a boy, sitting upon the seat, can readily vibrate the hoppers to drop the seed. The bottom of the hopper has two holes formed through it, of such a size as to contain enough seed for a hill, and is recessed to receive a small circular plate, which has two notches cut in its edge, at a little distance from each other, to allow the seed to pass through to the holes in the hopper bottom. The part of the plate between the notches is placed directly over the hole, through which the seed passes to the ground, so as to serve as a cut-off, to prevent any more seed being dropped at a time than enough to fill one of the holes in the bottom of the hopper. The sides of the furrow are pressed in at the rear of the plows by the concaved rims of the wheels, which press the soil down upon the seed and form a low ridge along the row.

Improved Cotton Planter.

William T. Huff, Atlanta, Ga.—The rear and lower end of a shoe rests in a notch in the upper part of a spout, which passes down between, is secured to, and supported by bars pivoted to the rear uprights. The bars rest in inclined grooves in the sides of the spout, are clamped to the same, and are bent inward and forward, so that their forward ends may be upon and close to the opposite sides of a wheel, and may rest upon the transverse pins, which are passed through the said wheel at a little distance from its rim. By this construction, as the wheel revolves, the ends of the bars drop from one pin to another, which jars the spout and shoe, and causes the seed to pass out regularly.

Improved Churn.

Asa Palmer, La Cygne, Kan.—This invention relates to an oscillating churn box, having vertical spring supports, and secured thereto by clamping devices. A lever is detachably secured to the upper ends of the springs in such a position as to bear upon bars on the cover, and thus hold the latter down, and at the same time hold the cream box in place upon the springs. The dasher is formed of a series of slats, set inclined. In operating the churn, it is moved back and forth, which causes the milk to pass rapidly from one end of the box to the other through the dasher, the inclination of the slats throwing it into numerous currents and into violent agitation, bringing the butter in a very short time. The box is easily oscillated, a slight push being all that is required to keep it in motion.

Improved Folding Cot-Bedstead.

Wendell Wright, Phœnicia, N. Y.—The legs at each end are connected by a transverse rail, and are pivoted to the side rails so that they will readily fold back against the inner sides of the side rails. When the bedstead is in use the legs stand bracing, and are supported by the head and foot boards, the end pieces of which have projections which enter mortises in the legs. The foot board is pivoted, so that it will fold down between the side rails. The head may also be pivoted so as to fold in a similar manner. By means of a projection on the head and foot boards, the legs may be more perfectly supported than they would be by the rails.

Improved Truss.

William Shields, Mount Sterling, Ill.—This is a conveniently and easily applied anal truss or bandage for the purpose of treating and curing successfully diseases of the rectum.

Improved Ore Separator.

Pentecost J. Mitchell, Brigham city, Utah Ter., assignor to himself and Joseph E. Gay, New York city.—The vat is mounted on an upright frame, under an overhead frame. The sieve, which is suspended in the vat from a rock shaft, drops, when let fall, on bars supported by springs. Below the sieve the vat is hopper-shaped, with passages through it, having an adjustable gate. Below the vat is a receiver, into which the matters fall to be conducted into the upper compartment of a descending reciprocating car. The materials then pass through a contracted passage, over an amalgamator and into a basin, over the top of the lower end of which the light matters pass off with the water, leaving ores not previously collected deposited in the bottom of the basin. The sieve may be lifted up at any time above the top of the vat by a lever, and be swung forward over the side of the vat and tilted upward to be cleaned of the coarse matters lodging in it.

Business and Personal.

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

For Sale—One new side wheel Steamboat, 50 feet long—one propeller (new), 25 feet long, by S. E. Harthan, Worcester, Mass.

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Cobalt and Nickel Salts and Anodes, the best coating for all metals, with instructions for Electro-plating. Chromium negative plates for batteries, three cents per square inch, and batteries for all purposes; the best known for power and constancy. G. W. Beardslee, 122 Plymouth St., Brooklyn, N. Y.

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A Boon to Manufacturers—A Pulley that uses no Keys, Key-seats, Set-screws, Bolts or Pins—that cannot injure the smoothest shafting, or be thrown out of balance in fastening. One pulley sent on trial to any part of the U. S. For description and address, see this number Scientific American.

Wanted—To establish a Manufacturing business in the West. Will purchase the right of some good article, or admit a partner. S. & Co., Box 1182, Fort Wayne, Ind.

A first class Machinist and Toolmaker wants a permanent situation. Address Th. Alberti, 22 Eldridge St., New York. Best References given.

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Mechanical Expert in Patent Cases. T. D. Stetson, 23 Murray St., New York.

Sure cure for Slipping Belts—Sutton's patent Pulley Cover is warranted to do double the work before the belt will slip. See Sci. Am. June 21st, 1873, P. 389. Circulars free. J. W. Sutton, 95 Liberty St., N. Y.

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Gas and Water Pipe, Wrought Iron. Send for price list to Bailey, Farrell & Co., Pittsburgh, Pa.

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Boilers and Engines, Second Hand. Egbert P. Watson, 42 Cliff St., New York.

Taft's Portable Baths. Address Portable Bath Co., 156 South Street, New York city.

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For economical Vertical Steam Engines, go to the Haskins Machine Co. 46 Cortlandt St., New York.

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Peck's Patent Drop Press. For circulars, address Milo Peck & Co., New Haven, Conn

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Dean's Steam Pumps, for all purposes; Engines, Boilers, Iron and Wood Working Machinery of all descriptions. W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

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A. G. says: I have a small sectional steam boiler, made of galvanized sheet iron 1-16 of an inch thick. It is made in the best manner, of good iron, thoroughly soldered and riveted. How much pressure to the square inch will it stand? How large a cylinder can I make for my engine, to run 200 revolutions a minute? How large a safety valve should I have? How large a balance wheel should I have? A. The boiler will safely sustain a pressure of 40 lbs. per square inch, if well built. Calculate the number of square feet of heating surface that it contains, and allow 15 square feet for a horse power in the engine. You can then proportion your engine accordingly, by rules that we have frequently given in former answers.

J. B. asks: What is considered a good result as the temperature at which the products of combustion escape into the stack? A. With natural draft, the gases should leave the boiler with about the temperature of the steam. Your other questions can only be properly answered by a manufacturer.

T. J. M. asks: 1. Where is the greatest pressure on a boiler? If I take a barrel and fill it with water, and then put in several pounds of gold in the bottom, and attach a pipe to the top of the barrel, and run it up fifteen feet to the bottom of a reservoir full of water, where would the greatest pressure be? A. On the bottom in each case, that is, if we have the correct idea in regard to the second query.

M. F. K. asks: Will it take any more pickets to go over a mountain 25,000 feet high than it will to go across the base of the same mountain? The pickets are to be the same width at each end, and to be perpendicular over the mountain. A. No.

W. A. W. asks: 1. How, when, and where did the April fool custom originate? A. There are many different opinions on this subject, the most common one being that it originated from a custom of the Hindoos. 2. Can you tell who was the first black man, and where he lived? Was it the climate that made him black, or was the color natural? A. We expect that no fellow can find answers to these questions.

W. J. R. T. asks: 1. Is it known to be true that the moon has no influence upon the tides of our globe? A. No. 2. Has it any on the vegetable kingdom, or in any other respect? A. Not directly. 3. If the former is correct, what then causes the tide in the Bay of Fundy to rise to such a great hight? Is the Gulf Stream the reason of it, by expansion by heat? A. It is on account of the form of the coast. 4. It would shorten the seaway considerably to certain ports of the Pacific Ocean if the Isthmus of Panama were cut through; why has this not yet been done? A. There are many in favor of such action, but, so far, the necessary capital has been wanting.

W. N. J.—Lava in cooling absorbs water. The moon has a very attenuated atmosphere. The tension of aqueous vapor varies with the temperature.

C. B. L. asks: 1. Are aniline colors poisonous in any way? A. Aniline is poisonous, but its salts are generally considered harmless. 2. I saw in your paper a recipe for keeping glue soft, by mixing a little nitric acid with it; is glue so made in any way poisonous or harmful, when applied to cuts, etc., as described in your paper? A. We think not. As to your other question, we have repeatedly given rules on the subject, which must now be familiar to all our readers.

D. M. M. asks: Can you explain to me the principles and workings of the hydraulic jack? Can I construct a small one? A. It works on essentially the same principle as the hydraulic press. By addressing manufacturers you can obtain illustrated circulars, explaining the construction. You can construct one, if you do not employ any of the patented details.

C. W. W. says: I am constructing a small flat bottomed sailing boat. If I make the stern quite square, and perpendicular to the surface of the water, that is, like the end of a drygoods box, will the helm act, or will it be powerless unless a portion of the under part of the boat's stern is cut away? A. For an ordinary rudder, you must cut away so that the water can get at it. But if you are very desirous of building the square stern, you can steer with a rudder placed like an oar, so as to act at some distance from the stern.

E. W. R. says: 1. I am tending three engines. One is an 85 horse power, of which the slide valve is beginning to wear. Is this the fault of the engineer, or is it incident to all engines which are in constant use? A. It is not necessarily the fault of the engineer. It may be due to poor construction. 2. In Bourne's "Catechism of the Steam Engine" he says that one cubic foot of steam at a given pressure would just indicate one half the pressure if the space should be doubled. There are here 6 boilers side by side, three in a set; each has three gages of water. I let the fire go out under 3 of them, and blow off the steam. The other 3 have 60 lbs. pressure. I open the connecting valve, allow the steam to gain the same pressure in each set, and the steam gage indicates 48 lbs. in each. Is Bourne right? If so, please explain. A. Bourne's rule is approximately correct. As we understand your mode of making the experiment, three of the boilers are forming steam all the time, having fire in them, and the other three also make some steam, because the water has a greater temperature than that due to a pressure of 48 lbs. per square inch. 3. Comstock's "Philosophy" says that if you stand a pork barrel on end, insert a 2 inch pipe 50 feet high, and fill it with water, it would break the barrel. He said a ¼ inch pipe would do it just as quickly as a 12 inch pipe. Is he right? A. Yes.

H. S. W. says: In your issue of May 30, G. S. F. asks: Why does the point of the needle of a surveyor's compass at times rise and adhere to the glass, and you reply that it is due to magnetic disturbance, and at times to the influence of local attracting forces. I think you have failed in this instance to point out the true cause of this occasional phenomenon. I have known surveyors to be greatly puzzled by it. It has happened often in my own experience, and is due to frictional electricity, produced by rubbing the hand over the glass. It occurs only in dry, cold weather, when there is little moisture in the air and none on the fingers. At such a time, should the surveyor in the woods find any small leaf, piece of a twig, or bark from a tree, fall upon his glass near the point of the needle, he brushes it away. The friction of his hand developes electricity, and he is surprised to find the needle glued fast to the glass, where it will remain for a long time unless he happens to know the cause and the remedy of the trouble. The glass must at once be moistened; and if there is no water at hand, he should spit upon it and rub it all around with the finger, whereupon the needle will be instantly relieved. I have often intentionally electrified my glass in this way for the amusement of the curious. So far as my experience teaches, this is the only cause of the phenomenon, and G. F. S. or any other surveyor can prove the correctness of the solution on any day when the required conditions exist, by actual experiment.

R. asks: What amount of coal is used in 24 hours on board the steamships in the New York and Liverpool trade in ordinary weather? A. It varies from 30 to 60 tuns a day according to the size of the vessel and the power and construction of the engines.

R. L. M. asks: With what force does a weight weighing 50 lbs. strike on falling a distance of 2 feet? What is the rule for finding the force that different weights strike, falling different distances? A. It is proportional to the moving force or the momentum of the weight, which is found by multiplying the weight in pounds by the velocity in feet per second, and dividing by 32·2.

R. W. B. asks: How are tables of logarithms calculated, with 10 as the base of the system? For instance, log. 2=0·301030. By what calculation is the decimal 0·301030 obtained? A. The principle by which such calculations are made is the development into a series, by means of the binomial theorem. It would occupy too much space to give a full explanation in these columns. You will find the matter fully explained in Law's "Treatise on Logarithms," Weale's series.

D. G. asks: Is there any means by which gas can be obtained and used for light while the coal is being used for heating purposes? Is it possible to do it? A. Yes. In the manufacture of gas from coal, the coal remaining after the gas has been extracted (called coke) is used to heat the gas retorts; and the remainder is sold in market as fuel. The gas companies here sell large quantities of coke.

E. W. S. says, in reference to the "blowing up" question: "If the person lying down does not inhale all he can, and hold his breath, and the lifters do not both inhale and exhale (no matter if they do work together) it is impossible to raise him without straining the fingers while lifting: so it is not imagination that prevents the lifters from feeling the weight. If possible, please tell me why we can raise a person by the above means, and by those means only? A. So far as our experience goes, we see no reason to modify our previous answer, believing that the principal benefit of the inflation is to make all the lifters act together.

J. F. asks: 1. Does the outside of a belt run faster than the inside? A. Yes. 2. A friend says that, when an engine is on the up or down center, the piston is not exactly in the middle of the cylinder. I say it must be in the middle of the cylinder when it is on the up or down center. Which is right? A. Your friend. 3. Is the *Science Record* printed every year? A. Yes. As to your engine and boiler question, you do not send sufficient data.

B. B. B. asks: 1. How large a pipe is needed to give a full flow of water through twenty ¾ inch faucets, from a tank 40 feet above the place supplied, all the faucets to be on the one pipe? A. It should have an area at least as great as the sum of the areas of the separate faucets. 2. What would be the pressure per square inch at bottom of said pipe? Is there a work on this subject that will answer all such questions? A. Divide the hight in feet by 2·3, which will give, approximately, the pressure on the base in pounds per square inch. 3. Is there a work that treats on steam piping and heating by steam? A. We do not know of any works that will give you precisely the information you want. We can, however, recommend Trautwein's "Engineer's Pocket Book," and Tredgold's "Treatise on Ventilation and Warming."

W. H. S. asks: What is a sill level with when you use a correct spirit level on it? A. It is level with the horizon, or the line between sea and sky.

W. T. asks: 1. Is the process of zincography used in America? A. Yes. 2. Is this process patented in the United States? A. No.

J. W. asks: Can a true cylinder be bored with a boring bar (not having a sliding head) on a slide lathe, said cylinder being bolted to the carriage and fed by it, when the boring bar is not in line with the lathe shears? I contend that it can be done only when the bar and shears are parallel. If bored when the bar is not in line, the cylinder may be straight but cannot be round. A. A cylinder bored by a bar out of true with the lathe shears will be true whether the cylinder feeds to the bar head or not, the only result of the bar being out of true is that the cylinder will be thinner at opposite ends on opposite sides; the bore will not be true with the outside of the cylinder but true of itself, nevertheless.

H. W. S. says: We have a boiler carrying 110 lbs. steam. If we put in another boiler of similar size, connected, would 55 lbs. pressure on each boiler do the same amount of work? If so, how would you calculate the horse power of an engine under such circumstances? A. It would not, under ordinary circumstances, with the same engine. We have frequently given rules for calculating the horse power of an engine.

R. Z. J. asks: What kinds of lenses are used in a wonder camera, what is their size, and how many are there of them? What are their focal distances, and how must they be set in the tube? A. Any double convex lens will do. Its size, focal distance, etc., depend upon the desired magnitude of the picture to be thrown upon the screen. How it is fixed in the tube can be seen by inspecting any photographer's camera. The wonder camera is now sold by opticians and in many toy stores, and can be purchased at prices ranging from $3 to $10.

A. B. C. says: I am unable to understand the working of the parallel motion illustrated in your number of June 13, and I beg you to explain further. On making a rough model of about the proportion of the engraving, I find that, as D A is about three times the length of D B, B can never arrive at A, as mentioned in your remarks, and that B can only perform about 1/6 of a circle about J. There is evidently something about it which I do not understand. Will you explain in your answers to correspondents how B can revolve about the center, F, without becoming disconnected from D and E? A. The circles were drawn for the sake of the explanation, and not to indicate that B made a complete revolution. That a circle can be changed into a straight line is manifestly impossible with the device. Its object is simply to do perfectly that which Watt's and other like mechanism does imperfectly, that is, to convert curvilinear motion into rectilinear motion with mathematical exactness.

S. R. asks: 1. What is the new parallel motion used for? A. For changing curvilinear into rectilinear motion, or *vice versa*, in any machine, suitable modifications being made in its form to suit varying circumstances. 2. Is the walking beam still used on steamboats? A. Yes. 3. How is the parallel motion of the piston transmitted to the beam? A. There are various plans. See Bourne's "Handbook of the Steam Engine," or any other standard work on the same subject.

E. W. B. asks: How shall I make a sand wheel for wood? What kind of sand shall I use, and how shall I fasten it on? A. Make an ordinary wood wheel in sections; fasten leather round its periphery, then coat it with glue (about a foot at a time), and cover it with sifted white sand (sea sand will do) while the glue is hot, pressing the glue on with a piece of board. The leather may be recoated as often as necessary.

G. C. U. asks: 1. If the equatorial diameter of the earth is 25 miles more than the polar diameter, why is it that the Mississippi runs toward the equator? A. Because the source is further from the center of the earth's gravity than the mouth. 2. What is used to petrify human bodies? A. See p. 22, vol. 29. 3. Can you give me a recipe for sticking paper together? A. Use a stiff mucilage of gum tragacanth. 4. Who founded the order of Free-masonry, and in what year? A. The origin of the order is too ancient to be definitely known.

L. B.—This cone pendulum is a heavy ball and rod, suspended from a tripod of brass tubes by four bits of watch spring, of which two are at right angles to the others, so that the ball may swing in a circle. The clock has a brake wheel, which is controlled by an electromagnet, so that the pendulum must rotate once in two seconds.

W. F. M. says: 1. I am constructing a small engine with a cylinder 2 inches in diameter x 2½ inches stroke, intending it to run at about 175 revolutions per minute under a pressure of 5 lbs. per square inch. Of what size and weight should the fly wheel be? Are ports ⅜ x ½ inch too large for such an engine? A. It will be sufficient to make it of such a size that it seems to be well proportioned to the rest of the machine. The steam pressure and size of ports will probably answer very well. 2. Is the D valve used in locomotives? A. No. 3. Can a perfect cut-off be obtained at any point of the stroke where the D valve is used in connection with link motion, by having a cut-off lever? A. No. 4. Would you have given a different answer to my previous questions, concerning steam engine eccentrics, had I said "being link motion engines in both cases? A. No.

W. H. B. asks: To what depth should I sink an artesian well after coming to water, so that the water will flow out at the top? If I strike water at 40 feet and have 8 feet of water in the well, how deep should the well be? A. No general rule can be given on the subject. It is usually necessary to sink an artesian well to a considerable depth.

G. J. L. says: I am building a small steam fire engine. I have the working part done, and it works smoothly and fast until water is turned on to the pump, then it draws the water until the water cylinder is full, and then stops. This trial was with a block tin boiler, 6x14 inches, over a charcoal furnace. The steam and water cylinders are both the same size, being 1¾ inches bore and 1¾ inches stroke; both have slide valves alike; it is upright, about 9 inches high, turning a balance wheel 4 inches in diameter. The steam cylinder is at the top. Is it possible for me to get it to throw water at all with both cylinders of the same size? If so, by what means? Could it be run well with a very high head of steam? What pressure of steam would run it? Would a boiler and furnace combined, 14 inches high and 8 inches in diameter, do? The furnace takes up 7 of 14 inches, leaving the boiler 7x8 inches, with 12 one inch flues. The total heating surface of the boiler (not including the top, which would have considerable heat on it, on account of all the heat and smoke collecting there to get to the smoke stack) would be 2 square feet. This is the largest size of boiler I can put to it. A. We suspect that the trouble arises from improper adjustment of the water valve. The present boiler is very small, and so is the one that you propose. Still, you ought to throw some water.

F. J. says: I wish to suggest a change of manufacture of low pressure engines. Pass a stream of water from the tender on the cylinder from which the steam is transferred to the condenser. This will diminish resistance, and the steam will be condensed with less water, which has to be pumped against the atmospheric pressure. Horizontal cylinders would not be unequally heated, and the heat of the outside of cylinder would be disposed of. The cylinder would not contract. The heat of the piston would radiate, diminishing a liability to cleave to the cylinder and reducing friction. A. This would be going back to old practice. It is desirable to prevent, as much as possible, all condensation of the steam while in the cylinder.

M. D. says: I have a vat of 300 gallons of liquid which I wish to keep below 70° Fah. Having a cistern 6 feet square with 3 feet of water, I propose to build a vat of 150 gallons capacity, running a pipe from the vat into the cistern, using between 200 and 300 feet of ¾ pipe for cooler, running the water from the 150 gallons vat through the pipe, back in under the 300 gallon vat. I can fix a pump to raise this 150 gallons of water, and run it through the pipes, using 2,100 foot lbs. to furnish a continuous stream. 2. We think that this proposed arrangement will answer very well.

J. A. S. asks: What is the best process for bending timber? I have a steam chest which I use, but cannot accomplish a satisfactory job. I often see the most fragile wood which has been bent without the least crack. I have reference to fork handles, shovel handles, wagon tongues, etc. A. It is done by securing the piece to be bent to a template, and bending it little by little, after successive steamings, if necessary.

D. S. H asks: 1. What fraction of a horse power will an average man exert by working a treadle? A. About one seventh. 2. In the description of the new domestic steam engine, p. 386, last volume, it is said: The boiler contains water enough to furnish some 42 foot pounds for 4 or 5 hours. Does this mean $\frac{1}{2500}$ of a horse power? A. Yes. 3. What is the best appliance to prevent belts slipping on a wooden pulley? A. To make the face of the pulley as smooth as possible.

F. M. says: A friend of mine, in speaking of cosmical systems, describes them as machines moving without friction according to the laws of mechanical equilibrium, every part being physically connected with the rest. That, for instance, two bodies would form a couple, each moving with a force in the inverse ratio of mass and distance round their common center of gravity. Whereas, in our solar system, there are many bodies, the moving force of each is one of a couple, the other being the mass of the primary on the opposite side of the center of gravity; there being, however, a common center for the system as a whole. Is this a correct representation? A. Yes, substantially.

J. W. C. asks: How can I stick the bottom of a glass goblet to the bottom of a glass globe so that the goblet will make a standard for the globe, and the joint be waterproof? A. Use some of the cements sold at the drug stores for cementing glass.

J. C. W. asks: Can salt be used more than once in making ice cream, or does contact with the ice chemically change it into a different article from chloride of sodium? A. It is not changed. The salt could be recovered by evaporation and used again.

J. D. L. asks: With Mr. Ericsson's floating ball, if a great mountain could be suddenly placed by the side of it, would it not draw the ball over to that side of the cup next to the mountain? A. We think so.

F. M. F. asks: 1. Can you give me a recipe that will preserve a minnow, so that it will be flexible, to be used for bait? A. Try dipping it into glycerin. 2. Will mineral water keep if carefully sealed? A. Yes.

L. M. asks: Is there a material, a good non-conductor of heat, that is suitable for covering glass blowers' tools? A. Porcelain is used for purposes similar to that mentioned.

J. E. L. asks: 1. What will be the best method for refining solder? A. Re-melting. 2. What is a recipe for gas fitters' cement, such as is used on iron pipe? A. 4 parts black resin, 2 parts brick dust.

B. W. S. asks: 1. Is the atmosphere heavier or lighter on a cloudy, damp day? A. The latter. 2. Why is it that smoke arises so much more slowly on a damp day? A. Because the weight of the column of air which issues from the chimney and contains the smoke is equal to or greater than the weight of an equal bulk of the surrounding atmosphere.

M. E. W. asks: Does the increase of the thickness of ice, when freezing, occur on the upper or lower side of the ice? A. On the lower side.

J. A. H. says: An almost insuperable objection to the use, in Southern waters, of steam barges by parties for their private use and pleasure is the requiring, by government officials, of the employment of licensed engineers and pilots. Is there such a law? If so, why does it not apply equally to New York as to Georgia and Florida? A. If the boat is used by the owner alone, it is not necessary to employ a licensed engineer. But if passengers are carried, or the boat is let to other parties, the case comes under the United States law.

F. H. A. asks: How is the gilding put on spelter trimmings for gas fixtures? A. With tin solder, fill all the holes and defects, and scour the piece by passing for a few seconds in a boiling solution of 100 parts water with 5 or 6 caustic soda, and rinse in fresh water. Then steep for half a minute in a pickle of 1 part sulphuric acid in 10 water, and rinse with boiling water. Then put in a cold or warm electro-bath of copper or brass until it is covered with a metallic coating, which will be the work of a few moments. If the deposit is black and dull, scratch-brush it, and dip again into the bath.

H. J. F. asks: Can you give me a recipe for removing medicine stains from white linen without injuring it? A. When we know the character of the medicine, a recipe can be given for removing the stain which it makes, but no general recipe can be given for removing all medicine stains.

H. A. B. asks: How can I soften finished machine work without discoloring or spoiling the polish? A. Place the finished work in a box made airtight with clay, and pack around the work shavings and turnings of the same metal as the work itself; let the box be kept in a furnace sufficient time to heat the work to a dull red, when the furnace fire may be allowed to go out, and hence the box to cool gradually; or otherwise, take the box from the furnace and cover it with ashes, lime or sand, so as to cool gradually, and your finished work will be softened without losing its finish.

F. C. B. asks: 1. How large should the core of an induction or Ruumkorff coil be to produce the best effect? The coil is to be 3 inches in diameter. A. See p. 379, vol. 30. 2. What is a commutator? A. A commutator serves to break contact or send the current in either direction. 3. How long a spark should a coil 3 inches in diameter and 6 inches long give? A. This depends upon the size and quality of wire used, also upon the construction of the coil.

A. asks: Please give me a method of mixing walnut graining color in oil, so as to allow penciling in imitation of the growth. I cannot get the white shade behind the penciling. A. Grounds for graining are made of white lead colored to suit the special purpose.

T. A. P. asks: How can I bronze tin or any white metal? A. Try the following: Take 1 pint strong vinegar, 1 oz. sal ammoniac, ½ oz. alum, ½ oz arsenic; dissolve the three last in the vinegar, and the compound is fit for use.

H. W. D. asks: What is good for a pain in the lower part of the back? I have a friend who has been afflicted with a pain in the lower part of the spine for about eight years. Would not electricity, applied by a good operator, be good? The spinal marrow and nerves appear to be affected. Would not electricity tend to irritate and excite the nerves? A. Electricity under the direction of a physician skilled in these matters, is frequently applied with benefit in such cases.

J. S. asks: How can I bend glass tubing? A. By heating the tube, slowly revolving it at the same time, in the flame of an ordinary gas burner. It should be held in the same direction as and not across the flame. When it softens take it out, and bend very gently. Repeat until the proper curvature is obtained. This method gives a beautiful curve. When cold, wipe off the soot.

O. A. Jr. says: Several of my neighbors own a spring of water together. Said spring is some 10 feet higher than my outlet. The main pipe runs up and into the reservoir in my kitchen, and makes a turn out and downward and goes on to my neighbors below. In the bend in the pipe a small hole is made from which I receive my share of water. In order to have the water run out of the hole, I put in a straight compression cock, in the pipe leading from the tub; and closing said cock would back up the water and make it run as I desired for a few days, then sediments of some kind would collect and partially stop up the hole in the cock; then I would get more than my share of water. The water in the spring is clear, and there is a good copper strainer at the spring. Can I make a filter of some kind to put in at the spring, which would be better than a strainer, to prevent foreign matter in the pipe? A. Probably you can overcome the difficulty by using a valve which will give the full opening of the pipe.

T. M. J. asks: 1. Water is composed of 8 parts oxygen and 1 part hydrogen gas. Can these gases be separated? A. Yes, by the galvanic current. 2. Are ginger drinks injurious to the health? A. No, if not taken immoderately.

G. B. S. asks: In your answer to L. E. R., for a polish for walnut, you say: "Melt 3 or 4 pieces sandarac of the size of a walnut, and add 1 pint boiled oil and 1 dram Venice turpentine," etc. You must use something else besides sandarac, as it will not melt in oil. You can dissolve it in alcohol or turpentine, but it will all curdle up as soon as it is mixed with the oil. A. Melt your gum separately, and then mix with boiling hot oil.

P. S. asks: 1. Will it do to run lightning rods into a cistern of water outside a house? Would it injure the walls of the cistern? A. The walls of your cistern would probably remain intact until the lightning struck. 2. Will it do to have 4 points of lightning rods all drawn together and down one rod to the cistern? A. There would be nothing gained by multiplying the points in the way you speak of. The safety of these rods consists mainly in their stoutness.

P. says: I have a piece of machinery with polished iron shafts. It stands in a damp place. What varnish will effectually prevent rust, without injuring the polished surface? A. It will be your best plan to buy some transparent varnish from a manufacturer.

P. V. J. asks: 1. In working a telegraph, the keys and receivers of which are ¾ of a mile apart, do I need an intensity or a quantity battery, and how, is each made with a Bunsen battery? A. Connect your zinc of one cell with your copper or platinum of the second cell. 2. In what proportion should I mix sulphuric acid and water for a Grove battery? A. About seven of water to one of acid.

D. H. H. asks: 1. Is the black lead known as German lead (not plumbago) found anywhere else than in Germany (Bohemia)? A. Yes, in many places in this country. 2. Is it supposed to exist in sufficient quantity to supply the large demand for it for foundry facing, polish, etc.? A. Yes, in sufficient quantities to last many years.

F. E. W. says: Some time ago I noticed among queries the question: What will remove Indian ink marks? Your answer was, I think, that you knew of nothing. I have just come across the following: Rub well with a salve of pure acetic acid and lard, then with a solution of potash, and finally with hydrochloric acid. Sometimes these marks may be obliterated by blistering the skin and keeping the blister open for a while. When the new skin grows the marks will have disappeared. A. These remedies are a good deal worse than the Indian ink stains. They amount to an absolute removal of the skin.

R. F. L. asks: 1. What preparation can I apply to large wooden friction wheels to prevent silvering up on the face? A. There is no effective method of preventing the silvering of large wooden friction wheels. 2. What kind of paper is used for small friction wheels, and how is it used? Is it clamped between flanges, with or without glue, or is it put on in layers with glue? A. Paper friction wheels are of thick brown paper, put together in layers without glue, under hydraulic pressure.

F. H. L. asks: Will you give me a rule for computing the length of a pendulum rod for any clock in any part of the world, as clocks require longer or shorter rods according to locality? A. We suppose you refer to the length of the seconds pendulum. Its length in feet = $3{\cdot}26058 - 0{\cdot}008518 \times$ the cosine of twice the latitude of the place. Having found the length of the seconds pendulum, that of any other can readily be calculated by observing that the vibrations made by two pendulums, in a given time, are inversely as the square roots of their lengths.

S. R. L. asks: What sized boiler shall I use for an engine 3¼ x 2½ inches? What should be the weight and size of the fly wheel? A. Calculate the probable power from the proposed speed and pressure, and allow from 15 to 20 square feet of heating surface per horse power. Make a fly wheel from 12 to 15 inches in diameter, weighing from 50 to 60 lbs.

F. H. asks: I am using a powder, for welding steel rails into frogs, which I believe is composed of caustic soda and borax. What does caustic soda add to the welding properties of the powder? It is very bad for the health of those using it; and if you could inform me of some flux that I could use for welding steel rails at a very high heat, to keep them from cracking, I would be thankful. A. There are several patent compounds in the market, but we know very little in regard to their merits. If you insert a notice in our "Business and Personal" column, you will probably hear from the manufacturers.

A. A. W. says: I am running a pair of 18 inch engines; they both exhaust into one pipe. Would there be any difference in power if each engine had a separate exhaust, and does not the exhaust of one engine throw a back pressure on the other? A. It depends a great deal upon the size and arrangement of pipe. If properly proportioned, one pipe will answer as well as two. As to your query on water pipes, you do not send sufficient details.

G. A. N. asks: Will a boiler 10½ inches diameter x 26 inches high, with 26 one inch tubes 12 inches long, made of 3/16 iron with flue sheets ¼ inch thick, be of sufficient capacity to drive an engine of 2 inches bore x 7 inches stroke? What pressure would such a boiler carry with safety? A. The boiler is rather small.

W. H. S. says: In an argument on cannons, an Englishman asserted that the largest guns in the world were made in England. This the American would not admit, saying that the 20 inch guns at the Rip-raps or Fortress Monroe, were the heaviest. A. We believe that some 20 inch guns, the largest of which we have heard, have been made in Europe.

G. F. T. & Co. ask: Please give us the best manner of cleaning gilt frames. A. Use a sponge moistened with urine or oil of turpentine.

E. W. says that W. E. M. can bleach tallow without injuring it, as follows: Heat the tallow to 140°, keep it hot at least 50 minutes, then dash water into it, and stew the water and tallow for a few moments. If correctly done, the tallow will be in small lumps like shot, or butter when it first comes in the churn. Skim the tallow and melt it again, remove all the water and stir the tallow while cooling; this makes good tallow for some purposes. I do not know much about an engine cylinder; but for launching a ship, the tallow must be freshly rendered beef tallow. Five per cent of mutton tallow will spoil launching tallow. Mutton tallow will not slip like beef tallow. Tallow can be heated until it will scorch a feather without apparently injuring it; but it will not slip after that, but will dry like linseed oil. For friction, use beef tallow rendered before decay commences, with but little boiling; for belts and the like, mutton tallow is best. For paint or making a hard surface, superheated tallow is best, because it will not slip.

J. H. J. says, on the subject of draining a cellar, p. 379, vol. 30: My cellar is sunk in clay ground, and after heavy rains would be flooded with water coming in below the wall. In such a case the cellar wall should be built on a trench filled with broken stone, with a tile or a broken stone drain to an adjoining low ground. My walls not having been so built, I proceeded thus: I made a slight trench at the inner foot of the outer wall, so as to catch the drainage, which was all brought to the front and carried under the wall. I then made an outside drain, five feet deep to one foot deep, in which I laid a brick drain (brick on edge covered with cross brick) and refilled the trench. This was 35 years ago. Occasionally I am told that water is standing in the cellar floor. By way of instruction, I take my informant to the outfall of the covered drain and, with my cane, remove a few leaves which had gathered upon the opening, and forthwith a bright stream of water would flow out. At the same time when I made these drains, I dug a well in one of my cellars to the gravel bed below (12 feet) walled it with bricks and covered it securely. Into this well are made drains, 10x12 inches, filled with broken stone and covered with earth, which keep every apartment dry. I have no need of cement and prefer the dry clay. Beds of solid clay have drainage seams in them, which would not be suspected. Many years ago I purchased a lot adjoining my own grounds; this lot had on it a small brick house, under which was a cellar so frequently filled with water that the family occupying the house used the cellar as a cistern. Within my own grounds I made a large cave, covered with logs and earth, for storing vegetables in winter. At times the bottom of the cave would be almost filled with inflowing water. To remedy this, I dug and walled a well in one corner of the cave down to the gravel. The remedy was complete, and after that the cellar spoken of, distant sixty feet from the well, was drained and dry.

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

W. S. V.—No. 28 does not contain tellurium. It contains silver, copper, arsenic, and antimony, and the green color is due to the second and fourth of these substances. No. 26 is a variety of the rare mineral orthite, having a specific gravity of 3·74. No. 27 is a variety of serpentine of unusual hardness and high specific gravity (2·74), and is probably to be referred near the variety bowenite; No. 29 is prehnite.—P. S.—No. 1 is amphibole. No. 2 is ferruginous sand rock. No. 3 is quartz. No. 4 is quartzite with yellow ocher. No. 5 is minute rock crystals on bluish quartz. No. 6 is pea stock coal. No. 7 is magnetite imbedded in quartz. No. 8 is magnetic oxide of iron.—D. B.—An analysis of the clay shows silica, silicate of alumina, and lime (very small quantity). It will not burn to a stone when kept at white heat for 10 minutes. What was done to it to make it burn to a stone?

S. C. H says: I have a drawing in Indian ink on tracing cloth. I wish to mount it by pasting on a paper background, and then varnish the surface. What kind of paste and varnish should be used?—W. C. says: In your last issue E. H. R. asked: In the driving wheel of a locomotive, where does natural philosophy place the fulcrum, the power, and the weight, respectively? I think that the axle bearings are the fulcra, the pressure of steam in the cylinder the power, and the locomotive the weight. [This general idea is correct, but some modifications are required. Perhaps one of our readers will point them out.—EDS.]—J. A. asks: What is the *modus operandi* of putting on the seed bag on well tubing to stop water in rock boring? The bore of the present hole is 5⅛ inches diameter and 500 feet deep; we are going to bore 800 feet more of 2⅛ inches diameter.—W. Z. asks: Can you give me a formula for a jet black stencil ink that will not rub off when handled or exposed to the weather?—F. W. M. asks: How can I stain bamboo and rattan a black color?—M. J. S. asks: How can ink ribbons for hand stamps be saturated with inks of different colors, and how are the inks prepared?—R. S. asks: How can I take the moldiness out of hams? What will prevent a ham from molding without injuring its taste?—W. H. G. asks: What will protect gold jewelry from the stain caused by heat of the blaze while soldering? The trouble with borax is that it runs the solder in the wrong place.—J. S. W. says: We all know that, when a fresh green board or plank is first exposed to the air, it will shrink from its original size. Now if a hole be drilled in the middle of it, say of an inch in diameter, will the hole remain of the same size? Will it shrink longitudinally or transversely with the shape of the plank, or both?—W. F. W. asks: How can I glaze earthenware jugs, also the snuff jars used in tobacco stores?—O. P. B. asks: How can I paint an outside door so as to prevent its blistering, cracking, and peeling?

COMMUNICATIONS RECEIVED.

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

On Railway Earthwork. By J. B.
On the American Log. By S. B.
On Cobalt and Nickel. By G. W. B.
On Raiding Ants. By J. S. D.

Also enquiries and answers from the following:

C. W.—W. N. W.—H. W. D.—F. W.—F. H. D.—G. T. B. S.—G. S. R.—J. H. W.—R. A.

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.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

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

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

June 9, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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APPLICATIONS FOR EXTENSIONS.

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

30,023.—ROCK DRILL.—L. M. Gilmore. Aug. 26.
30,076.—WOOD SAW FRAME.—W. H. Livingston. Sept. 2.
30,168.—SADDLE TREE.—S. E. Tompkins. Sept. 9.

EXTENSIONS GRANTED.

28,644.—PUMP.—N. S. Bean.
28,670.—RAILROAD BRAKE.—N. Hodge.
28,681.—CORN PLANTER.—D. C. Myers.

DESIGNS PATENTED.

7,483.—WIRE CORD.—G. W. Kingsley, Buffalo, N. Y.
7,484 and 7,485.—OIL CLOTHS.—C. T. Meyer *et al.*, Bergen, N. J.
7,486.—IRON FENCE.—W. Snow, Detroit, Mich.
7,487.—CARPET.—W. F. Wait, Auburn, N. Y.
7,488.—FRAME.—G. F. Beebe, Quincy, Ill.
7,489.—FOOT SCRAPER.—C. W. Reed, Chagrin Falls, O.
7,490.—ORGAN CASE.—G. S. Shepard, Lebanon, N. H.

TRADE MARKS REGISTERED.

1,821.—TOBACCO.—S. M. Bailey, Richmond, Va.
1,822.—WHISKY.—C. Rebstock & Co., St. Louis, Mo.
1,823.—SHIRTS.—H. Wallach's Sons, New York city.
1,824.—MOWERS, ETC.—F. Bramer, Little Falls, N. Y.
1,825.—SPECIAL MEDICINES.—J. M. Connell, S. Francisco, Cal.
1,826.—SMOKED MEAT.—L. W. Drake & Co., Buffalo, N. Y.
1,827.—RUBBER.—Goodyear's I. R. Man. Co., Naugatuck, Ct.
1,828.—STOVES, ETC.—Perry & Co., Albany, N. Y.
1,829.—IRON WARE.—St. Louis Stamping Co., St. Louis, Mo.
1,830.—LARD.—W. J. Wilcox & Co., 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
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On application for Extension of Patent $50
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On application for Design (14 years) $30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA

MAY 29 to JUNE 10, 1874.

3,498.—I. Atkinson, Hamilton, Ont. Improvement in curing and packing meats, called "Atkinson's Improved Process of Treating Meat by Compression." May 29, 1874.

3,499.—E. McCoy, Ypsilanti, Washtenaw county, Mich., U. S., G. G. Roby, and C. G. Ward, Detroit, Mich., U. S. Improvements on lubricators for steam engines, called "McCoy's Steam Lubricator." May 29, 1874.

3,500.—T. Lalor, Toronto, York county, Ont. Machine for locking cells and other gates, called "Lalor's Simultaneous Locking Apparatus." May 29, 1874.

3,501.—A. E. Salisbury, Martin, Ottawa county, O., U. S. Improvements on barrel heaters, called "A. E. Salisbury's Barrel Heater." May 29, 1874.

3,502.—J. Lydiatt and E. R. Kent, Hamilton, Ont. Improvements in glass furnaces, called "Lydiatt's Improved Glass Furnace." May 29, 1874.

3,503.—A. B. Smith and G. H. Comer, Oakland, Brant county, Ont. Improvements on hasp locks, called "Smith's Hasp Lock." May 29, 1874.

3,504.—J. Bradley and J. Nicholas, Gomer, Allen county, O., U. S. Improvements on combined thrashing, grain-separating, and clover-hulling machines, called "Bradley's Oscillating Board." May 29, 1874.

3,505.—L. K. Drew, Magog, Stanstead county, P. Q. Improvement on carriages, called "Drew's Improvement on Carriages." May 29, 1874.

3,506.—William Humphrey, Sharon, Walworth county, Wis., U. S. Improvements in artificial marble, called "Alpine Artificial Marble." May 29, 1874.

3,507.—H. Cottrell, Newark, Essex county, N. J., U. S. Improvements on machinery and tools for cutting, turning, molding, sawing, and polishing stone, called "The Cottrell Diamond Stone Cutting Machinery." May 29, 1874.

3,508.—S. P. Olney, Detroit, Wayne county, Mich., U. S. Improvement on a machine for gumming saws, called "Olney's Saw Gummer." May 29, 1874.

3,509.—H. A. Howe, Detroit, Wayne county, Mich., U. S. Improvements on harvesters, called "Howe's Eureka Harvester." May 29, 1874.

3,510.—E. A. Street, Lynn, Essex county, Mass., U. S. Improvements on hydraulic hose, called "Street's Hydraulic Hose." May 29, 1874.

3,511.—E. E. Wheeler, South Norwalk, Fairfield county, Conn. Improvements in wheels, called "Wheeler's Improvements in Wheels." May 29, 1874.

3,512.—G. Wilkinson, Aurora, Ont. Improvements on the construction of gang plow frames, called "Wilkinson's Gang Plow Frame." May 29, 1874.

3,513.—J. H. Blessing and F. Townsend, Albany, Albany county, N. Y., U. S. Improvements in steam traps, called "Blessing's Steam Trap." May 29, 1874.

3,514.—E. Evans, Lynn, Essex county, Mass., U. S. Improvements on attachment to gas burners, called "Evans' Gas Burner." May 29, 1874.

3,515.—J. L. Sprague, Hermon, St. Lawrence county, N. Y., U. S. Improvements on milking stools, calling "Sprague's Combination Milking Stool." May 29, 1874.

3,516.—William West and P. West, Toronto, York county, Ont. Improvements on the manufacture of burial cases, called "West's Improved Burial Case." June 8, 1874.

3,517.—A. D. Cable, Montreal, P. Q., assignee of G. Murray, Cambridgeport, Suffolk county, Mass., U. S. Improvements on faucets, called "Murray's Improved Faucet." June 8, 1874.

3,518.—A. D. Cable, Montreal, P. Q., assignee of L. Dauze and E. H. Boyce, same place. Improvements on lifting jacks, called "The Young Samson." June 8, 1874.

3,519.—E. M. Jones, Brockville, Leeds county, Ont. Improvement on tucking devices, called "Jones' Tucking Device." June 8, 1874.

3,520.—J. Abaterdam, New York city, U. S. Improvements on the manufacture of steel, and welding steel and iron, called "Abaterdam's Process of Manufacturing Steel and Welding Steel and Iron." June 8, 1874.

3,521.—T. J. Reynolds, Irvington, Washington county, Ill., U. S. Improvements on railway switches, called "Reynolds' Railway Switch." June 8, 1874.

3,522.—W. M. Wiswell, Portland, Cumberland county, Me., U. S. Improvements on car couplings, called "Wiswell's Canadian Automatic Benefactor." June 8, 1874.

3,523.—R. Litster, Halifax, N. S. Improvements on coffer dams, called "Lister's Improved Coffer Dam." June 8, 1874.

3,524.—J. S. Ellis, Washington, D. C., U. S. Improvements on locking nuts or bolts, called "Ellis' Lock Nut." June 8, 1874.

3,525.—L. Gill and E. S. Coon, Watertown, Jefferson county, N. Y., U. S. Improvements on spring bed bottoms, called "Gill & Coon's Improved Bed Bottom." June 8, 1874.

3,526.—G. L. Eason, Des Moines, Polk county, Iowa, U. S. Improvements in corsets, called "Eason's Improved Corset." June 8, 1874

3,527.—H. Gross, Cincinnati, Hamilton county, O., U. S. Improvements on mail bags, called "Gross' Mail Bag." June 8, 1874.

3,528.—F. W. Beckwith, Merrickville, Leeds county, Ont. Improvements on washing machines, called "The Queen Washer." June 8, 1874.

3,529.—J. Bennett, St. Johns, N. B. Improvements on paper files, called "The Parallelogram Paper File." June 8, 1874.

3,530.—B. Ward, Dundas, Wentworth county, Ont. Improvements in spring needle circular knitting machines, called "Ward's Improved Presser for Circular Knitting Machines." June 8, 1874.

3,531.—E. Newcomb, Westbrook, Cumberland county, Me., U. S. Car replacer, called "Newcomb's Car Replacer." June 8, 1874.

3,532.—J. Bradley, New York city, U. S. Improvements in apparatus for ventilating railroad cars, steamboats, dwelling places, and other like places, called "Bradley's Improvements in Ventilating Windows." June 8, 1874.

3,533.—J. W. Meaker, Detroit, Wayne county, Mich., U. S. Improvements in hatchways for hoistways in stores, factories, and other buildings, called "Meaker's Improvement in Hatchways." June 10, 1874.

3,534.—S. Scholfield, Providence, R. I., U. S. Improvements on saws for logging, called "Scholfield's Logging Saw." June 10, 1874.

3,535.—J. Dawson, Greenwood, McHenry county, Ill., U. S. Improvements on machines for cutting bolts, called "Dawson's Improved Bolt Cutter." June 10, 1874.

3,536.—A. C. Rand, Minneapolis, Hennepin county, Minn., U. S. Improvements on gas retorts, called "Rand's Improved Gas Retort." June 10, 1874.

3,537.—E. W. Barker, Portland, Cumberland county, Me., U. S. A new car coupling, called "Barker's Improved Car Coupling." June 10, 1874.

3,538.—F. Hungerford, Rochester, Monroe county, N. Y., U. S. Improvement on furnaces for burning oil and other liquids for generating steam, called "Hungerford's Oil Burning Furnace." June 10, 1874.

3,539.—G. G. Felland, Hudson, St. Croix county, Wis., U. S.—Improvements in automatic registering grain meter, called "Felland's Improved Automatic Registering Grain Meter." June 10, 1874.

3,540.—G. J. Colby, Reading, Hillsdale county, Mich., U. S. Improvements on washing machines, called "The Colby Washer." June 10, 1874.

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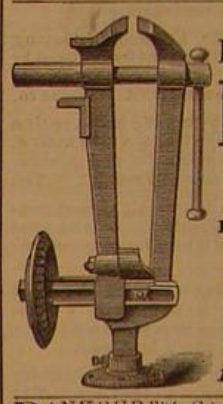
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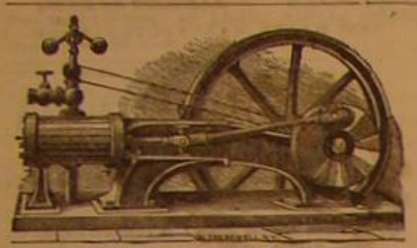
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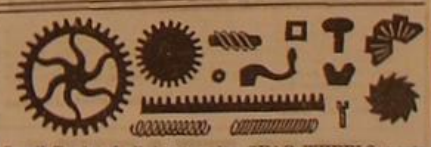
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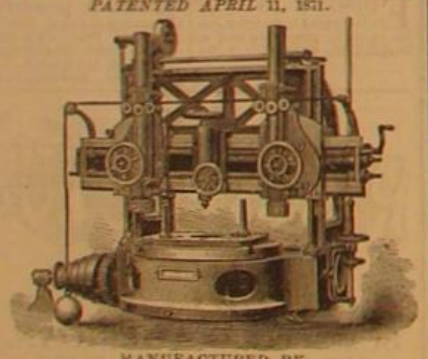
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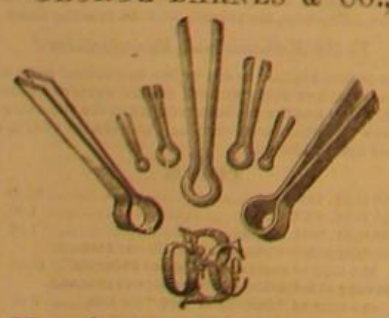


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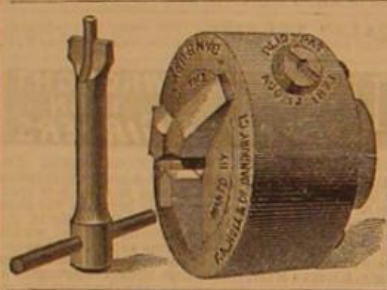
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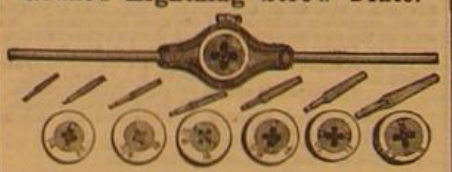
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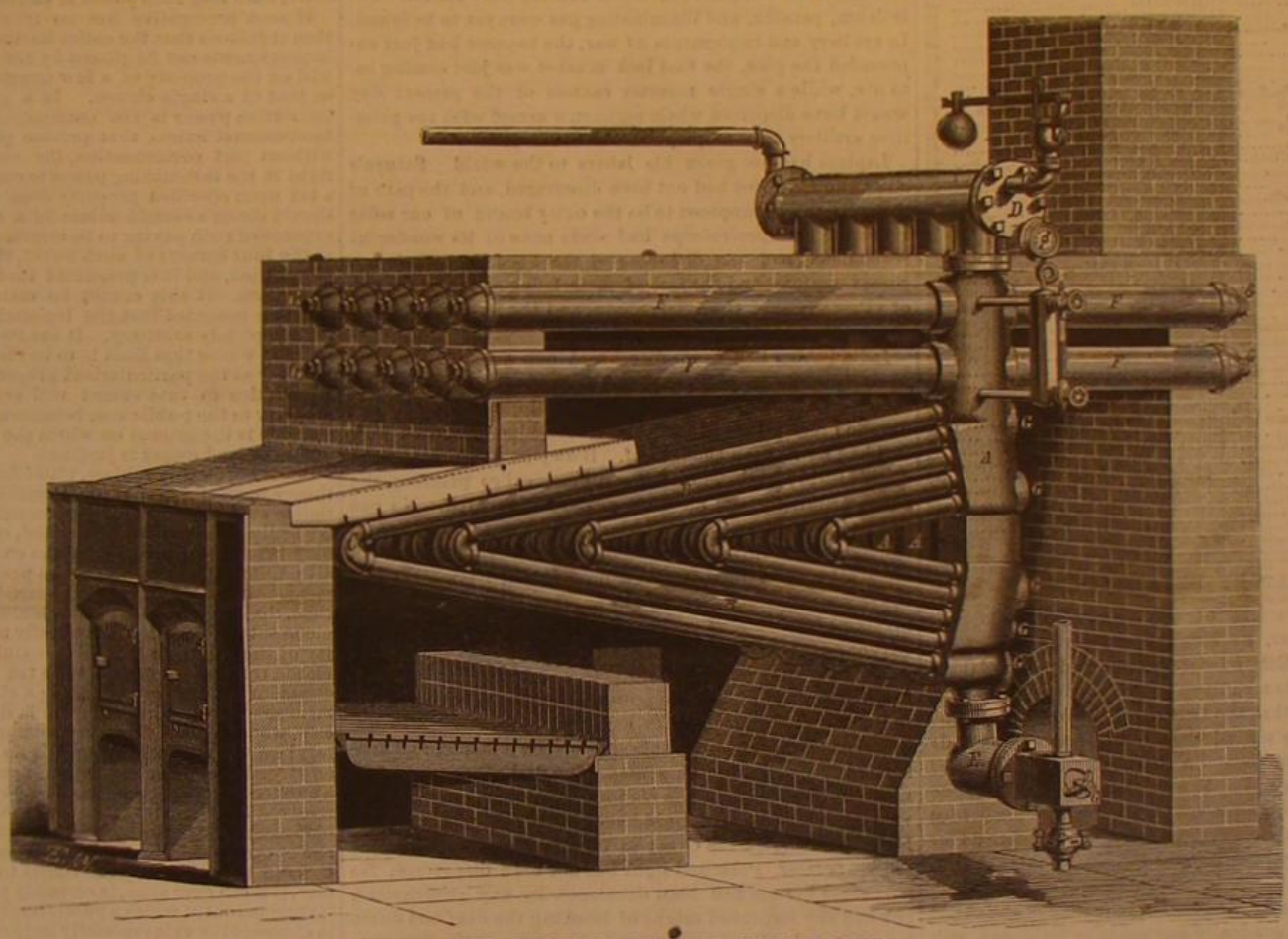
Vol. XXXI.—No. 3. [NEW SERIES.] NEW YORK, JULY 18, 1874. $3 per Annum, IN ADVANCE.

THE ECLIPSE STEAM GENERATOR.

We illustrate herewith an improved form of the Eclipse steam generator, a sectional boiler which was described in these columns several months since. The invention, as modified, is claimed to combine safety, durability, and economy with cheapness of construction and facility of repairs.

The boiler, we are informed, has been used for driving all classes of machinery with great success. The improved method of construction now adopted allows any tube to be easily removed, replaced, or entire sections detached or added, without interfering with other parts of the generator.

The water and steam chambers, A, are of ample size, made of semi-steel, and so formed that the steam can rise to the surface and the water freely return to the lower tubes. The tubes, B, are lapwelded, and the bends, C, are semi-steel. These parts, being exposed to the fire, are arranged so as to allow for expansion and contraction, and provide for complete circulation. The top or roof pipes, F, are used, the lower row for carrying a supply of water and the upper for drying the steam. There are hand holes, G, in the ends of each roof pipe, F, for the purpose of cleaning; also hand holes in the backs of all the chambers, A, so situated that any and every one of the circulating tubes, B, can be commanded their entire inside length, or detached if ever necessary, without disturbing the upright or main parts. The space between each tube will allow the removal of any < without disturbing another.



THE ECLIPSE STEAM GENERATOR.

The object of giving the tubes the <, or angular, shape is to secure the greatest possible amount of heating surface of a continual upward incline, and to allow of unequal expansion. If one arm of the < becomes longer from the heat, the other will springs up or down to accommodate itself, without opening a joint. The water has a complete circulation, running up the inclined tubes, B, and falling down in the sections, A. This is caused by the steam and hot water rising to the surface, and the colder water rushing to its place. The upright return chambers, A, are large enough for the free passage of the water from the exhaust or top openings of the tubes to the lower. This secures a continued and uninterrupted circulation up through all the inclined tubes, B (which are immediately over the fire), and back down the sections, A, where there is larger volume and less effect from the furnace. The steam, as generated, escapes to the upper part of the boiler. The sediments settle in the drum, E, below the fire surface, where they can do no injury and can be readily removed. The heating surfaces are kept clean by this arrangement.

There are no chambers exposed to the action of the heat sufficiently large to cause a destructive explosion. The boiler is short, so that all parts are brought into close proximity to the fire. No packing or caulking is said to be necessary. The joints are ground iron to iron. The tubes are attached with improved lock nuts which can be unloosed at any time, and every part is easy of access for cleaning or repairs.

It is claimed that the bulk of the water, being carried in the upper part of the boiler, prevents the heating surfaces from becoming dry so long as any water remains in the generator. This obviates the necessity of having large water chambers for a reserved supply, while requiring but little attention to keep the water at a proper level.

For further particulars address the Eclipse Steam Manufacturing Company, Sharpsburg, Pa. Information can also be had at their branch office, 87 Wood street, Pittsburgh, Pa., or of the general agent, Isaac H. Shearman, 45 Cortlandt street, New York city, and 132 North 3d street, Philadelphia, Pa.

Electricity Produced in Mechanical Actions.

Certain phenomena of electricity of tension, observed in leather belting by M. Joulin, have recently been the means of directing the attention of that physicist to the subject forming the above heading. He has constructed machines in which the mechanical tension of the belt can be varied at will, and has used for conducting pulleys the following materials: Iron, brass, zinc, red copper, white iron, lead (the last four metals applied in thin laminæ to wooden pulleys); the imperfect conductors, walnut wood, leather, hardened rubber, in sheets of 0 36 inch, applied to wood; cloth and silk fastened in form of cushions, also to wooden pulleys.

In the machines formed of metal and leather, in the latter body electric tensions of surprising intensity were found. Independently of the long sparks obtainable, a metallic wire brought near the belt was traversed with a continuous current powerful enough to deflect the needle of a galvanometer, with electricity of tension to weakly decompose water, and in slightly modified Geissler tubes to produce a distinct stratification of the electric light. The circumstances influencing the electric production may be referred to three causes: separation, more or less rapid, of the bodies; the complex mechanical action of incurvation, depending, in the case of leather, on the elastic state and dimensions of the pulley, and the number of incurvations in a given time; lastly, the common temperature of the two bodies or that of one of them.

Sirius.

At a recent meeting of the Royal Astronomical Society, a paper on Sirius, by Mr. J. M. Wilson, was read. His observations tended to confirm the speculations of spectroscopists that Sirius is intrinsically much brighter than the sun, and must, therefore, be of a higher temperature. His measures of the position of the companion of Sirius showed that it is now passing away from its periasteon, and that the time of a complete orbital revolution is probably nearly two hundred years. Taking the parallax of Sirius as 0·22", the distance of the companion from the principal star is about fifty times the earth's distance from the sun. This would give the mass of Sirius as only 3½ times the mass of the sun, while the amount of its light is estimated at more than two hundred times the light of the sun. He therefore concluded, that, area for area, Sirius must be much more intensely luminous than the sun. He wished to direct attention to the companion of Sirius, and to point out that it is within the reach of instruments of only moderate aperture. The telescope with which his observations have been made is a refractor of 8½ inches. He has ordinarily used a power of 400.

Mr. Mattieu Williams said that it seemed to be assumed that increased brightness was necessarily an indication of increase of temperature; but that though this might be true for solids, it did not follow that it was true for gaseous bodies. When one gas flame was placed behind another, the brightness was doubled, but the temperature remained the same.

Mr. Ranyard said that the speculations of spectroscopists as to the heat of Sirius were founded on the blueness of its light rather than on its general brightness.

Check Chains on Car Trucks.

At the recent session of the Master Car Builders, the merits, *pro* and *con*, of check chains were discussed. A large number of accidents were cited, in some of which the trucks had the chains and in others no chains. Some of the members thought the chains were of no value, but the mass of the evidence was in favor of their use, and the report of the committee to that effect was adopted. Members believed that every truck ought to have four strong check chains. The committee say:

"Check chains, as usually applied, with eye bolts through the truck sides and sill of the car, are defective from being so placed that the full strength of the timber is not available, as the strain is down and sideways on the sill, and usually tears out the lower portion of it, leaving the upper part in place, and with the truck *vice versâ*. Where hook or eye plates are bolted to the truck side and sill, the strain bears on the bolt nearest to the hook or eye, and the result is that either the bolts or timber break and give way in detail; and in cases where lag or wood screws are used, the result is the same.

"In order to have check chains of value, they should be of such proportion that their strength will be equal to the resistance of the timbers to which they are attached, and the fastenings to the timber should be so constructed that the full strength of the timber would be utilized. The point of attaching chains to truck and car body, respectively, should be such that the chains would be at right angles to the body of the car when the chains are drawn taut, and the length of chain just sufficient to admit of running the shortest curves with safety.

"There are different methods of attachment to the sill or a special timber, so that the full strength of the timber can be made available. One method, which your committee would recommend, is to place an iron plate of suitable size and strength on the inside of the sill with an angle turned over, and extending half across the top of the sill, and an eye to receive a ring at the lower end of plate near the lower inside corner of sill; also a similar plate on the opposite side, with an angle extending half across the top, and another angle at the lower outside corner; the plate extending across the bottom of sill to near the inside corner, with an eye to receive the ring above referred to; then by bolting through the plates and sill, and the ends of the plates being drawn together by the ring passing through the eye near the ends, the sill or timber is securely inclosed, and, with the irons properly proportioned, its strength is fully utilized."

Oil Tank Cars.—On the Atlantic and Great Western Railroad, these tanks are made of three sixteenths iron, and are sixty-one inches in diameter. They hold eighty-five barrels. They resemble cylindrical boilers; are fitted with man hole, dome, filling and draw cocks, and are strapped down to platform cars by means of plate iron bands. The arrangement is cheap, safe, simple and durable. Pipe lines leading from the wells to the railroad stations convey the oil, which pours directly into the tank cars.

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..... $3 00
One copy, six months..... 1 50
Club rates { Ten copies, one year, each $2 50..... 25 00
Over ten copies, same rate, each..... 2 50

VOLUME XXXI, No. 3. [NEW SERIES.] *Twenty-ninth Year.*

NEW YORK, SATURDAY, JULY 18, 1874.

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A COMETARY RETROSPECT.

From recent calculations of the elements of Coggia's comet by Mr. Plummer, an English astronomer, there appears to be a close similarity between them and those of Comet II of 1737. There is a sufficient correspondence, it seems, to warrant the belief that the two comets are identical, and that we are receiving a second visit from the vagrant body which attracted the notice of the astronomers of a hundred and thirty-seven years ago. We find no record of its being a very prominent object, although it appears to have been observed in many of the great cities of Europe. Nor do we find statements of any peculiar phenomena connected with its appearance.

There will doubtless be many who, in gazing at the comet night after night as it gradually augments in brilliancy, will ponder as we have over the vast progress which the world has made since the era of the former visitation.

Looking at the condition of Science in 1737, from our present standpoint, it is easier to regard the circumstances negatively, to imagine our own condition if deprived of the results of discovery and of progress which have accumulated in the intervening years. The spot, on which the building in which we now are stands, was then but a green meadow. The crowded metropolis was existing only in the germ, and that merely a few straggling streets close to the water's edge. George II. was on the throne of England, and Louis XV. on that of France. Both amiable sovereigns were struggling to monopolize as much of North America as possible; and although at the time peace reigned in the colonies, it was but a temporary one, which ended in still fiercer hostilities seven years later. Sir Isaac Newton had been dead for six years, and the mathematicians of England were arrayed against those of the continent, squabbling and bickering, with an acrimony intensified by international jealousy, over the theory of gravitation. Newton had studied out the subject of electricity and had invented the glass globe machine. Stephen Gray had also made some investigations, but no one had ventured a theory, nor had an application of the new phenomena been suggested. Telegraphy, the galvanic battery, the innumerable inventions based thereon, were all things of the future. There were plenty of alchemists in Europe, and the science of chemistry was just wrenching itself free from connection with their chimerical fancies. Stahl had but recently announced his theory of phlogiston, a substance which Cavendish in subsequent discoveries believed identical with hydrogen. But the transition period in chemical science was yet nearly forty years distant. Priestley, the discoverer of oxygen, was but an infant. Black, the investigator of the alkalies, and Scheele, the inventor of modern organic analysis, were likewise children. Out of the sixty-three elements, but fifteen were known. Aluminum, chlorine, oxygen, hydrogen, nitrogen, platinum, and nickel were among those which had never been recognized.

Newcomen's steam engine was used in the mining districts, and the boy, who sat beside it and worked the condenser valves, had not been struck with the brilliant idea of making catches and strings perform the labor in his stead. The Marquis of Worcester and James Watt were unknown to fame. The first railroads were in use in the coal districts of Northumberland and Durham, but the rails were nothing more than wooden beams, and iron was not to be substituted for them for thirty years. In the blast furnaces wooden bellows were in use. Puddling, rolling, and the hot blast were unknown. In Europe cast steel had never been made, and but a short time had elapsed since the publication of Réaumur's work, making known the process of manufacturing ordinary steel. In this country Jonah Higby's patent, obtained from the Connecticut legislature, for a "curious art to transmit common iron into good steel" had just run its term of ten years. Having no autonomy as a nation, we had no patent right system in those days, and even civilized France had made no effort toward establishing one. The arts of photography or sun painting in any form were undreamed of. The sciences of aeronautics and of agricultural chemistry had never been imagined. Surgeons hacked off the limbs of their victims and seared the flesh with red hot irons, regardless of the agony they inflicted, for anæsthetics were unknown. The phenomena of digestion were but little understood, and quinine, with hundreds of other remedies now common, had not been discovered.

Whale oil was burned in the lamps, which formed the sole means of illumination when candles were absent. Petroleum, paraffin, and illuminating gas were yet to be found. In artillery and implements of war, the bayonet had just superseded the pike, the flint lock musket was just coming into use, while a single monster cannon of the present day would have dispersed whole regiments armed with the primitive artillery then employed.

Laplace had not given his labors to the world. Saturn's rings and satellites had not been discovered, and the path of that planet was supposed to be the outer bound of our solar system. The spectroscope had made none of its wonderful revelations, and the distances of the fixed stars, their apparent motions, and the fact of their being suns and centers of other systems, the 5,700 nebulæ, and the 136 asteroids, all were unknown.

India rubber had been discovered one year. There was no definite system of botany, and Cuvier's researches in natural history had not appeared. The caloric engine, the hydraulic press and ram, the sewing machine, and the diving bell had never been thought of. Blowpipe analysis and the atomic theory, a system of logarithms, calico printing, the steam printing press, all were yet to be invented. No one had deciphered the inscriptions on the monuments of Egypt. Jenner had not introduced vaccination, nor Hahnemann homœopathy as a school of medicine. Steam navigation and the screw propeller were yet to appear. Captain Cook was making his celebrated voyages around the world. Immense portions of Australia, of Africa, of the polar regions, had never been visited by civilized races. Anthracite coal had never been burned, nor the powerful explosives now known to Science used to tear rocks asunder. Dentistry was unknown as a profession on this side of the Atlantic, and artificial teeth had not been invented. The first chronometer had not been completed. The pianoforte was a new-fangled invention, which no one would have aught to do with until his Majesty Frederick the Great of Prussia deigned to buy one ten years later. Polarized light had not been discovered. No post office system had been developed by any government, nor had any improved means of teaching the deaf and dumb been adopted. Steel pens were unknown, and the SCIENTIFIC AMERICAN was not one of the seven newspapers then existing in North America.

Our retrospect already extends beyond intended limits, and we have far from even summarized the great discoveries of the past century and a half. That our descendants will surpass us as much as we do our ancestors is within every bound of probability. When our celestial visitor again appears, as it will in the year 2011, it will reveal itself to the gaze of earthly inhabitants, regarding the magnitude of whose knowledge and whose powers it would be idle even to speculate.

TAXING POWER OF THE LEGISLATURE.

Law, in its true sense, is the product of the highest reason coupled with the most exact justice. The Civil or Roman Law and the Common Law of England are to be admired as models. The great deviations from genuine law are to be found in arbitrary acts of our State Legislatures, seriously affecting the rights, liberties, and property of individuals, and the tendency of the courts to give validity to such acts in contravention of constitutional guaranties and those of the common law.

The most notable instance of this may be found in such legislative acts as provide for the disbursement of large sums of money in making public improvements, and then charging the whole cost as a tax on specific individual property without the consent of the owners, and, as has sometimes happened, to the entire confiscation of the property. The power of the legislature to do this, and to act as the final judge on the propriety of any public improvement, from which the individual has no redress, although ruined thereby, is now, as we understand the law, laid down by the Court of Appeals of the State of New York.

This doctrine is so arbitrary in form and so destructive of individual rights that it becomes a relief to know that our sister State of New Jersey, through Chief Justice Beasley, of its Court of Errors and Appeals, lays down a much milder and wiser rule for that State, in a recent decision made by him at the suit of "The Mayor and Common Council of Newark *ads.* The State, *Agens et al.*

The facts were that a certain street in Newark had been repaired under an act of the legislature which provided that two thirds of the cost should be imposed on the owners of lots fronting on the line of the improvement, and one third on the city treasury; and the question was whether the legislature could fix, at its mere will, the ratio of expense to be put upon the owners of the property along the line of the improvement. The following is an extract from the very able opinion of the Chief Justice, fully concurred in by his associates, and well worthy the attention of the courts of this and other States:

"* * * That the effect of such laws may not extend beyond certain prescribed limits is perfectly indisputable. It is upon this principle that taxes, raised in counties, towns, and cities, are vindicated. But while it is thus clear that the burthens of a particular tax may be placed exclusively on any political district to whose benefit such tax is to ensure, it seems to me it is equally clear that, when such burthen is sought to be imposed on particular lands, not in themselves constituting a political subdivision of the State, we at once approach the line which is the boundary between acts of taxation and acts of confiscation. I think it impossible to assert, with the least show of reason, that the legislative right to select the subject of taxation is not a limited right. For it would seem much more in accordance with correct theory to maintain that the power of selection of the property to be taxed cannot be contracted to narrower bounds than the political district within which it is to operate, than that such power is entirely illimitable.

If such prerogative has no trammel or circumscription, then it follows that the entire burthen of one of these public improvements can be placed by the force of the legislative will on the property of a few enumerated citizens, or even on that of a single citizen. In a government in which the legislative power is not omnipotent, and in which it is a fundamental axiom that private property cannot be taken without just compensation, the existence of an unlimited right in the law-making power to concentrate the burthen of a tax upon specified property does not exist. If a statute should direct a certain street in a city to be paved, and the expense of such paving to be assessed on the houses standing at the four corners of such street, this would not be an act of taxation, and it is presumed that no one would assert it to be such. If this cannot be maintained, then it follows that it is conceded that the legislative power in question is not completely arbitrary. It has its limits, and the only inquiry is where that limit is to be placed. * * *

So far as the particularized property is specially benefited, an exaction to that extent will not be a condemnation of property to the public use, because an equivalent is returned, and this is the ground on which the abnormal burthen put upon the land owner is justified.

Speaking on this subject, Chief Justice Green says: 'The theory upon which such assessments are sustained, as a legitimate exercise of the taxing power, is that the party assessed is locally and peculiarly benefited, over and above the ordinary benefit which, as one of the community, he receives in all public improvements, to the precise extent of the assessment." ("State *v.* City of Newark, 3 Dutch. 190.) It follows, then, that these local assessments are justifiable on the ground alone that the locality is especially to be benefited by the outlay of the money to be raised. Unless this is the case, no reason can be assigned why the tax is not general. An assessment laid on property along a city street for an improvement made in another street in a distant part of the same city would be universally condemned, both on moral and legal grounds. And yet there is no difference between such an extortion and the requisition upon a land owner to pay for a public improvement over and above the exceptive benefit received by him. It is true that the power of taxing is one of the high and indispensable prerogatives of the government, and it can be only in cases free from all doubt that its exercise can be declared by the courts to be illegal. But such a case, if it can ever arise, is certainly presented when property is specified out of which a public improvement is to be paid for, in excess of the value specially imparted to it by such improvement. As to such excess, I cannot distinguish an act exacting its payment from the exercise of the power of eminent domain. In case of taxation the citizen pays his quota of the common burthen; when his land is sequestered for the public use, he contributes more than such quota; and this is the distinction between the effect of the exercise of the taxing power and that of eminent domain. When, then, the overplus beyond benefits from these local improvements is laid upon a few landowners, such citizens, with respect to such surplus, are required to defray more than their share of the public outlay, and the coercive act is not within the proper scope of the power to tax. And as it does not seem practicable to define the area upon which a tax can be legitimately laid, and beyond which it cannot be legitimately extended, and as there is, as has been shown, necessarily a limit to the power of selection in such instances, the principle stated in the case cited is, perhaps, the only one that can be devised whereby to graduate the power. Consequently, when the improvement, as in the present instance, is primarily for the public welfare, and is only incidentally for the benefit of the landowner, the rule thus established ought to be rigidly applied and adhered to."

A full review of this able decision and the cases it cites would interest and instruct all lovers of sound law. It imparts the good old doctrine that States and Legislatures are only the product of an aggregate of individuals, created alike for the general and individual good, and not to be the means of oppression or extortion of the highest or the most weak and humble citizen.

RECENT PRINTING PRESS IMPROVEMENTS.

In the working of nearly all printing presses the sheets of paper are supplied by hand, the workman being known as a "feeder." Each sheet must be taken up singly and exactly placed on the feed board, where it can be seized by the press nippers at the proper moment, and carried to the types. Any carelessness on the part of the feeder results in bad printing and the spoiling of sheets. Measured by the manual force expended, the feeder's labor is slight; but no press can be run, not even for the smallest job, unless the feeder is on hand to place the sheets, while his inexorable weekly wages are a serious expense in every printing office. Many have been the attempts made, extending over a period of twenty-

five years past, to substitute mechanism for this species of hand labor, but without much success until the present time. We have recently had the pleasure of witnessing, at the extensive press rooms of the *Independent* newspaper, Rose street, in this city, the practical operation of a mechanical feeder which is, apparently, the perfection of success. It takes up the sheets separately upon a steel point, carries them forward and delivers them to the nippers, between the adjustable guides, with almost infallible accuracy. Every contingency seems to be provided for. If by any possibility the device fails to place the sheet properly, or fails to feed, the press instantly stops. If two sheets in the pile are by any means tucked or folded together, or if two sheets are lifted, the press stops. All inaccuracy of feeding, or the running through of doubles or "packets," is prevented, and much spoiled work obviated. The first move or slide of the upper sheet of the pile is given by a rubber-faced presser, no air suction being used. The apparatus is suited to nearly all presses, and is quickly adjustable to sheets of various sizes.

When we consider that there are some thirty thousand power printing presses now worked in the United States, to which this improvement is applicable, its importance becomes in some degree apparent. It is believed that the invention will save its cost in less than a year by its diminution of spoiled sheets, to say nothing of its saving in the wages of feeders. It is applicable to steam, lithographic, and other presses used in color printing, and it will greatly reduce the cost of producing fine chromo pictures, some of which are required to be fed through the press from twelve to twenty times, a separate impression being necessary for each shade or print of color. Mr. C. E. Baker, the superintendent of the *Independent* press rooms, 21 Rose street, New York city, will furnish additional information concerning this invention.

PATENTED CAR IMPROVEMENTS.

Two or three years ago the Master Car Builders' Association adopted, as a plank in their constitution, the brilliant idea of excluding from discussion all mention of patented devices concerning railways. If any man patented a car that could be built equally as strong as the present cars for half the money, or if he should invent and patent a truck that would not leave the track, and thereby greatly improve the safety of cars, preventing loss of life and property, he was forbidden to explain its merits before the Association, and that enlightened body could not, officially, take any cognizance of the new discovery.

There is no mistake about it that the discussions of the Master Car Builders, composed, as they are, of practical, wide-awake men, are of great importance in imparting and circulating sound, valuable information about the needs and merits of railway vehicles. We doubt whether there is a more able body of practical workers associated together in any of the various branches of American industry than these same car builders; and how they could ever have permitted such a streak of narrow-mindedness as this anti-patent declaration to creep into their constitution is to us quite unaccountable. At the late session of the Association, one of the members, in discussing the merits of various car roofs, was taken to task because he had spoken well of somebody's patented roof. But it was alleged in reply that, if the Association had done wrong heretofore in such matters, it was time that correction should now be made, for it was demonstrated that, in order to make progress, the Association must, of necessity, investigate patented improvements, and adopt those that are best. This is a sensible conclusion, and one that almost any old lady would have come to without waiting three years, or stirring up bile in the family.

THE MINES AND MINERALS OF INDIA.

For ages unnumbered, India has been famous for wealth in precious stones. Our geographies still speak of it as a land of gold and diamonds; and the popular idea is that its mineral resources are immense and inexhaustible.

So much for current fame. The facts of the case, as developed by the labors of the government geologists, show a very different state of things. The greater part of the vast area of the Indian Peninsula is either destitute of valuable minerals, or they occur in a manner which throws serious obstacles in the way of their utilization; while in the richer districts, the real mineral wealth lies not at all in the mines for which the country has been celebrated. The only diamond mines that pay or promise to pay for working are of the "dusty" variety, more useful for fuel than for ornament; and its precious ores are chiefly those of iron, as yet but little developed.

Copper occurs in many parts, and is mined in several places among the Himalayas, especially in Kamaon, Gurhwal, Nepal, and Sikkim. The mines are worked by natives, and the product is so inconsiderable that, even where the mines are most abundant—in Kamaon,—it is insufficient to supply the local demand. In the alluvial plains of Northern India, the copper-bearing points are few and the yield insignificant. In the metamorphic areas of the eastern and southern parts of the peninsula, where metallic ores occur but sparingly, the principal points, at which copper mines have been worked by the natives at various periods, are in Rajputana, the countries southwest of Bengal, and in the Presidency of Madras. At present the only works regularly carried on are near Jaipur, in Rajputana. Ancient workings abound near Chaibassa, in Bengal, where an extraordinary series of deposits occur, partly in lodes, partly disseminated through schists, and extending for a distance of eighty miles. Much fine ore still remains here, chiefly carbonate and red oxide of copper, with copper glance occasionally; but attempts to re-establish the workings by European miners have never proved successful.

Lead is less abundant than copper, with which it is commonly associated. Rich veins of galena are said to occur in Kulu, in the Northwestern Himalayas, and more sparingly in Gurhwal and Sirmur, but little has been done toward developing them.

Tin has been reported from two to three localities in the plains of India proper, but nothing is accurately known of its occurrence. Rich tin deposits are believed to exist among the mountains between British India and Siam, the same range which affords the well known stream deposits of Malacca, farther south: but the inaccessible character of the country has hitherto prevented any attempts to work them.

Silver is said to occur with the galena in Kulu, and with certain copper ores in Deogurh, but the quantity is small. The Deputy Superintendent of the Geographical Survey visited the latter place, but could find no evidence of a vein or other regular deposit of the ore. Gold is found in many parts, but always in very small quantities, in stream gravels. It is extracted by rude processes of washing, and the yield is so small that none but the poorest of the natives engage in the search, and these only in the spring, when agricultural work is suspended.

Small quantities of an ore of cobalt are found near Jaipur, in Rajputana, and are used for the coloring of enamels. Antimony occurs in Kulu and Lahaul, and zinc at Jawad in Mewar. Chromic iron ore is found near Salem, in the Madras Presidency.

Considering the immense area of India, its share of the more precious metals must be rated as extremely small. Nor is it probable that future discoveries will greatly increase its resources in this respect. For thousands of years the country has been thickly populated by natives familiar with at least the rude processes of mining and metallurgy; and as the remains of extinct and in many cases extensive workings abundantly testify, the country has been thoroughly exp'ored. Besides, with the abundance of labor at the absolute control of the rulers, it has been possible to work mines, especially for gold and precious stones, which would not pay expenses with hired labor. Even the diamond workings, which helped to supply the ancient rulers with their stores of gems, were very likely carried on at a cost of labor which, if paid for, would greatly exceed the value of the proceeds.

The diamond-bearing districts are chiefly in the country around Karnul, Kuddapah, and Ellore, in the Madras Presidency, near Sambhulpar on the Mahanadi; at Weiragad southwest of Nagpur, and at Panna, in Bandelkhand. Of late years comparatively few diamonds are found, and the few attempts that have been made to reopen the mines have proved unprofitable.

Of rubies, sapphires, and other precious stones, India is quite destitute, though they are found in Ceylon, Independent Burma, and in the countries northwest of the Himalayas. The best that India can offer for jewelry are agates, cornelians, and other forms of quartz derived from the trap rocks of the central and western portions. Corundum occurs in Mysore and Salem, also in Rewah, where there is a bed several yards in thickness, associated with jade.

Infinitely more valuable than the gold and gems of the past are the salt beds of the present. The deposits of this homely yet necessary substance in the salt range of the Punjab furnish upwards of fifteen hundred millions of dollars a year to the revenue of the government. The deposits are practically inexhaustible, and for extent and purity have no known rival. The prevalent color is white, sometimes tinted pink or reddish, the mines forming crystaline grottos of indescribable beauty. Another kind of salt is found in great quantities in the Trans-Indus county of Afganistan, occuring in masses in the beds of ravines; and though less white than that of the Punjab, is considered more savory.

More important than the salt mines are the extensive deposits of coal. So far as explored, the coal fields of India are chiefly comprised in a tract of country stretching from the neighborhood of Calcutta, and from a line roughly parallel with the coast of the Bay of Bengal and distant from it between one hundred and one hundred and fifty miles, to about the 78th parallel of east longitude. On the north it is bordered by the plain of the Ganges, and on the south it extends locally a little beyond the Godavari. Outside of this area, the only coal fields of promise are those of Upper Assam. The geological age of these coals, long in dispute, has now been clearly ascertained to be that of the Australian coal, differing little if at all from the carboniferous of Europe. A few deposits of lignite occur in the Punjab, but they are small in quantity and inferior in quality.

Geographically the coal fields of India are roughly divided into four groups: 1. Those of Bengal, including the coals of the Rajmahal Hills and those of the valley of the Damuda 2. Those of Rewah, Sirguja, Bilaspur, Chutia, Nagpur, and the tributary mehals of Orissa. 3. Those of the Nerbudda valley and the hills to the south of it. 4. Those of Chanda and the Godavari.

The principal field is that of Raniganj, beginning about 120 miles northwest of Calcutta, and extending northward about eighteen miles, with an extreme breadth of fourteen miles. This field supplies about half a million tuns a year, ten times the yield of all the other fields together. The seams which are mined vary in thickness from 4½ to 35 feet, and are individually variable. Eighteen distinct coal-bearing areas are enumerated in the several groups, but the most of them are so little explored that no trustworthy estimate can be made of their contents. In all the basins the coals are mostly concentrated in one bed of great thickness, consisting of alternations of coal and shale, and the beds thin out rapidly to the west. In the Raniganj field, where the formation attains its maximum thickness, the upper group is 5,000 feet thick, the lower 2,000, each containing several seams of coal. To the west the upper group is replaced by rocks containing no coal, while the lower diminishes greatly in thickness.

Scarcely anything is known of the Upper Assam fields save that there are several seams and the coal is of excellent quality, containing only two to five per cent of ash. Unfortunately these deposits are almost at the extreme east end of the Assam valley, in a country thinly inhabited and hard to be got at. Some of these coals are said to coke while burning; but with this exception, the Indian coals are all free burning and will not form coke. Generally, too, they are very lean, containing from ten to thirty per cent of ash. For mechanical purposes, they are little more than half as valuable as English coals, and are consequently unfit for use in sea going vessels, owing to the great bulk and the labor of handling. Unless they can be made available for smelting purposes, especially for iron, the demand for them will be restricted almost entirely to railway use, river steamers and stationary engines. It is hoped, however, that with proper selection and care they may be made available in the manufacture of iron; in which case the greatest possible impulse will be given to coal mining, and there is reason to believe the immediate future will bring to India an iron age of productive wealth compared with which the barbaric splendor of the past will be as nothing.

Unlike the ores of the rarer metals, those of iron are widely and generously distributed throughout India, some of the deposits being unsurpassed in quality and abundance. The more valuable of these deposits are of magnetic and specular ores and red hematite, in beds or veins among metamorphic sub crystaline rocks; for size and character, they remind one of the iron mountains of Missouri. There are, besides, clay iron ores in the coal-bearing strata and beds of brown hematite in other stratified rocks; also surface deposits of magnetic iron sand, and nodules of brown hematite, which supply the ores chiefly used by the native smelters.

The most remarkable deposits are near Salem, in the Madras Presidency. They consist of immense beds, from fifty to a hundred feet or more in thickness, the outcrop extending frequently for miles. One of these forms the ridge of a hill 1,500 feet high and four miles long. Another hill of equal length, not far distant, contains five bands of magnetic ore, from twenty to fifty feet thick, which can be traced all round the hill. These are but two instances out of many that might be cited from this locality. At Lohara, in the Central Provinces, a hill two miles long and half a mile wide appears to consist entirely of specular and magnetic ore which yields 70 per cent of metallic iron.

The deposits of hematite, though on a less imposing scale, are often of great extent and richness. The clay iron ores are similar to those of the English coal fields, and the quantity large. A great number of specimens from the Raniganj field yielded on assay an average of 39 per cent of iron. Thus far the few attempts to manufacture iron in India on a large scale have, for various causes, resulted in failure. There is no reason to doubt, however, that the difficulties will be overcome, and these vast beds of iron ore be made the sources of immense industrial activity and wealth.

The Next Fair of the American Institute.

We have received the usual pamphlet containing the announcement of the 43d fair of the American Institute. The exhibition will be held in the same building as last years' on Third avenue between 63d and 64th streets in this city, and opens, for the reception of machinery, August 17, 1874. Goods will be received from the 31st of the same month, and the formal opening to the public takes place on the 9th of September. Unless it be deemed expedient to continue the fair an additional week, the 14th of November is designated as the closing day.

Some changes have been made in the classification of entries, and the number of awards has been increased to nine. They now consist of gold medals of honor and progress, a medal for taste, a silver medal, a bronze medal, diploma, and special diplomas for continued superiority and excellence and for coöperation.

We would remind intending exhibitors of the necessity of early preparation. There is plenty of time afforded, to have everything in readiness before the fair opens, and so to avoid the confusion which usually occurs during the opening week.

Cincinnati Industrial Exposition.

The success of the expositions held annually in Cincinnati for the past four years has justified the managers in enlarging their space and extending the field of operations. The very elaborate circular now before us contains over 900 premiums to be awarded for excellence in all departments of manufactures, domestic industry, agriculture, science, and art. Although the space at the disposal of the management is very large, it is desirable that early application be made for allotments, as the wish to exhibit at these expositions becomes more and more extended. The buildings will be open for the reception of goods from August 3 to September 1 and the exposition will open to the public on September 2 and will remain open till October 3. Applications for information and documents must be addressed to W. P. Anderson, Secretary, Cincinnati, O.

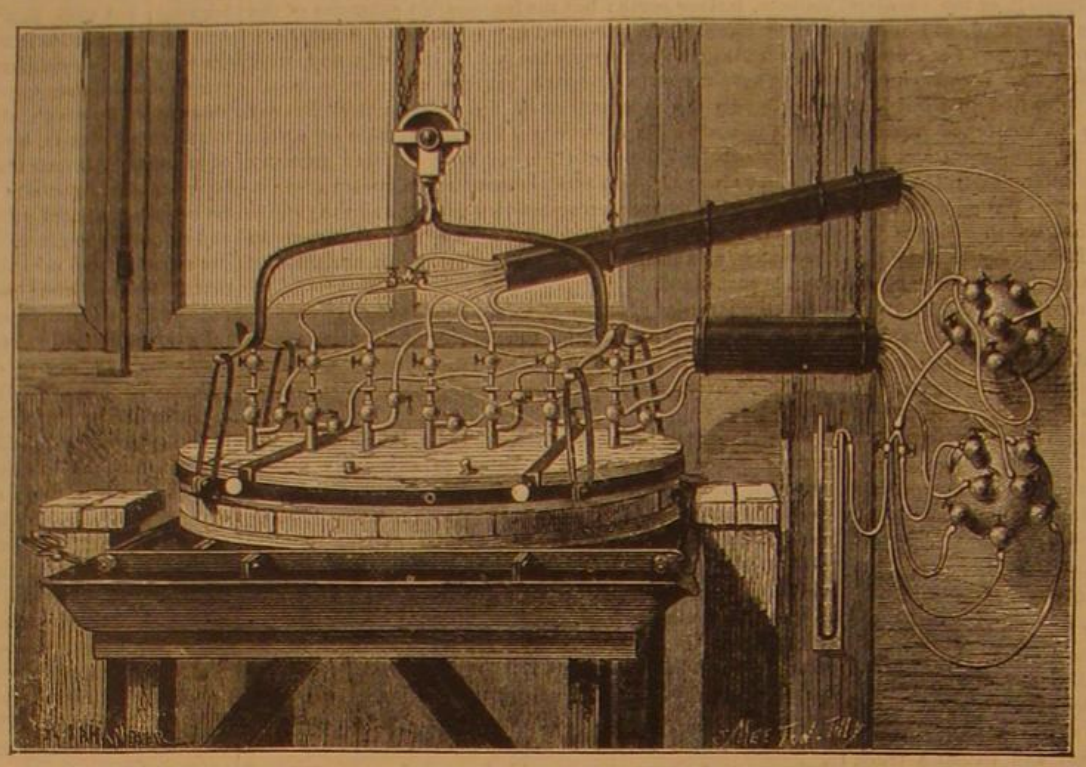
POWDERED chalk, added to common glue, strengthens it A glue which will resist the action of water is made by boiling one pound of glue in two quarts skimmed milk.

CASTING THE STANDARD METER.

Some time ago we gave a brief account of the labors of the International Metrical Commission in Paris, with regard to the determination of the exact length, properties, etc., of the standards to be used as the basis of the metrical system of weights and measures, in nearly all the countries of the globe. The metals fixed upon for the alloy were iridium and platinum; and about a year ago, the former component in its proper proportion, some 55 pounds, was prepared in the laboratory of M. St. Claire Deville.

Quite recently the ingot from which the standards are to be made was cast, the utmost care being taken to secure a perfectly homogeneous alloy. The platinum together with the iridium was melted in quantities of 22 pounds. The ingots thus formed were cooled, cut in pieces, and again melted, 176 pounds at a time. These masses were again cooled and once more cut up and finally run into a single block. The work was done at the *Conservatoire des Arts et Métiers* in Paris, and occupied two hours.

We give herewith an engraving, extracted from *La Nature*, showing the furnace used. The apparatus is the largest of the kind ever constructed, and it has served to prove that the liquefaction, by heat, of great masses of platinum is no longer an obstacle to Science. The lump of metal, when inserted, measured 44·8 inches long by 6·6 inches broad, and 3·1 inches thick. Its value was $50,000, and it was the largest quantity of platinum ever melted at a single time.



FURNACE FOR MELTING PLATINUM.

The crucible was made of Saint Waast stone, a large grained calcareous material, containing about five per cent of silex, and lightly pulverulent. When the platinum was melted, in a cavity hollowed in the stone, the carbonic acid (due to the heating of the mineral) only became disengaged on the edges of the liquid mass, and did not bubble up through the same. The decomposition of the limestone took place through a depth of about 0·6 of an inch, so that the metal rested on a bed of lime of quite considerable thickness.

At each extremity of the crucible were openings through which the platinum, cut up as we have above described, was passed. As soon as the seven oxyhydrogen burners were lit, the fusion began with great rapidity. Through openings left for the purpose, the aspect of the melted metal could be observed. It appeared of a brilliant silver white, as fluid as mercury, and having a mirror-like surface. Large and very brilliant flames also burst forth from the side orifices of the crucible. The temperature of the mass was about 4,172° Fah.

The numerous small tubes shown in the engraving serve to lead the gases to the burners, and each set springs from a copper sphere. The consumption of oxygen was about 3,327 cubic inches to a pound of platinum. During the melting, the ignited products arising from the vessel were carefully examined by means of the spectroscope. Some traces of palladium, it is said, still exist in the alloy. It is stated that, in preparing the iridium, enough osmium was obtained to make 22 lbs of osmic acid, one of the most deadly poisons known. The above quantity, M. Deville said, in addressing the French Academy, was enough to kill every person in the world. The block, after being rolled to 77 times its present length, will be cut into rectangular bars and formed to the proper standards by accurate mathematical measurements.

THE CLAMOND THERMO-ELECTRIC BATTERY.

In 1821, Professor Seebeck, of Berlin, discovered that by soldering together a bar of bismuth and a bar of copper, and applying heat to the junction, an electric current was generated of sufficient intensity to be plainly indicated by the galvanometer needle. To this current and couple, he gave the name of thermo-electric, in order to distinguish them from the hydro-electric or ordinary current and couple. The thermo-electric current is ascribed by Becquèrel to the unequal propagation of heat in the different parts of the circuit, since, when all the portions of the latter are homogeneous, no current is produced on heating, because the heat is equally propagated in all directions. As compared with the hydro-electric current, the electro-motive force is very small, producing but feeble chemical action.

It is unnecessary to enter into the details of past investigation into this subject, since a reference to any standard work on physics will afford all necessary information. The principal application of thermo-electricity is to be found in the thermo-electric battery, which accumulates the tensions produced, in a circuit composed of several metals, when the alternate solderings are heated, the others being kept at constant temperature. This battery, in the form of Nobili's pile, employed in connection with a galvanometer, is used in Melloni's thermo-multiplier for measuring temperature, the the slightest differences in which it indicates with unfailing accuracy. Those of our readers familiar with Tyndall's work "Heat as a Mode of Motion" will remember that the thermo-electric battery was the thermometer used in the entire course of brilliant experiments described in that volume.

Save for purposes of demonstration, the thermo-electric pile has been of little practical value. It has played no part in industrial operations, though attempts thus to utilize the curren have not been wanting. Farmer exhibited two models at the French Exposition of 1867, of ingenious construction, but they lost their power rapidly, and the bars, being excessively fragile, broke in cooling. In 1869, Becquèrel presented to the French Academy a battery constructed by MM. Clamond and Mure, of couples of galena and iron plates, in which, however, the current gradually weakened because of the augmentation in the resistance of the apparatus. As this invention formed the basis on which the remarkable device which we are about to describe is founded, it may be well to notice more carefully its defects and the means taken to cure them. The difficulties lay, first, in the oxidation of the contact of the polar plates with the crystalized bar under the influence of heat. Second, in the splitting of the bar of galena and its separation into different portions in planes perpendicular to its length. The result of M. Clamond's efforts to overcome that was the battery represented in our engraving—in perspective, Fig. 1, section, Fig. 2, and plan, Fig. 3. In order to get rid of the first trouble, he altered the mode of attachment of the iron plate, bending it back on itself irregularly so as to present many re-entering angles. These are made to envelope the bar so that as the latter heated it expanded more than the surrounding metal, and so forced itself all the tighter into the angles. This disposition will be understood from Fig. 3, in which B B are the bars, and L L the plates. The second difficulty offered greater obstacles, as it had been found that, when a thermo-electric body, either metal or metallic sulphide, is cast in a cold cubical mold, splitting ensues, parallel to the faces of the cube. These divisions become visible after heating, and are supposed to be due to the extreme fragility of the body and its crystalization against the surfaces of the mold. In order to prevent the splitting, M. Clamond heated his molds to temperatures nearly equal to the fusing point of the thermo-electric substance, and employed couples made of an alloy of zinc and antimony (in lieu of galena) and his iron plate as before. This alloy he adopted on account of its good electrical conductivity, and because the temperature of its melting point rendered his method of casting easier. Iron he used in preference to copper or argentar, because it resists the effects of the alloy more effectually.

Fig. 1.

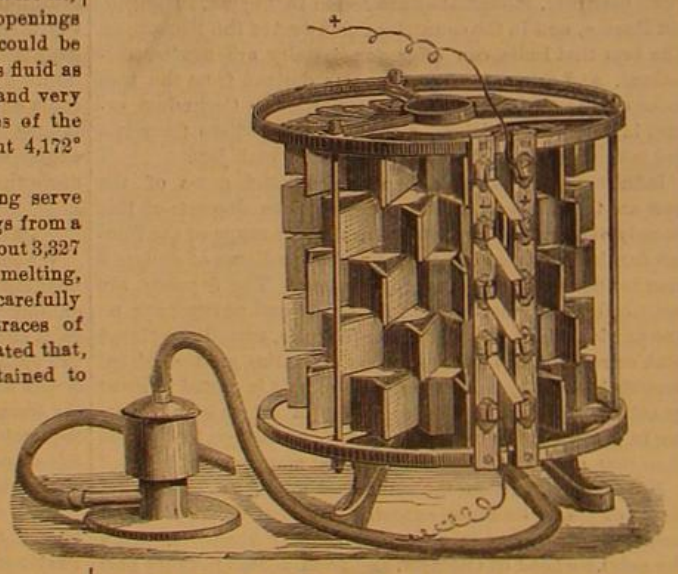
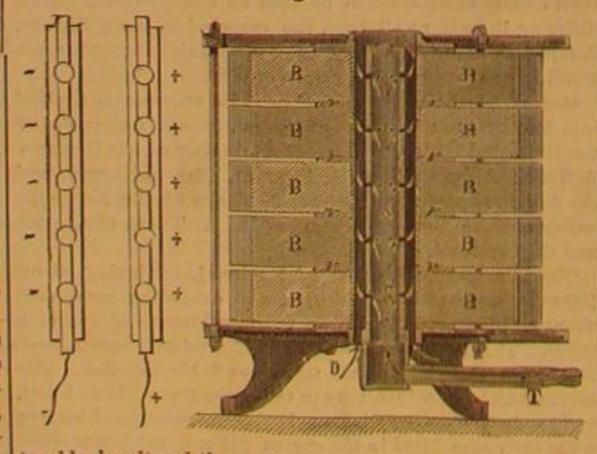


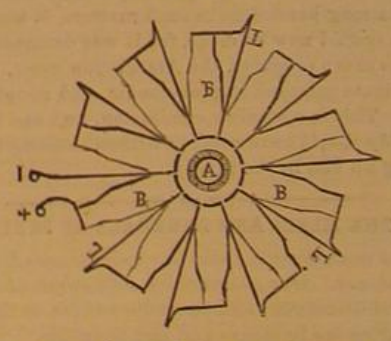
Fig. 2.



The bars of alloy, as shown in our engravings, for which we are indebted to *La Nature*, are assembled in crowns and coupled for tension. These crowns are each composed of ten bars, B, Fig. 2, superposed and separated by collars of asbestos. The apparatus forms a cylinder, the interior of which is lined with asbestos and heated by means of a pipe, A, of refracting clay, pierced with holes. The gas entering at T escapes through these orifices and mingling with air, which comes in at D, burns in the annular space between the tube and bars. The extremities of each crown are held in clamps of copper fixed in two standards, shown separately at the left of Fig. 2, and at the front of the apparatus in Fig. 1. The crowns may be coupled for tension or for surface, the latter for each crown being 7 square feet, or 35 square feet for the entire battery.

The Gerond regulator is used to render the flow of gas uniform; and thus arranged, the battery works for months without requiring the slightest attention. The apparatus exhibited before the French Academy of Sciences uses one cent's worth of gas per hour to deposit 308 grains of copper in similar time. So that for fifty cents 2·2 pounds of the metal may be deposited. The quantity of electricity augments in proportion to the size of the bars, which are made of different dimensions, varying from half an ounce to nine pounds. Experiment also shows that, with an equal number of couples, the weights of copper deposited are proportional to the weight of the couples.

Fig. 3.



The battery, we understand, is now being used in the printing office of the Bank of France, and in the large photo-engraving establishment of Goupil, at Asnières, giving remarkably successful results.

Epsom Salts and Sulphurous Acid in Dyeing.

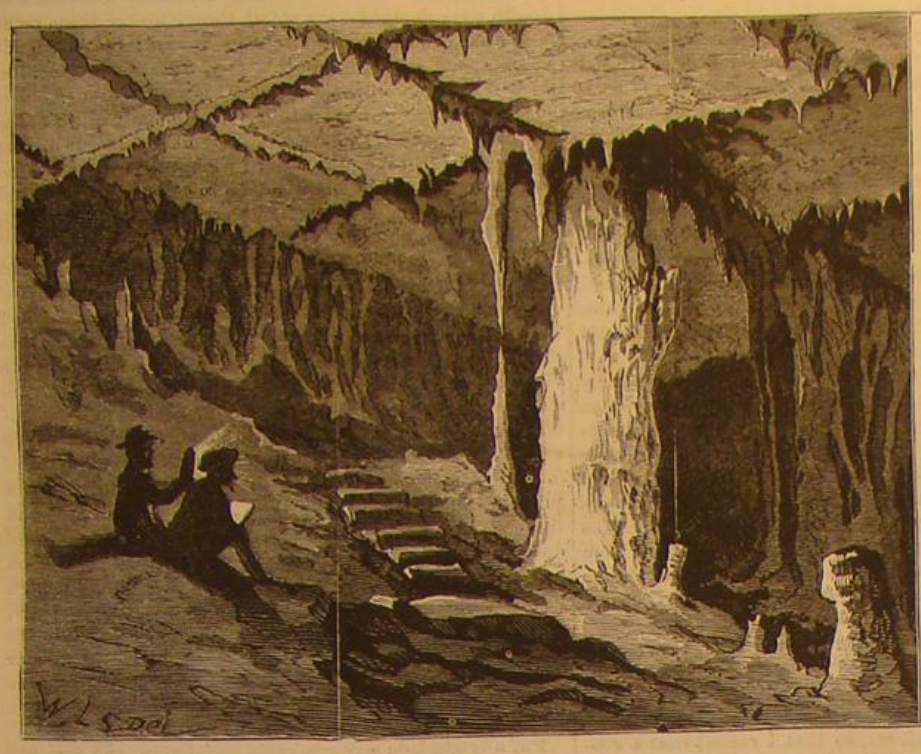
It has been long remarked that woolen goods dyed with aniline colors, and treated with Epsom salts, will stand the action of soap and soda, and the dressing process generally, better than when not so treated, or than when treated with any other substance.

Dr. Reimann advises the use of Epsom salt on yarns to be dyed violet. By the action of soda, the magnesian salt is decomposed, with separation of insoluble magnesian compounds, which exert no action upon the coloring matter; any alteration in color by the alkali is thus prevented.

All woolen dyers are agreed that, in dyeing with methyl- and dahlia-violet, the use of sulphurous acid is very advantageous. The colors are thus obtained of a brighter, clearer tint.

It may be that, a partial reduction of the methyl-rosaniline to leucaniline having taken place, oxidation then effects the transformation of the latter into the former.—*Dingler.*

A NEW life-saving invention has recently appeared in Paris in the shape of a durable garment which covers the entire body. It is made of rubber, and is provided with a flexible tube which has a mouthpiece. By blowing into the latter, the person in danger inflates the garment, which buoys him up when in the water,



PANELED HALL, NEAR THE ENTRANCE.



SINGULAR FORMATIONS.



No. 1.—JEFFERSON'S TOBACCO BARN.



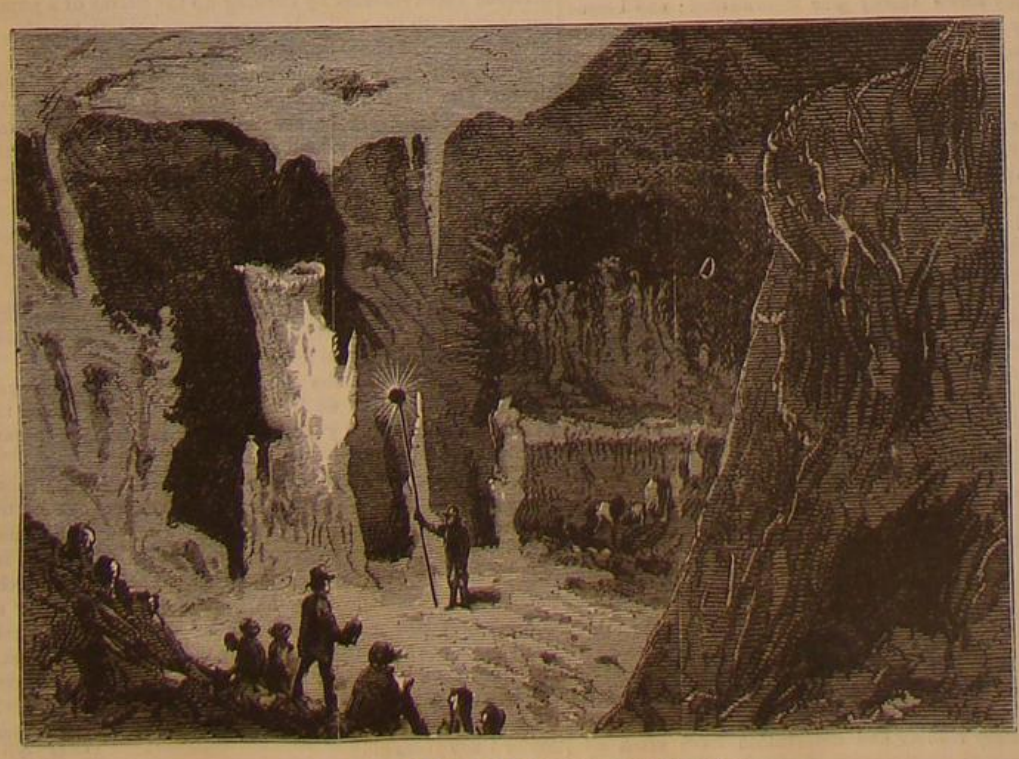
No. 2.—ELF'S BATH.



HALL WITH THE WHITE PILLAR.



ARCHED PASSAGE BETWEEN THE TWO HALLS.



LARGE HALL, NEAR THE END OF THE CAVE.



THE HANGING MAN.



POMPEY'S STATUE.

VIEWS IN FOUNTAIN CAVE, VIRGINIA.

FOUNTAIN CAVE, VIRGINIA.

Though of much less extent than the Mammoth, Weyers, or other great caves which rank among the chief natural curiosities of the United States, Fountain Cave, in Augusta county, West Virginia, is remarkable for many singular as well as beautiful formations, interesting alike to the student of geology and the tourist for pleasure. We give on another page a series of illustrations, engraved from sketches made of the most prominent features, from which a most excellent idea may be gained regarding the curious freaks of Nature within the recesses of the cavern. Many of the most delicate and fascinating attractions are not of a character to be adequately represented, so that the sparkle of the incrustations and the myriad and ever changing forms of the stalactites and stalagmites must necessarily be left to be supplied by the imagination of the reader.

One of the most striking portions of the interior is "Panel Hall," peculiar both for its size as well as for the odd markings on its walls and roof, caused by the drippings from the rock. "Jefferson's Tobacco Barn" derives its name from a singular row of stalactites which resemble tobacco hung across a pole to dry. The "Tannery" has formations, the size of the largest side of leather, depending from the roof. "The Hanging Man" is a stalactite nearly seven feet long and located some ten feet above the floor, which, as will be seen from the illustration, looks very much like a suspended human body. "Pompey's Statue," a beautiful white formation about two feet in hight, on a pedestal twelve feet high, bears a striking resemblance, when the light is held in the proper position, to a figure in helmet and antique dress. The group of stalactites and stalagmites given in one of the smaller cuts, is about thirty feet in total hight and very beautifully marked. "The Elf's Bath" is a picturesque series of basins filled with pure sparkling water, in which it is easy to imagine that the elves or the gnomes which we read of in fairy lore may choose to disport.

Although the existence of the cave had been suspected for several years, it was not discovered until four years ago. It is located seventeen miles northeast of Staunton, on the Chesapeake and Ohio Railroad. Access to its interior has been made quite easy, and explorations may be conducted to a long distance from the mouth.

Correspondence.

The Transmission of Sound.

To the Editor of the Scientific American:

On page 177 of your journal is an account of the investigations of Professor Tyndall respecting the transmission of sound, and the varying distances at which the same sound can be heard. I have a theory that differs from his, which at the same time, I think, accounts for all the phenomena therein stated.

It is known that atmospheric air can hold a considerable quantity of watery vapor in suspension; but the amount depends directly on the temperature. For example, at a temperature of 30°, air will contain 2·2 grains of water per cubic foot without being saturated. At a temperature of 90° it will require 14·5 grains per cubic foot to bring it to the point of saturation, or dew point. It has been observed that, when the atmosphere is saturated with vapor and about to deposit dew, sounds can be heard at a great distance; whereas when it is devoid of moisture or far removed from the dew point, sounds can be heard but short distances; in other words, the ability of the atmosphere to transmit sounds is directly as its proximity to the point of saturation. The following case will illustrate: On a certain occasion the puffing or exhaust steam of a locomotive, in starting a train, was heard distinctly six miles. This occurred in the winter season and on a day when there was neither wind nor sun, and I am certain the atmosphere was near the point of saturation, for it was a dark, hazy morning, just before a misty rain storm. A few days subsequently, the same sound, over the same course, was entirely inaudible at a distance of three quarters of a mile. This, too, was on a cold, cloudy, still day, and the atmosphere must have been devoid of moisture, as it was a day in which electrical action could be readily excited by stroking the hair with a comb, or a garment with the hand; and it is well known that, in order to excite electrical action, there must be an entire absence of moisture.

This readily accounts for the phenomena of Professor Tyndall. He states that, on a hazy day, his fog horn could be heard twelve miles dead to windward, whereas on a clear, warm, sunshiny day, neither horn nor gun could be heard two miles. On the former day, it is evident the atmosphere was near the point of saturation; but on the latter day, the sun was shining hot. This would raise the temperature of the air and remove it from the point of saturation, as it requires a greater amount of water to saturate it at the high temperature. "But," he adds, "a cloud obscuring the sun, the sound began to be audible and became louder and louder till sundown, when it had increased fortyfold." It is evident that as the sun became obscured, the atmosphere began to cool, and therefore came nearer the dew point, and in that proportion the sound became more audible.

This theory can be verified by many ordinary observations. For example, it is known that sounds can be heard more readily at night than in the day time; and it is likewise known that the atmosphere is then nearer the dew point. It is also regarded by many that the hearing of sounds a great distance, as the running of trains, is a sign of an approaching storm, and this is only an indication that the atmosphere is becoming saturated with moisture. Violinists are also aware that, when electrical action can be excited, as by stroking the fur of animals, their instruments lack power; and that is only an indication that the atmosphere is devoid of moisture.

Respecting the theory of Professor Osborne Reynolds that sound is refracted or bent upward under certain conditions, it does not follow that such is the case, because sound is heard more distinctly from an elevated location than from one near the earth. If the observer be in an elevated place, besides the amount of sound passing directly to him, the earth would reflect a large additional volume. That could not be the case if the observer were near the earth, as the reflected sound would be intercepted by objects near the earth. Besides, if sound is refracted similarly to light, by certain varying temperatures, etc., why should light be refracted or bent downward, enabling us to see the sun before it has arisen and sound be bent upward, as it would seem that similar causes should produce similar effects in both cases?

Professor Osborne Reynolds seems to have pretty clearly demonstrated that sounds can be more readily heard from an elevation than near the ground, and infers that the sound is bent upwards. But suppose, in the place of the sounding body, a loaded shell be placed and exploded. An observer in an elevated position would be much more likely to receive injury than one on the ground, not because the course of the fragments of the shell is bent upward as they radiate from the point of explosion, but because the force of the explosion seems to be directed more upward than horizontally, on account of the reactionary force of the earth.

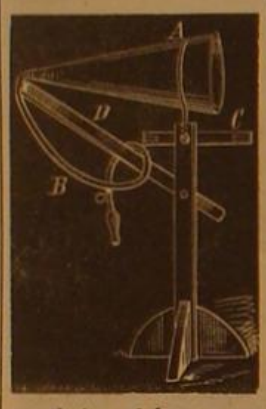
Bridgeport, Conn. F. G. FOWLER.

A Simple Ear Trumpet.

To the Editor of the Scientific American:

I am afflicted with deafness, so that I cannot hear a conversation carried on in an ordinary tone of voice. In order to assist my hearing, I have constructed an apparatus which enables ordinarily deaf persons to hear a lecture or a sermon, or to enjoy a theatrical performance.

The horn is made of paper (two thicknesses) with some ornamental paper covering the exterior and interior. It is shaped over a confectioner's "pyramid mold," of the hight of 18 or 20 inches, and width, at the large end, of about 15 or 16 inches.



At A, it is surrounded by a strong brass wire, of which one end is inserted into the upper end of the stand, which has a hole bored in it sufficiently large for the wire to act like a pivot. A flexible tube, B, of any desirable size, is attached to the small end of the horn, and ends in a mouthpiece of horn or gutta percha, connected with the ear. C is a cross piece with holes bored into each end which enables one, by turning, to elevate the horn, and D acts as a supporter and also as an elevator if desirable. The rest explains itself. As this simple device is probably not patentable, I give it to those unfortunates who are similarly afflicted.

Sacramento, Cal. JOHN EITEL.

The Spiral Theory of Physical Phenomena.

To the Editor of the Scientific American:

I once saw a juggler take a long cord, fastened at its further end a few feet above the floor, and by quick movements of the other end in his hand produce the appearance of a revolving spiral, having a pitch and diameter which varied at the will of the mover. I then thought and said: That suggests an explanation of the wave theory of sound and light.

Just now, in looking over Chambers' *Encyclopædia*, I came upon the article on sound, and was startled by the appearance of a diagram of the above described movement in explanation of the wave theory, but my eager search for an intimation of my screw theory was unrewarded; and I came home to copy the above description, and the following outline from a manuscript written a few months ago (although I have a sketch of the theory written in February, 1872); and I now present the idea for consideration and, as I confidently anticipate, verification.

Briefly, my suppositions are (1) that the ultimate ether molecules have a constant rotation upon their axes, with polarity; (2) that the intermolecular spaces contain the elastic magnetic fluid; (3) that any disturbance of their equilibrium occasions rather an accelerated axial rotation of the molecules with decrease of temperature, or a retarded rotation with increase of temperature; (4) that any change of initial molecular velocities is accompanied by a progressive rotation at right angles to the plane of the disturbing impulse; (5) that the actual progression is limited to the vicinity of the impulse, while the apparent progression continues until obstructed; (6) that the velocity of the helical revolutions, or progressions, is determined by the impulse, and continues in the same time for the same impulse; (7) that all observed phenomena are manifestations of personal presence and character in effecting the action and interaction of the fluid and the molecules, with and upon the cosmic dust. If hydrogen gas is a metal in particles, there can hardly be any particular objection to the word "dust" as generally descriptive of cosmic substances, in distinction from the ether and the fluid.

The formulated suppositions are, as you will observe, partly adopted and partly speculative, the theory arising in the described manner several years ago; from that time to this, my desultory reading and observation have often appeared strikingly to confirm my conjecture; and just now, as I read your articles of June 13 on "The New Theory of Quantivalence," and "Refraction of Sound," I for the hundredth time thought "my spiral theory makes these points clear; strange that some one does not see it!" When Mr. Proctor was lecturing in this city, I hastily put together these formula to bring them under his notice through one of our daily papers, but the editor was suddenly called out of town that morning, and the article slumbered in his drawer several days past the time when I wished it to appear. I reproduce it mainly now, and wish you to notice the coincidence between parts of it and the closing paragraph of your article on quantivalence.

In view of my inexperience as an experimenter, and want of knowledge as an investigator, I may appear presumptuous in my suppositions, but I fall back upon my inherited Yankee right to guess, even to the degree of thinking that physical facts generally will be found in accordance with the formula; while I venture particularly to suggest, for instance, that the string of a musical instrument does not vibrate, but does gyrate, and that the sound is due the given velocity of rotating helices of proper sized ether molecules in appropriate polar relations to the dust, suspended at a suitable temperature in the magnetic fluid. Reed, pipe, and vocal sounds are likewise gyratory, and are perhaps produced as water is twisted by angle of exit and friction on leaving the hydrant faucet; for example, in a flute, the high tones result from entrance at a proper angle, high velocity, small friction, and exit at a fine pitch of spiral, while the lower tones have different angles, lower velocities, greater friction and exit at a coarser pitch of screw; the trombone may be similarly explained, the "mouthing" consisting in giving the right twist and size to the rope of air.

Put a bright iron screw in rapid revolution, and you will have a striking illustration of the apparent movement of light in waves and emissions, light thus arising from a change in the velocities and other enumerated conditions of the molecules, and of the fluid and dust; and the phenomena of reflection, refraction, and polarization of light will soon find clear explanations on the spiral theory.

The solar spectrum with its Fraunhofer lines may thus be said to be an untwisting of the ray thread to show its colored strands, which also, being untwisted, throw out the entangled dust which casts its shadow lines across the field.

The electric current will also be found a helicoid, and the bare statement of this proposition is startling in its suggestion of many well known analogies which send in spiral thrills of quick succeeding sense, and the pleasing thought that now at last we have the clue long sought.

Whirlwinds and waterspouts need only to be mentioned to bring at once the thought of spirals, grand and awful, and waves may readily appear before the mind as formed by nearly horizontal screws, whose pitch, diameter, and speed decide if ripples, billows, or great water hills shall in procession move.

This given theory embraces the small and great, the general and particular, the seen and unseen; therefore it may be humbly anticipated that the displayed cross section of a cord of light would afford a clear illustration of all aerolites, asteroids, satellites, planets, suns, and stars, as viewed from the axis of the rotating helicoid Universe.

W. STORER HOW.

Foul Wells.

To the Editor of the Scientific American:

My well, though yielding in general very good water, will occasionally get foul both to taste and smell. I suppose all wells are liable to the same difficulty. Generally it results from some body, a potato or other vegetable, or (still worse) an animal substance, which has accidentally found its way into the water. But sometimes no cause is apparent. I use common wood charcoal, which I pound quite fine in a cloth bag and throw into the well—one or two quarts in quantity. But this, though efficient, and finally settling to the bottom, requires one or two days for the process, and will sometimes occasion inconvenience by choking up the valves of a pump connected with the well. If any of your readers practise a better method, I should be grateful for the information.

Being obliged to continue using the water in spite of its ill smell and taste, it occurred to me to boil it for five minutes. This I did at evening, boiling a bucketful for drinking the next day and allowing it to cool over night. The result was very satisfactory. The water was delicious—perfectly sweet and pleasant, even without ice.

Englewood, N. J. J. V. B.

The Growth of Timber.

To the Editor of the Scientific American:

I send you a small piece from my flagstaff, recently erected; before it was trimmed, its diameter was fourteen inches at the base, and its length sixty-six feet.

When you examine the closeness of its concentric rings 63 in three quarters of an inch, you will not be surprised to learn that it was 230 years growing, that is, that it was living in the time of Oliver Cromwell.

When we consider that the straight and tall growth of the pine depends on its being so crowded by other trees as to have all its foliage grow at the top, while the lower branches die for want of light and air, and that the ground room is insufficient to support roots enough for the growth of much top, we may conclude that the growth of the wood for a tall, straight tree must necessarily be very slow, and that many years are required to produce one of much thickness. If, then, such a small tree be two hundred and thirty years old, what must be the age of some used for large masts? Cannot some of your correspondents tell of some pine trees 500 or 1,000 years old? H. M. S.

[The concentric circles in the specimen are wonderfully regular and close.—EDS.]

SCIENTIFIC AND PRACTICAL INFORMATION.

HOW TO KILL GRASSHOPPERS.

Reports of Western railway trains stopped by grasshoppers are apt to be taken by Eastern people as samples of Western humor rather than as statements of actual fact. Similar incredulity was manifested on the other side of the Atlantic, a few days ago, when a telegram came from Algiers telling of the delay of a train from Oran, six hours, for the same cause, namely, the accumulation of grasshoppers on the rails. But it was no joke. The grasshoppers are as great a pest there as they are in some parts of the Far West, and just now they threaten the utter destruction of the growing crops over considerable areas.

Many plans have been tried for their suppression, the most successful, according to a circular of instruction lately issued by General Chanzy to the generals of division and prefects of Algeria, being that employed in Cyprus. By this plan the attack is made neither on the eggs nor on the fully developed insect, as practised elsewhere, but during the intermediate or wingless period of their development, a stage beginning about a month after the eggs are hatched, and lasting three or four weeks, during which the "crickets" wander about in compact masses and are easily taken in V-shaped traps open to the line of march. The sides of the traps are made with strips of silk a hundred yards long and two or three feet wide firmly attached to poles set in the ground. The bottom edges of these walls of silk are banked with earth so that the crickets cannot crawl under them, and the upper edges are waxed or bordered with oiled silk, which prevents their climbing over. As they have no wings to escape with, they are forced to mass themselves at the apex of the system (as it is called) where they tumble into a trench edged with plates of zinc, which offers no foothold, so that they are effectually trapped. When the trench is full the insects are covered with earth, and the system is moved on to continue the work of destruction elsewhere Upwards of 7,000 cubic yards of grasshoppers were thus destroyed in Cyprus in a single season. With the conversion of our Western plains into farm lands, it is becoming more and more necessary to combat the grasshopper plague on a grand scale. Our farmers will do well to profit by the experience of the East.

VANILLA FROM PINE TREES.

There has recently been submitted to the French Academy some small crystals which are the pure aromatic principle of vanilla. These, it is remarkable to note, were extracted from conifers. The cambrium of the latter contains a crystalized glucoside, coniferine, which MM. Tiemann and Haarmann consider represented by the formula $C^{16}H^{88}O^{18}+2H^2O$. Submitted to the action of emulsion, the coniferine separates into glucose and a component crystalizing in fine prisms which melt at 163·4° Fab. The latter material is readily soluble in ether, less soluble in alcohol, and insoluble, or nearly so, in water. It contains C^{10} H^{18} O^3. Under the influence of oxidizing agents, the product of the fermentation undergoes a remarkable change. In warming it with a mixture of potassic bichromate and sulphuric acid, it disengages first ethylic aldehyde, and then an acid substance soluble in water, which may be separated by agitating with ether. By evaporating the latter, star-shaped crystals are obtained which melt at 177·8° Fah., and which are identical with the aromatic principle of vanilla. The formula is C^8 H^8 O^3, which corresponds exactly with that attributed to the aromatic extract of vanilla.

NOVEL IMPROVEMENTS IN STEAM BOILERS.

Mr. Charles H. Haswell, a well known engineer of this city, has recently patented a new steam boiler which presents many valuable points of advantage, and which appears to be well worthy of the examination of steam users generally.

It is hardly possible to enter into the details of the invention without the aid of illustrations. In the improved boiler, the principal features consist in inclined tubes, which extend transversely across the boiler and slope from the central flue down to the two side flues. By this arrangement, a transverse area required by the area of grate surface, the area of heating surface, and the volume of the steam chamber above can all be obtained without prejudice to the hight of the furnace below, and without involving an impracticable length of boiler. The tubes can also be readily removed and replaced, and the necessary work can be prosecuted within the boiler. A vertical diaphragm is introduced in the return flue, which serves to direct the products of combustion so as to admit of the base of the smoke pipe being located at any portion of the length of the boiler, a matter of great convenience in the construction of sailing steamers. The smoke connections are arched, and consequently afford the required strength without bracing.

Mr. Haswell has also patented another invention relating to steam boilers having a steam chimney—notably marine boilers—which has for its object to strengthen the boiler and to brace the chimney. It consists in retaining the boiler shell between the outer shell and the inner shell of the steam jacket, and jointing it to the latter instead of cutting it out as heretofore. The reclaimed portion is perforated, so as to allow a free circulation of the steam between the boiler proper and the steam chimney. Mr. Haswell is of opinion that the usual removal of this part of the boiler is a cause of weakness, which is obviated by his invention; while, at the same time, he secures increased strength to the chimney and adjacent portions.

Both devices seem to us practical and useful, and there is little doubt but that they will meet in practice with that ready appreciation from steam engineers which is so confidently expressed by them on an inspection of the inventor's models.

Natural Gas for Puddling.

A novel feature in iron working has been introduced recently by Messrs. Rogers & Bruchfield, of the Siberian Iron Works, Pittsburgh, which consists in the application of gas from a gas well as fuel. Their mill is situated at Leechburg, Armstrong county, and is devoted to the manufacture of sheet iron. The well is situated on the opposite side of the Kiskiminetas River from the works, and is 1,200 feet deep. The gas is let from the well through steam pipes into a horizontal cylinder, with safety valve near by, and thence across the river to the mill. Here it is fed under the boilers through a horizontal pipe, running longitudinally their entire length, pierced with small holes. A very perfect combustion is secured in this way. It is fed in the puddling and heating furnaces in like manner, through a pipe in the rear of the fire bridge, but here the combustion is not so perfect, and considerable black smoke is seen issuing from the stacks. An ample supply of gas is furnished by the well, and at a very regular pressure, which has not been measured, but is thought to be over 30 lbs. The volume of gas used is easily controlled by cocks, and can be adjusted for various purposes with the utmost nicety. "Mr. Rogers estimates that the saving to them in fuel amounts to $700 per week and states that they obtain 33⅓ per cent more yield from the metal than they did when using coal—at the same time producing an article of very superior quality, on account of the purity of the gas. The firm is now manufacturing an article of tin plate, which they claim to be equal, if not superior, to any manufactured abroad, which they could not do when using coal. The well was bored for oil originally, and had been in existence some four years when the idea was conceived to utilize its gas in this way, four months ago.

Our readers may remember that on page 370 of our last volume we gave an account of the gas wells of New York State, as presented by Professor Wurtz, who shows that there are three belts of gas wells running across this State. In view of the successful application of natural gas to puddling in Pennsylvania, he suggests a trial boring here. "Think," he says, "what a noble thing may be before us: should we find ourselves able to tap and draw from stores of gas pent up under the Catskill range, conduct this gas to the brink of tide water along the Hudson, and operate therewith upon the pure limonites of Putnam, Dutchess and Columbia, and the magnetities of Orange and Rockland, Champlain and the Adirondacks. "Making two blades of grass grow where one grew before" would be a feeble figure of speech to apply."

Hygienic Treatment of the Aged.

Mr. Habershon, in a clinical lecture at Guy's Hospital, London, referring to the case of an old man, remarked: "The man died simply from the shock produced by coming out into the cold and fog, which, though only an inconvenience to us, was sufficient to lead to a fatal result on one whose circulation had become enfeebled, and whose vital force had so nearly lost its power. I am reminded, by this case, of an instance of longevity communicated to me by a gentleman the other day. His mother, who had died at the age of one hundred and two, during the winter months 'had refused to get up, saying that she was only warm in bed.' I have no doubt that it was owing to this uniform, warm temperature that she lived so long; and I mention the instance as a recommendation for you, when you have to prescribe for old people, to advise that they be kept warm. You should also look carefully after their nourishment. Old people cannot eat large meals; therefore they must take them more frequently. Many old people will wake up about three or four o'clock in the morning. It is a good plan that they should have some nourishment then; otherwise the interval between the night and morning meals is too long for their declining strength. It is by care in such minutiæ that we may prolong the life of the aged."

The Magnetization of Steel.

If a recently tempered steel needle be introduced into a magnetizing bobbin connected with a battery of constant current, battery and bobbin comprising the circuit, it acquires a total determined magnetism at the end of a period which appears not to exceed that of its introduction. On slowly withdrawing the needle, it is found to retain residual magnetism which, together with the total magnetism, increases with each repeated introduction until a limit is reached. The needle may be magnetized in the bobbin by three other methods:

1. *Establishment.*—Introduce the needle; establish the current; slowly withdraw the needle.
2. *Interruption.*—With a closed circuit introduce the needle slowly; break the current and withdraw the needle.
3. *Instantaneous Charge.*—Introduce the needle; establish and break the current; withdraw the needle.

Repetitions of any of these three processes (all things being equal) insure an augmentation of the needle's magnetic moment.

THE LARGEST LOCOMOTIVE IN THE WORLD.—A correspondent states that the largest locomotive in the world is the "Pennsylvania," on the Philadelphia and Reading Railroad. The principal dimensions of this engine are as follows: Diameter of cylinders, 20 inches; length of stroke, 26 inches; number of driving wheels, 12; diameter of drivers, 4 feet; and the weight of the engine alone is 60 tuns.

CEMENT FOR CAUSTIC LYE TANKS.—The tanks may be formed of plates of heavy spar, the joints being cemented together by a mixture of 1 part of finely divided caoutchouc, dissolved in 2 parts of turpentine oil, with 4 parts of powdered heavy spar added.

Qualities Most Estimable in the Rose.

A rose, taking all things into consideration, is, perhaps, the most splendid of flowers. Throwing aside the national affection for our emblem, the rose is appreciated for itself. It has qualities peculiar to itself. It is beautiful, from the moment when the color peeps from its green covering, until its flower is complete—handsome in all its stages. Its perfume is unequaled; and whether it be a single bud or bloom in the hand, a bush in the border, a tree on the lawn, or climbing the pillar, or winding around the archway, or covering the front of a house, it is equally admired.

In estimating the various qualities which give value to the rose, we are almost inclined to place that of continual blooming first, even before perfume, although without this a rose loses its great charm; but continuous flowering is of so much importance, the prolonging of the beauties of the garden is so essential, that we think it of more consequence than any other feature. See a garden, liberally planted with summer roses, in a blaze of beauty in June or July, and it is a second paradise; but what is it before or after that period? The rose trees bereft of adornment are eyesores; they are, in fact, in the way until they bloom again. But see the same or another garden, judiciously supplied with continuous blooming roses of the nature of the common China, and we have them in flower the last of all our favorites. A frost that will kill down dahlias to the ground will only injure the flowers of the rose; the buds are scarcely damaged, and it is not an uncommon thing to see continuous blooming roses flowering in a mild autumn up to Christmas; and be it remembered that we have now hundreds of beautiful varieties possessing this valuable quality.

We now come to a quality which is of more importance than it at first seems—namely, thickness of petal. The advantages of this are, first, that, whatever be the color, it is more dense than it can be in a thin petal; but apart from the superiority of color, thick petals are more lasting than thin ones, and sun and winds have less effect upon them. A rose with thick petals will remain perfect for days, while thin ones are burnt or shrivelled in a few hours; and we hardly know of a more disagreeable fault than speedy decay. To see the ground strewed with petals in a few hours, and the plants disfigured by the remains of decayed flowers, is very far from pleasant, and this is inevitably the case with thinly petaled roses.

Upon the whole, the qualities of a good rose are—continuous blooming; thick, smooth-edged petals; flowers round, forming half or two thirds of a ball, very double and full-faced, very symmetrical and imbricated; wood short-jointed; color dense, that is, whatever its shade be, the color decided; and, if striped or blotched, the stripes or blotches well defined.—*The Farmer.*

Training of Boat Rowers.

At some of the colleges the training of the racing crews is about as follows:

In the morning an easy walk of an hour's length, at noon a quicker walk of half a hour, and in the afternoon a pull of seven or eight miles, after which comes a bath and a good rubbing down. The system of diet is rather one of proscription than prescription. Certain articles well known to be unwholesome are proscribed. Other things may be eaten. Pastry, tobacco, coffee, pork, and all stimulants are ruled out. The crew pulled a plain forward and back stroke, with no special pretension to style or scientific points, making generally 32 strokes to the minute.

Car Couplers, Draw Bars, and Buffers.

It appears from the discussions of the Car Builders' Association that the members are not quite decided as to which of the various devices for couplers, draw bars, and buffers they ought to recommend for general adoption. The subject is regarded as one of great importance, and is continued for another year.

RECENTLY PLANTED TREES AND SHRUBS IN HOT WEATHER.—This is a trying time for young trees. Those that were set this spring, and have appeared to be doing well thus far, may succumb to the long continued drought and heat of midsummer. It is safest to mulch all young trees; but where this has not been done, all those that show signs of suffering should be attended to at once. A timely mulching may save the tree. It makes but little difference what material is used so that the soil around the tree is prevented from losing its moisture by evaporation. Stones, if most convenient, will answer as well as anything. If the trunk is fully exposed to the sun, it should be protected from intense heat. A couple of boards, tacked together like a trough and set up against the trunk, will furnish the required shade; or the trunk may be bound with a hay rope, or be loosely strawed up as for winter protection.

A CORRESPONDENT, J. H. says: "I consider the SCIENTIFIC AMERICAN to be an actual necessity in my shop, and I do not intend ever to be without it. I have gained more information from it than from all other papers and books combined. I have been a constant reader of it for nearly thirty years, and you may put me down for a life subscription."

CHARLES MERRILL & SONS have just completed, for the Lallance and Grosjean Manufacturing Company, of this city, the well known manufacturers of stamped tin ware (known as French tin ware), the largest drop press, we believe, yet made, it having a hammer and die 36 inches in diameter, weighing 2,000 pounds, and falling 3 feet 6 inches. The base of the drop weighs 6 tuns, and its elevation is about 12 feet.

IMPROVED HAY AND COTTON PRESS.

The invention represented in the annexed engraving is a novel and simple form of hand hay or cotton press, designed to replace the more cumbrous machines usually actuated by horse power. The present device, we are informed, can, if necessary, be operated by one man, and two men can, it is stated, by its aid, bale from six to eight tuns of hay per day.

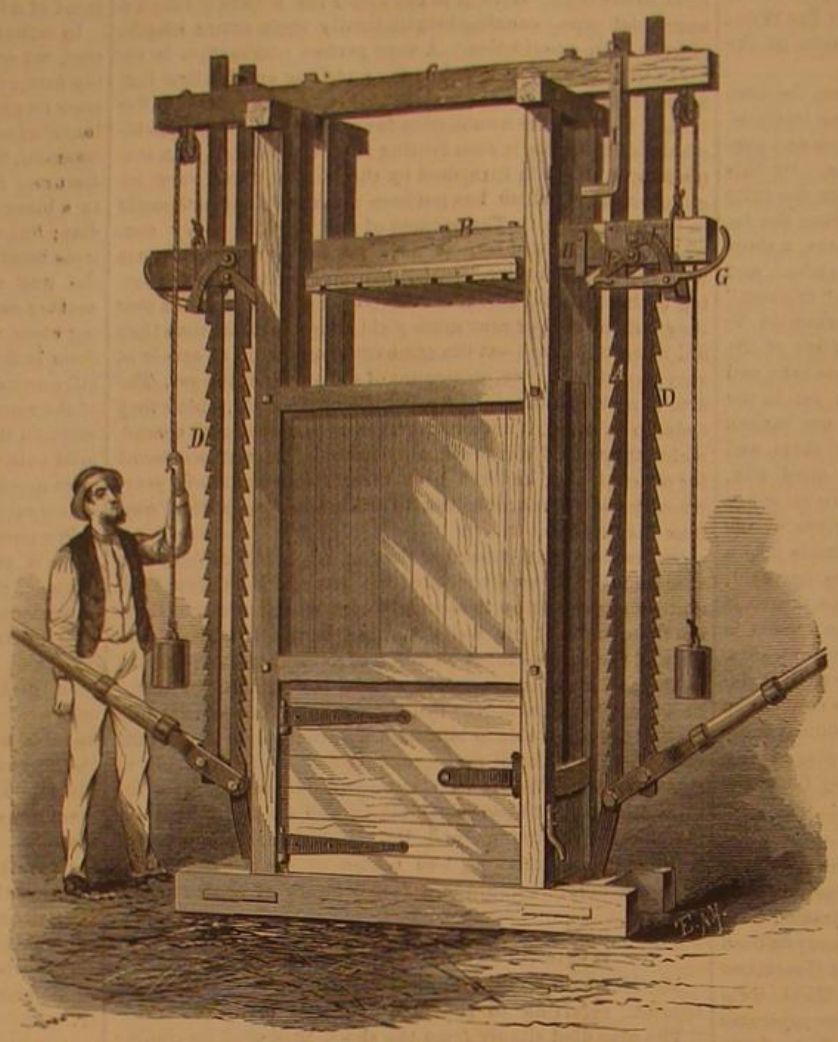
A are toothed bars secured to the lower cross piece of the frame, which pass up through slots in the follower beam, B, and are attached to the upper cross beam, C. At D are other bars notched outwardly, also passing through a slot in beam, B, and attached to beam, C. To their lower ends are pivoted the hand levers, as shown, the inner extremities of which work upon the bars, A, so that by means of said levers the bars, B, may be moved up and down.

Pivoted to the ends of the follower beam, B, are stirrups, E and F. E passes around the bar, A, so as to engage in its teeth, and thus hold the follower against the back pressure of the material being baled. The other stirrup, F, passes around the movable bar, D, so that, as the latter is raised by the lever, it will slide through the stirrup; but as the bar is drawn down, its teeth will catch in the stirrup, and thus carry the follower down with it, so compressing the material. The teeth of bars, A and D, are made larger at the upper end, and gradually become smaller toward the lower end of the bars, so that the press is worked with the greatest advantage of leverage where the heaviest resistance is encountered.

To the follower beam are connected ropes which, passing over guide pulleys, carry weights which balance the follower at any desired point. G is a short lever which is pivoted to one of the stirrups. Its inner end is so formed as to strike against the opposite stirrup, E, raising the latter away from the teeth of bar, A. The lower part of stirrup, E, then strikes a stop, H, attached to the follower beam, and is arrested, causing the lever, G, to raise the stirrup, F, from the teeth of bar, D, in which position lever, stirrup, and stop lock themselves, so that the follower may be readily elevated.

As the follower rises, a pin on lever, G, strikes a stop, I, on the framework of the press, which disengages the lever and allows the stirrups to drop, ready to take a new hold of the teeth on the bars when the hand levers are again operated.

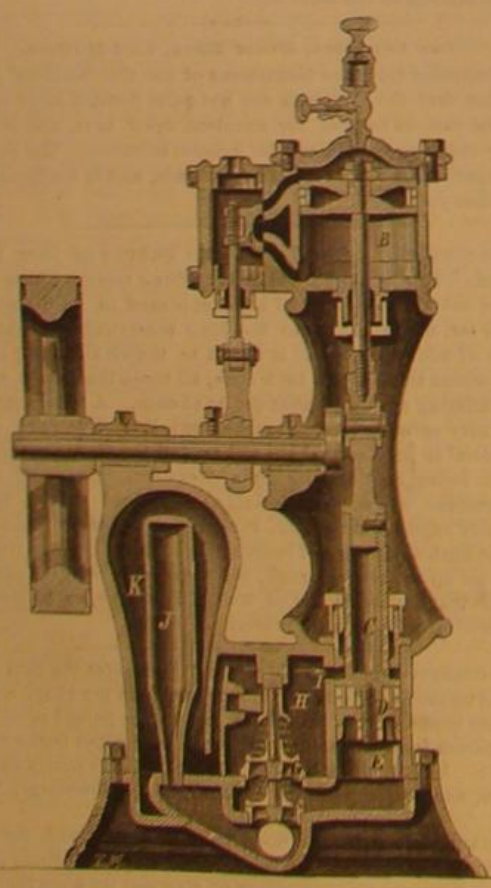
Patented through the Scientific American Patent Agency, April 21, 1874, by Mr. M. Mickelson. For further particulars address the owner of the patent, Mr. O. A. Davis, Ashland, Jackson county, Oregon.



DAVIS' HAY AND COTTON PRESS.

AN IMPROVEMENT IN STEAM PUMPS.

The Wright patent double acting bucket plunger steam pump, an engraving and description of which, not very long ago, appeared in our columns, has recently been made the subject of some valuable improvements which will doubtless tend to add considerably to the efficiency of the machine. The points of novelty consist in constructing the apparatus much heavier than ever before, a complete set of new patterns (nine sizes) having been made for the purpose. Bronze or gun metal has also been substituted for yellow brass, and steel has replaced iron, in portions where the latter metals were formerly employed. By simple modifications the water valves may be removed from the pump with great readiness. By the unscrewing of a single nut and the withdrawal of a key, which is inserted by hand, the discharge valve and seat may be taken out, thus giving access to the suction valves underneath. The key above mentioned is not driven in, but its end rests against the hand hole cover, so that it cannot work out of place.



The valves are simply circular pieces of metal, rubber, or leather, rising on a stem, which is fastened to the valve seats. Thus, should a valve fail, a circular piece of leather or rubber packing would answer temporarily until something better could be obtained.

Another improvement is in the lower end of the water plunger, which is now made separate from the remainder of that portion. Packing rings can be [illegible] inserted with but one cut in them, causing them, it is stated, to wear much longer and more evenly than when divided into several pieces, as was necessary in the old style of plunger. The inside ring also being made thinnest at the cut, greater elasticity is gained.

We give herewith a sectional view of the pump, from which the operation will be readily understood. A is the steam valve, and B the steam cylinder; C is the upper and small portion, and D the lower and large portion of the plunger connected thereto. E is the water cylinder, F the suction valve, and G the discharge valve. H is a hand hole for access to the water valves. I is a passage in the upper end of the water cylinder, through which water is taken in on the down and discharged on the up stroke. J is the vacuum, and K the air chamber.

The crank shafts, crank, and pin are in one continuous forging. The manufacturers, the Valley Machine Company, of Easthampton, Mass., (who may be addressed for further particulars), inform us that, out of seven hundred pumps of this description now in use, but one failure has taken place, and that could only be ascribed to neglect.

The agent for the company in New York is I. H. Shearman, 45 Cortlandt street, where the pump may be examined.

Microscopical.

At a recent meeting of the Royal Microscopical Society, Mr. Slack called attention to a slide exhibited under one of the Society's instruments as being a remarkable specimen of Herr Muller's technical skill in mounting. The slide has photographed upon it, in an extremely beautiful and perfect manner, eighty spaces, with the names of diatoms below each, and a diatom of corresponding species was mounted in every space. Mr. Slack said he had received specimens on silica solution in the milky condition described by Mr. Read at the last meeting, but was himself unable to detect any particles suspended in it, though some had been detected by Dr. Anthony. Mr. Charles Stewart described and figured on the board the peculiar position of the touch corpuscles in the skin of the hand, and he also exhibited and described a section of an ascidian, and explained the method of preparation.

The Hotchkiss Marine Log.

The self registering log, made by Captain Truman Hotchkiss, of Stratford, Conn., consists of a sort of clock which is placed on the taffrail or stern of the ship. A cord is then thrown overboard, to which is attached a small float that has feathers on its sides like a screw propeller. The feathers cause the float to revolve with a speed equal to the progress of the ship, and the float twists the cord which operates the pointers of the clock, and thereby shows at all times, day or night, the exact speed of the vessel in miles per hour, and also adds up and keeps account of the total distance traveled by the ship. We have received a letter from Captain Blakeman, commander of the large steamship Isaac Bell, plying between New York and Richmond, who states that this log has been for a considerable time in actual use on that steamer, with entire success. He informs us that during six passages between the Highlands of Neversink and Cape Charles, the log indicated substantially the same distance and corresponded in its showing with the government chart. Captain Blakeman considers it a valuable assistant and safe guard for navigation, and thinks that no ship, whether steamer or sailing vessel, ought to go to sea without the clock log.

A NOVEL COOKING STOVE.

The necessity of constantly maintaining a coal fire in a range or cooking stove during hot summer weather, in order to perform the necessary culinary operations, is an annoyance which many families would gladly be rid of. A device which avoids the trouble, saves fuel, and, at the same time, forms a convenient substitute for the range, is represented in the annexed engraving. It consists of an ingeniously contrived stove, which, in a short time, can be heated by a coal oil lamp sufficiently to fulfil all culinary or laundry requirements. When no longer needed, the flame can be extinguished, and the heat, which would otherwise render the kitchen and house uncomfortable, be done away with.

In Fig. 1 is shown the peculiar form of lamp, in which any kind of oil may be used, and which requires no chimney. There is a central air tube between the wicks, and air passages outside of the latter. A suitable air chamber protects the oil from the heat of flame. The arrangement is such that a current of air is brought in contact with the tip of each wick, thereby supplying oxygen and causing, it is claimed, a clear and smokeless flame. Means are provided for regulating the size of the latter, and consequently the heat, and also for governing the draft.

A sectional view of the stove will be found in Fig. 2. A is an oven, at side of which is a hot water tank. Heat is applied to the tubes at C. B is a steamer having a perforated bottom.

The inventor claims that the stove will roast 12¼ pounds of meat in two hours and a quarter, and will bake a loaf of bread, 3 pounds in weight, in one hour. It will heat water, steam vegetables, and roast meat at one and the same time. It is claimed to steam potatoes perfectly in half an hour; and, in brief, will do any cooking that can be accomplished with an ordinary coal stove. There is no smell from the lamp

Fig. 2

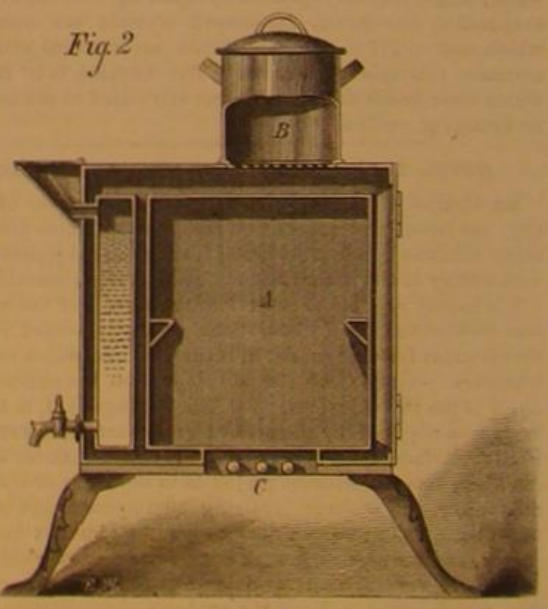
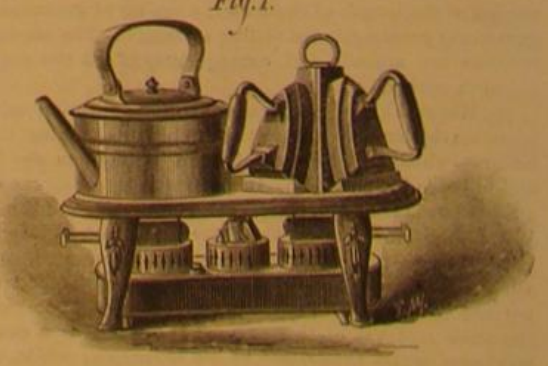


Fig. 1.



Patent pending through the Scientific American Patent Agency. For further particulars regarding sale of rights, etc., address the inventor, Mr. James Iredale, 101 Queen street, Toronto, Canada.

MORE CURIOUS VEGETATION.

We give below descriptions of four curious plants, in which, while proving novelties to the horticulturist, will be found many features of interest to the student of botany. With one exception none are indigenous to this continent, and, so far as we are aware, no specimens of the peculiar species represented are under cultivation in the eastern portion of the United States.

The plant represented in the first engraving—for which, with the other illustrations, we are indebted to the English *Garden*—is a cycad. It is not a quick grower, but very permanent in its character, as are all the other species of similar ferns. Other species in this group are also very effective when well grown, and none more so than the *c. horridus*, a stout dense-growing form, with spinose foliage, and one of the most striking of all foliage plants for conservatory decoration. *E. Caffer*—or, as it is popularly called, Hottentot bread—is another noble plant, forming, as it does, a fine trunk, surmounted by deep green, leathery foliage, which droops or arches gracefully on all sides. There are some good specimens of this in the palm house at Kew, England, and it deserves a place in every collection of warm conservatory plants. Cycads are as invaluable and as deserving of general culture as are the palms themselves, although they are more limited in number. Many come from the Cape district and Natal, or Southern Africa, where they form distinctive features of vegetation.

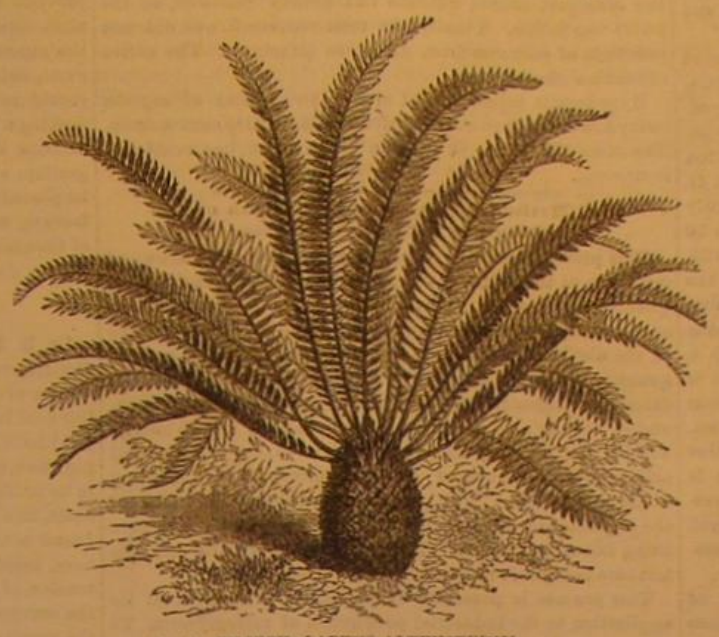


FIG. 1.—ENCEPHALARTUS ALTENSTEINII.

The odd-looking plant shown in our second illustration belongs to the genus *Dicksonia*. They are distinguished by their coriaceous fronds, the sori being situated upon the end of a vein near the margin of the pinnules, and inclosed within a coriaceous two-valved involucre.

The species represented is the *D. antartica*. The stem is both tall and stout, attaining in its native country, we are told, to from 30 to 35 feet in hight, and measuring from 1 to 2 feet in diameter. Upon the summit of these stately stems is borne a grand crown of dark green, plume-like, somewhat coriaceous fronds, which vary from 3 to 10 or more feet in length. The young fronds are beautifully arched, but with age they bend over and become more pendulous. The beautiful symmetry of this stately plant cannot fail to recommend it to every plant grower. It would appear to be common in mountain gullies and ravines in Tasmania and Australia.

Although the flowers of the stapelias are not merely devoid of fragrance, but exhale a repulsively fetid, carrion-like odor, many of them are, nevertheless, beautiful in color and singular in form. There are about ninety species of these plants, all of which are natives of the Cape of Good Hope, with the exception of *s. Europea*, which is found in Spain and Algeria, as well as in South Africa. *S. hirsuta minor*, of which we give an illustration in Fig. 3, and the allied species emit such a powerful scent of decomposing flesh that the common blow fly is deceived into depositing its eggs among the hairs of the corolla. Its numerous succulent stems are thickly set with quadrangular, conical, ascending branches, forming tufts from 12 to 16 inches in hight. As in the genus cactus, the leaves are very rudimentary, being reduced to insignificant scale-like processes. The flowers are solitary, from two inches to two and a half inches in diameter, and are produced near the bases of the branches. The petals are thick and fleshy, smooth, and greenish on the under side, very much wrinkled on the upper surface, marked near the base with transverse sinuous lines of purplish brown, and marbled and spotted all over with blotches of sulphur



FIG. 2.—DICKSONIA ANTARCTICA.

yellow. The bottom of the corolla is concave, circular, and of a purplish brown color in the center, while the edges are marked with yellowish spots. The structure of the stamens is very singular. From the bottom of the corolla rises a sort of cup, nearly pentagonal in shape, the upper part of which is divided into ten narrow strips, five of which are turned inwards and five outwards. The five inner divisions are straight, cylindrical, slender, and covered with purplish tubercles. Each of them is again subdivided into two parts, of which the outer one has a thickened apex, and is bent over the pistil; the other, or inner division, is quite straight. The five external primary divisions are of a green color, spotted with purple, are flat and oblong in shape, and forked at the apex. The anthers are of an orange color.

Fig. 4 is a California cypress, described by some authors as a variety of *c. Californica gracilis*, while others make it a distinct species. It forms a small bushy tree, from 16 to 20 feet high, with numerous spreading branches, and small scale-

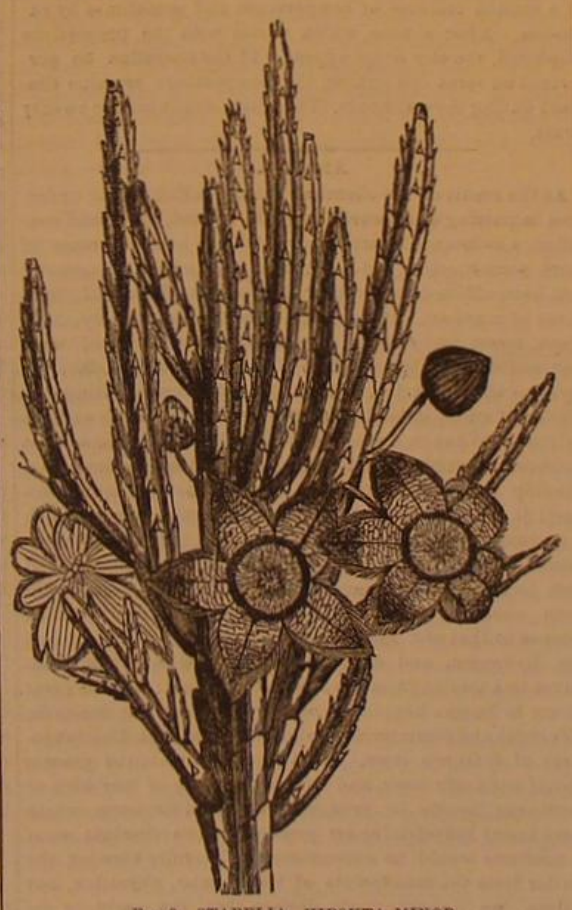


FIG. 3.—STAPELIA HIRSUTA MINOR.

like leaves, closely set together, broad at the base and pointed at the apex. It is particularly distinguished by the shape of its cones. These are of a dark brownish color, streaked with lighter lines, each of the four scales bearing, near its apex, a horn-like projection, nearly half an inch long, whence it derives its specific name, *cornuta*. These horns are generally curved at the point, as shown in our engraving, which represents the cones in their natural size. The tree is a native of the mountains of California, and is a hardy and tolerably ornamental subject.

Dog Killing by Electricity.

Whether the slaughtering of scores of dogs by carbonic acid gas, as practiced in this city, is a painless operation to them seems rather questionable from the length of time which their struggles continue. A correspondent asks why cannot electricity be used? He suggests that, with a powerful battery and a good sized Rhumkorff coil that will give a spark of from twelve to eighteen inches, thirty or forty dogs at a time might be killed instantly and painlessly. The wires could be led along the floor connecting with every staple to which the animals are secured. The chain and metal collar would serve to conduct the shock to the body.

WATERPROOF SILK PAPER.—Silk paper is allowed to float for a little time on the surface of an aqueous solution of shellac in borax, and then dried in the air. By the admixture of a small quantity of an aniline color with the borax, colored papers are obtained.

Korting's Condenser.

We notice that a Mr. Körting has invented and introduced a novel condenser, in which the work required to eject the condensed water is performed by its own velocity, instead of by the old-fashioned air pump and hot well. The condenser is of the old injector principle, in which the exhaust steam is admitted by various concentric cones around a stream of falling water. This disposition of parts causes the exhaust steam from any cylinder to offer a large surface to the cold water. Condensation is thereby effected, and a very considerable velocity is produced in the descending column of water. This causes a considerable vacuum behind the falling column. In order to produce the required effect, it is necessary that the falling water should have a small initial velocity. In M. Körting's arrangement, the water has a velocity due to a head of 9·85 feet. The water is pumped up into a tank at that hight by means of a pump attached to the engine; so that the power required to work this pump must be deducted from the effective gain of the condenser. The advantages of the apparatus are thus summed up.

1st. Its price is not more than from an eighth to a quarter of an ordinary condenser. 2d. There is no need for any foundation, and consequently it is easily applied to existing engines or to new ones. 3d. It works without air pump, which saves the loss of work and the inconvenience of setting up and of operation of the latter. 4th. There is nothing to regulate, and, in consequence, it demands no particular care from the attendant. 5th. As there are no moving parts (pistons, valves, etc.), there is no wear, repairs, or interruption in work. 6th. Its application is especially advantageous to small machines, where the inconvenience and the price of an air pump is very great.

Atmospheric Dust.

M. Vorlet d'Aoust says, in *La Nature*, that in Mexico deposits of atmospheric dust occur in beds of sufficient thickness to stamp them as true geological layers. These strata, which have frequently formed a puzzle to geologists, are composed of a yellowish clayey earth, which not only envelopes isolated mountains but forms the flanks and bases of some of the most elevated ranges, such as those of Popocatepetl and Ouzaba. The revetment extends upward to a hight of about 12,000 feet and in its lower portions varies in thickness from 180 to 320 feet.

In the midst of the deposit are found blocks if stone and detached fragments which have rolled down the mountains and which have become agglomerated by the dust as if by cement.

The dust is raised by dust storms (*remolieros de polco*), which frequently occur on the Mexico plains. These throw up great clouds to hights of 1,500 and 2,000 feet in the air, often obscuring the sky and changing its blue to a yellowish color. The dust is then blown by wind currents toward the mountains, which act as a barrier and check its further pro-



FIG. 4.—CONES OF CUPRESSUS CORNUTA.

gress; for, once deposited on their slopes, it cannot again rise as the storms take place only on the plains. It is curious to notice that this action of the atmosphere completes a circle begun by the water. The latter carries earth from the hills down to the plains, where it is transported back to the mountains by the winds, and so a continual circulation is maintained.

MEDICAL NOTES.

Erysipelas.

Professor D. M. Salazar, of Madrid, reports that he has cured eight cases of facial erysipelas in 48 hours by the use of glycerin of borax, without any ill effect following. He applys the solution to the diseased parts with a brush, and then covers them with a mask of raw cotton.

In erysipelas in general, tincture of muriate of iron, used internally and locally, has been the chief remedy of late, but it is found not to be proper in all cases. When the redness of the inflamed part is vivid and deep, and there is increased redness of tongue and mucous membranes, the iron tincture is the true remedy. Internally it may be given in doses of from 5 to 20 drops every three hours,and outwardly applied from full strength to a dilution of one part to 8 or 10 of water and glycerin. Erysipelas has been cured with veratrum alone, used internally and externally, when the cases were marked by high febrile action and a full pulse. In othercases of the zymotic type,when the cellular tissue is affected, the remedies should be taken from the group o antiseptics. Sulphite of soda is good when the tongue is pallid and dirty. The dose is 10 to 20 grains every four hours. Chlorate of potash has been tried with good effect. In phlegmonous erysipelas, permanganate of potash solution is the best outward application. In these cases the color is purplish or dusky. Carbolated glycerin is also a good dressing. It should not be forgotten that,in erysipelas of children or of adults where the skin is very sensitive, a simple dressing of fresh lard will often give the best results.

To conclude the subject of erysipelas, the collector of these notes would mention that he has observed the cause of the disease twice in himself and two or three times in others, where there was no doubt. That cause was animal fat, either fat fowls or, generally, lard and pork used to excess. It seems that the disease is very frequent in the West during winter, hog's fat being eaten there most extensively. Those who have never had the disorder can easily bring it on by persistence in such diet; and though it will trouble even when it is light, yet, if they try the remedies above mentioned, and especially the lard or bacon fat when the complaint ends with a ticklish itching in the palms of the hands and soles of the feet, they will be almost amused. In acute erysipelas, the bane and antidote are one, as a rule.

Iodide of Potassium.

This chemical is used to a vast extent; but after a thousand prose pœans in its praise, many doubts begin to be expressed as to its value. Some of the best physicians of the old and new schools assert that the iodide is sometimes a failure, and sometimes much worse. The most discriminating doctor of the lot seems to us to be Dr. John M. Scudder. He says: "If your patient has a pallid tongue, especially of a dull leaden color, large, sodden, immobile, you have the indication for the drug, and then it becomes a remedy. If the color of the tongue is deeper than is natural, whether dusky red, purplish, violet, or bright red, if it be contracted, pinched, pointed, dry, then the iodide is contra-indicated, and will probably prove a poison."

Hypodermic Injections.

Subcutaneous or hypodermic injection of medicines, namely injection, by very fine pointed syringes,of liquids into the cellular tissue, form the grand new feature of medical practice. Until recently, these injections have been confined to narcotics or anæsthetics, where they have accomplished their object better than by the old style of dosing or inhaling, but in some cases the amount has proved too great. At this time, the trials of new articles used in this way for a host of diseases would require a volume to give full account of. We condense a few of the more important experiments. Dr. Zülzer, after having used every other medication, without success, in exanthematic typhus, and finding the pulse imperceptible, the extremities cold,the voice inaudible, etc., employed the ammoniacal tincture of anise in injections, 15 to 30 drops, one injection for each limb. In a few minutes the pulse became fuller and stronger, the death-like appearance and collapsed condition disappeared, and a good number of patients who seemed hopeless owe their life to this means, not sufficiently used. In some cases it caused little abscesses at the point where the injection had been made, but these accidents have never had any serious consequences. The formula is as follows: Oil of anise, 1 fluid dram; alcohol of 85°, 24 drams; ammonia, 5 fluid drams; mix. This medication is indicated in cholera, grave fevers, and paroxysms, where it will permit one to wait the favorable moment for the administration of quinine. Dr. Hüter strongly recommends a two per cent solution of carbolic acid in water as an injection in all inflammations of the cellular tissue. According to his experience, the results are almost miraculous. He says there are no material impediments to the use of these injections in such organs as the lungs and spleen. If he is correct, and a solution of carbolic acid can reach and heal the ulcers in consumption—but it will not do to put entire faith in such a wonder until the experiment has been fully and successfully tried.

Dr. James B Garrison, of De Witt, Ark., reports a curious case in his own practice, where a man had taken by mistake a large dose of sulphate of morphia. He was unconscious, cold and livid, and the pulse had ceased entirely at the wrist. The Doctor considered the case hopeless, but still went to work vigorously, causing the patient to be stripped, rubbed with dry mustard, then with water, which was poured on head and back, till a very strong decoction of coffee could be prepared; then almost a pint was injected into various parts of the patient's body during an hour,while rubbing with hot flannels and dashes of cold water were kept up. At the end of the first hour his pulse was perceptible at the wrist. The hypodermic injections of coffee were continued for two hours, his skin being perforated in every part where it could be done with safety. The friction and cold water lasted four hours, when the patient could swallow. Then he was made to drink a quart or more of the strongest coffee; quinine and brandy followed, as his pulse was feeble. Finally the man recovered, and did not complain of soreness from all these punctures. The coffee caused no abscesses.

Hypodermic injections of one or two grains of ergotin every few days have cured varicose veins in pregnant women. The same substance, 10 parts to 100 of water, has cured *prolapsus ani*.

New Method for the Transformation of the Alcohols into Nitric Ethers.

This process, recently reported by M. Champion, allows of operation at the ordinary temperature and upon considerable quantities of alcohol. It is founded on the reciprocal action of a nitrosulphuric mixture and of sulphuric combinations of the alcohols; and as this action is progressive,but a small quantity of heat is disengaged. It is otherwise necessary to cause the concentration of nitric acid to vary. Thus, for example, for the alcohols derived from the fatty series, butylic amylic, etc., ordinary nitric acid with an excess of sulphuric acid should be employed: in other circumstances, fuming nitric acid at 118·4° Fah. The sulphuric combinations of the alcohols are obtained by 2 of acid to 1 of alcohol, care being taken to prevent elevation of temperature and the mixture being left to itself for several hours.

This process is possessed of particular interest from its application to the industrial production of nitroglycerin. To glycerin at 30° B., ordinary sulphuric acid is added, care being taken to keep the heat below 122° Fah. After cooling the liquid is turned into a light excess of nitrosulphuric acid. Two pounds or so of this mixture can be almost immediately used, without requiring cooling. Although the temperature rises, it in no case gives place, if the operation be properly conducted, to the violent reaction which results from the action of glycerin on the acids, an effect manifesting itself by a sudden increase of temperature and sometimes by explosion. After a time, which varies with the proportions employed, the oily drops appear. If the operation be performed on some few ounces, the temperature remains constant during several hours. The action continues for twenty hours.

Alcohol.

As the result of the chemical change which sugar undergoes in passing downwards towards a dead, inorganic condition, a substance is produced which has been the cause of more sorrow, crime, and suffering than all other evil agencies that have afflicted the world. It has caused tens of thousands of murders, and uncounted instances of robbery, theft, arson, incest, and suicide; it has brought misery and want into millions of households; it has filled almshouses and asylums with wretched victims; it sends a never ending procession of crime-stained men and women to prison and the gallows. What an awful indictment this is to bring against a substance which stands so closely allied in chemical relationship to innocent sugar! Alcohol is not a natural product; it can only result from a spontaneous change which is excited in saccharine liquids under the influence of a ferment. If in the order of things this chemical change had been impossible, the human race would have been saved from shedding tears, the aggregated volume of which reaches to that of a mighty river. But alas! atoms of carbon, hydrogen, and oxygen are permitted to group themselves in a way to form the maddening liquid; and the great enemy to human happiness confronts us in all our domestic, industrial,and commercial relations. If through disarrangement of Nature's laws, the vinous fermentative process should suddenly cease, and not another drop of any kind of spirituous liquors be produced, no sensible harm would come to any industrial or art process, and no absolute want in medicine would be encountered. Carefully viewing the matter from the standpoints of the chemist, physician, and artisan, we unhesitatingly declare that the world in its present advanced stage has no need of alcohol; it is simply convenient, but not necessary. Why not then make a determined effort to rid the country and the world of the monster? Although alcohol results, as we have said, from spontaneous changes, yet the aid of man is necessary to form the various liquids containing it into attractive and permanent beverages. The fermentation of the juices of grapes and other fruits produces alcohol; but if let alone, Nature will not allow the spirit to remain except for a brief space of time. Nature abhors not only a vacuum, but manifestly one of her products, for alcohol is so unstable in its attenuated combinations that, if left to itself,it speedily runs down into the harmless form of acetic acid.

If man ceases to interfere in the series of natural changes which saccharine liquids spontaneously undergo, alcohol will not survive long enough to do mischief. Why not then compel the great army of men,engaged in isolating and compounding the agent, to let it alone? Alcohol is a poison; it acts inharmoniously with vital processes in the animal organism. In its purest and best form, it slowly undermines the constitution, and hinders or arrests metamorphosis of tissues; in its vile associations, as presented in these modern times, it kills with the certainty and almost with the rapidity of strychnine and arsenic. We ask again, why not attempt to arrest its production, and thus strike a blow at the root of the evil? There is virtue and moral force enough in this country to compel Congress to pass laws prohibiting its importation in any form; and there is virtue and moral force enough in most,of if not in all,the States to compel legislatures to enact laws prohibiting its manufacture. This is the point to which we must, sooner or later, come. All the laws ever made, or that ever will be made, conjoined with all the prayers of all the well intentioned women of the country, will never stop the gnawings of human appetite, or prevent its gratification, so long as rum, whiskey, wine, malt liquors, etc., are imported and manufactured under the sanction of law. Alcoholic beverages must cease to exist, before the world will be released from the terrible thraldom which they exercise over human appetite. In making a remedy for the enormous evils caused by alcohol, nothing absurd or impracticable is associated with the suggestion, and the time is not far distant when the poison will be placed under a ban, as regards its importation and manufacture, which will give a forced emancipation to the tens of thousands of slaves now in subjugation to the monster.—*Boston Journal of Chemistry.*

Cold Applications to the Neck.

Dr. B. B. Richardson, in the London *Medical Times and Gazette*, recommends a neck bag of rubber, with a constant stream of cold water through it, as an efficient means of applying cold locally to the neck. He says:

"I have used this method of applying cold to the cervical region now several times, in pyrexia, with increasing confidence in its usefulness. In a case of apoplectic seizure, with convulsions, in a lady of middle age to whom I was summoned, I found a temperature of 102° Fah., with deep unconsciousness, rapid pulsation of the carotids, and intense fullness and tension of the jugular vein. In this extreme instance I had the cervical region enveloped in a bladder of crushed ice, with the result of a fall of temperature to the natural standard in six hours, a quiescent condition of the circulation, and subsidence of all the acute symptoms, so marked in character that it is, I think, impossible to doubt that cause and effect were in their true place. This patient made a good recovery, and, although I do not attribute the recovery solely to the special remedy now being considered, I am convinced the remedy was of good service.

I had an opportunity of trying the effect of this mode of applying cold on myself. I took a feverish catarrh, attended with a rise of animal temperature to 100° Fah. I had the bag neatly adjusted, and let pass freely through it water, taken simply from the cistern, the temperature of the day being at freezing point. As the water current began to pass over the front part of the neck, with a gentle pressure which I regulated myself by the stopcock, I felt the effect of the cold very deeply, and at first not pleasantly. In three or four minutes, however, though the skin over the throat was ten degrees lower than on the other parts of body, the sensation of cold was lost, and all unpleasantness was gone. Within a quarter of an hour I was conscious of a general reduction of fever, and of lessened vascular activity. The cold also had a soothing influence, producing desire for sleep. On this followed perspiration, and within two hours a reduction of the temperature to the national standard.

These effects were satisfactory, because no other mode of treatment was employed to complicate the experience.

I shall look out with interest for the results of the observations of other practitioners on this method of reducing pyrexia. It stands on a good physiological basis; I believe its practical worth is clear; and I would that its usefulness were tested by the independent observation of other workers in our common field of labor.

I would urge on those who may study the effect of cold, more or less extreme, applied to the cervical region, to observe the influence it exerts,in different classes of cases upon the heart. If I am correct that it reduces the action of the heart, and if I am also correct in the view that it promotes a tendency to sleep, this remedy, so simple, will prove useful in many other forms of disease than acute pyrexia. In acute mania, in cases of insomnia, in cases of palpitation and cardiac irritability, it deserves the test of experience."

A Good Education.

The late Edward Everett condensed into a single brief paragraph his estimation of what constituted a good education. Here it is: "To read the English language well, to write with dispatch a neat, legible hand, and be master of the first four rules of arithmetic, so as to dispose of at once, with accuracy, every question of figures which comes up in practice—I call this a good education. And if you add the ability to write pure, grammatical English, I regard it as an excellent education. These are the tools. You can do much with them, but you are hopeless without them. They are the foundation; and unless you begin with these, not with flashy attainments, a little geology, and all other ologies and osophies, are ostentatious rubbish."

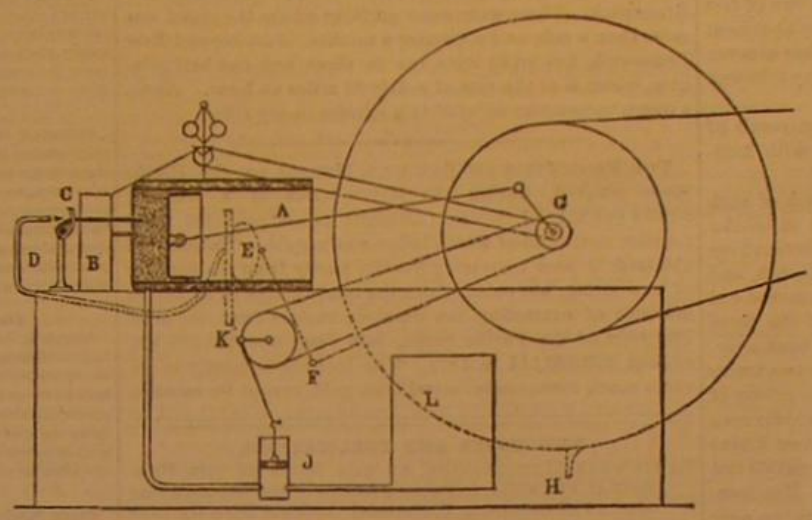
EXPLORATIONS have recently been made into the mounds of Ottumwa,Iowa. In one,a mass of charcoal,a bed of ashes, and some calcined human bones were found, showing that cremation was practiced by the people who erected them. As Indians never burn their dead, this adds another proof to the theory that they were not the original mound builders. The similarity of the mounds of Mexico and of Iowa point to the fact that they were constructed by the same race of ancient Mexicans.

A paragraph is going about the papers that the largest room in the world under a single roof, unbroken by pillars or other obstructions, is at St. Petersburgh, in Russia, and is 650 feet long and 150 feet wide. It is said to be used for military display. The Grand Central Depot, in this city, is 800 feet long by 240 wide, covering about 4 acres; the roof is supported by the side walls.

A PETROLEUM MOTOR.

An Austrian inventor has recently constructed the device represented in the annexed engraving, consisting of a petroleum engine, the principle of which is analogous to that of single acting steam engines, with the difference, however, that the expansive force of steam in the latter is replaced by the explosion of the finely divided oil. The *Revue Industrielle* says that the invention has been applied to sewing machines with considerable success. Although purporting to be an Austrian invention, we believe that it is nothing more than a poor copy of the petroleum engine invented by George B. Brayton of Boston, Mass., patented here in 1871-2 and now in successful operation in this country.

At the rear of the cylinder, A, are three valves. The valve in the center is covered with a finely perforated nozzle and allows of the entrance into the cylinder of the oil from a receiver, B. The valve opening on the left allows of the penetration of a flame, C, at the proper moment, said flame being driven through the orifice by air pressure as hereafter described. The effect of the flame meeting the oil in a finely divided state is an explosion, which shuts the two valves and at the same time drives the piston ahead. To the latter is hinged the connecting rod. The crank shaft, G, carries at one end a fly wheel and at the other a common pulley. The fly wheel has a cam, H, which at every revolution strikes against a lever, F, which communicates a pressure to an india rubber air bag, E. The current thus produced is led by tube, D, to the gas or petroleum flame, C, which is thus for an instant elongated and driven into the cylinder as above noted. The petroleum is introduced into the cylinder by atmospheric pressure, through a vacuum being formed in rear of the advancing piston. The return stroke of the latter is caused by the inertia of the fly wheel.



A PETROLEUM MOTOR.

The cylinder is jacketed, and is kept cool by the circulation of water through the intermediate space, forced by pump, J, from a reservoir, L. The governor, shown on the cylinder, connects in the ordinary way with the crank shaft; and by means of a combination of levers, governs the time of entrance of the petroleum. The smoke produced by the combustion of the latter escapes by the third valve before referred to, and into a chimney. The movement of the valve is governed by an eccentric on the crank shaft. The engine has been made of three horse power and is said to work quite cheaply.

The Use of Petroleum Benzin for Exhausting Oleoresinous Drugs.*

Many uses have been discovered for petroleum benzin since it became an article of commerce: and though but recently brought to notice, its applications, from thinning white lead to purifying rare alkaloids, from dissolving india rubber to removing grease from a silk dress, have secured for this product of Mother Earth a name and a place not to be despised.

The immense and overgrown development of the petroleum interest has tended to reduce the price of benzin to a very low figure; the common unpurified article is a drug in the market; and although efforts are constantly made to fit it for illuminating purposes, a means of rendering it free from liability to explode and to cause fearful accidents is yet to be discovered.

The purified benzin commands a much better price, is put to finer uses, and should alone be used for solvent purposes in pharmacy; the common article is unfit for any purposes in a preparation, for it will be sure, from its offensive odor, to leave its tracks in it.

The first requirement, in answering the query: What merit has petroleum benzin as a solvent for the extraction of oleoresinous drugs, like buchu, chenopodium, etc.?: was believed to be to secure a good benzin. This was readily done, and an article having the specific gravity of 0·642 was obtained, which on being tested proved to be free from objectionable impurities, and no odor was left on a clean sheet of paper when a small portion was poured on it, and suffered to evaporate.

Eight ounces of finely powdered buchu leaves were taken, and firmly packed in a Squibb's glass percolator, with the siphon arrangement. It was found to be best, however, to substitute the rubber lid for one made of wood, the wooden lid having a groove cut in the under surface to fit the rim of the percolator; and at the bottom of the groove, a rubber band made the joint airtight.

After allowing the powder to macerate for four days, the siphon was started, and the percolate, very dense and highly charged with extractive matter, came over, at first slowly, and afterwards rapidly; after two pints had passed, the buchu seemed to be exhausted, and so great had been the solvent power of the menstruum, so far as the chlorophyll and other coloring matters were concerned, that the residue looked as if it had been bleached.

The percolate was allowed to evaporate spontaneously, and the amount of oleoresinous extract obtained weighed 305 grains. This, at first sight, was supposed to contain all the active properties of the drug; and in order to test it, five grains were swallowed in a little water by the writer, producing, however, but little diuresis; the dose was increased to ten grains, which had but moderate effect.

Taking the dose of fluid extract of buchu at a fluid drachm, and granting that, one fluid ounce of the extract represents one ounce of the drug, it can be readily be seen, by a simple calculation, that, if the benzin had fully extracted the virtues of the buchu, five grains of the oleoresinous extract obtained would produce the same effect as a fluid drachm of the fluid extract, while ten grains would be a large dose.

This fact suggested that, although the buchu had every appearance of being thoroughly exhausted, it might yield some activity to alcohol, and it was then percolated with stronger alcohol, and a dense, dark colored liquid obtained, possessing a bitter taste and considerable odor.

Ten grains of this liquid produced active diuresis, and the writer has no hesitation in asserting that he believes alcohol to be much the better solvent for buchu.

Various other experiments with other drugs are now progressing, but sufficient progress has been made to justify the assertion that the uses of benzin in this direction are circumscribed; the principal objections to its use being inflammability and great volatility; it requires the use of apparatus not always at the command of all pharmacists; the odor is objectionable generally, and in many cases could not be tolerated by a weak stomach. A continuance of this subject was requested, in order to obtain further information with other plants.—*Joseph P. Remington.*

*Read before the American Pharmaceutical Association, September, 1873, and reprinted from the "Transactions."

Medical Value of Asparagus and Celery.

A medical correspondent of an English journal says that the advantages of asparagus are not sufficiently appreciated by those who suffer with rheumatism and gout. Slight cases of rheumatism are cured in a few days by feeding on this delicious esculent; and more chronic cases are much relieved, especially if the patient avoids all acids, whether in food or beverage. The Jerusalem artichoke has also a similar effect in relieving rheumatism. The heads may be eaten in the usual way; but tea made from the leaves of the stalk, and drank three or four times a day, is a certain remedy, though not equally agreeable.

So the English paper says. It may be well to remark that most plants which grow naturally near the sea coast contain more or less iodine, and in all rheumatic complaints iodine has long been a favorite remedy. One who was long in the drug business told the writer some years ago that many o the popular patent nostrums which some disinterested people—"for the good of their fellow creatures"—sold at two dollars a bottle, consisted simply of a few cents' worth of iodine in solution.

Iodine is dangerous, however, in overdoses, affecting especially the eyes. The same effect may be produced by eating abundantly of asparagus or celery, which are well known seaside plants. If these have no effect, the patent specifies will have none, and in that case a conscientious and intelligent physician is the best resort.

The Microscopic Examination of Well Water.

The author has sought an expeditious method of determining the quality of drinking water, and recommends the use of the microscope in detecting salts in solution by their crystalline form. For this purpose, a few drops of the water under examination are evaporated on a slip of glass either at a high or low temperature, and the forms of crystals obtained are compared with those of known salts, dissolved in water and recrystallized in the same manner. In this way one can detect with dispatch and certainty, common salt, calc spar, gypsum, etc., and to a certain extent the relative quantities present.

Sausages Colored by Aniline.

Aniline red is used to impart to sausages a fresh and healthy appearance. It can easily be detected by the use of alcohol or ether, either of which substances dissolves aniline, but not blood. The use of aniline red is severely reprehensible, not only from the fact that it is known to have caused the illness of entire families who have eaten meat colored with it, but also because, from its mode of preparation, it frequently contains arsenic, and must, therefore, act as a poison.

ICE is now selling in New York city at $20 a tun retail. This high price is alleged by the dealers to be necessary on account of the slim supply obtained last winter. The estimated cost of producing ice by machinery is $3 a tun. There is evidently a wide margin for profit and a good opportunity for inventors to bring out effective ice-making machines.

New Method of Coloring Metals.

Metals may be colored quickly and cheaply by forming on their surface a coating of a thin film of a sulphide. In five minutes brass articles may be coated with any color, varying from gold to copper red, then to carmine, dark red, and from light aniline blue to a blue white, like sulphide of lead, and at last a reddish white, according to the thickness of the coat, which depends on the length of time the metal remains in the solution used. The colors possess a very good luster; and if the articles to be colored have been previously thoroughly cleaned by means of acids and alkalies, they adhere so firmly that they may be operated upon by the polishing steel.

To prepare the solution, dissolve 1½ ounces of hyposulphite of soda in 1 pound of water, and add 1½ ounces of acetate of lead dissolved in ½ pound of water. When this clear solution is heated to from 190° to 210° Fah., it decomposes slowly and precipitates sulphide of lead in brown flakes. If metal be now present, a part of the sulphide of lead is deposited thereon, and, according to the thickness of the deposited sulphide of lead, the above colors are produced. To produce an even coloring, the articles must be evenly heated. Iron treated with this solution takes a steel blue color; zinc, a brown color; in the case of copper objects the first gold color does not appear; lead and zinc are entirely indifferent.

If, instead of the acetate of lead, an equal weight of sulphuric acid is added to the hyposulphite of soda, and the process carried on as before, the brass is covered with a very beautiful red, which is followed by a green (which is not in the first mentioned scale of colors), and changes finally to a splendid brown with green and red iris glitter. This last is a very durable coating, and may find special attention in manufactures, especially as some of the others are not very permanent.

Very beautiful marble designs can be produced by using a lead solution, thickened with gum tragacanth, on brass which has been heated to 210° Fah., and is afterward treated by the usual solution of sulphide of lead. The solution may be used several times.

Black Leading of Iron.

In these days of general diffusion of chemical knowledge, it is scarcely necessary to state that the "black lead" or "plumbago" of commerce is not lead at all, or any compound of lead, that it includes no lead whatever in its composition. Neither is it a carburet of iron, as is sometimes stated. It is simply carbon; pure plumbago is pure carbon, impure plumbago is impure carbon. Its proper name is graphite, that is, writing stone. I may venture to describe it as the softest of all true solids, and have often pondered wonderingly upon the apparently unnoticed, but very curious chemico-mechanical, paradox that the hardest and softest of all the solids existing upon this earth are, chemically speaking, the same substance: graphite and the diamond, being both carbon.

It is this wonderful softness, combined with persistent solidity, that enables us to smear it over any other solid surface, and thus obtain a solid paint, all body and no medium. For the class of castings to which it is commonly applied, where its application can be readily repeated, and where it is not exposed to the direct action of water, it is unrivaled as a protecting film to iron. Its chemical action, so far as it does act when cold, is reducing or anti-oxidising. Its color and tone are so similar to iron that Mr. Ruskin himself could scarcely make any æsthetic objections to its use, and the film is so marvellously thin that it obliterates nothing. I have never met with any attempt to estimate the thickness of a well brushed film of graphite, but I suspect that, if a hundred strata of such films could be piled in contact with each other, their combined thickness would fall short of that of the thinnest gold leaf.—*W. Mattieu Williams.*

The Magic of an Auctioneer's Advertisement.

The *Building News*, London, is responsible for the following:—An English country gentleman recently became tired of his house, and determined to sell it. He instructed an auctioneer, famous for his descriptive powers, to advertise it in the papers for private sale, but to conceal the location, telling persons to apply at his office. In a few days the gentleman happened to see the advertisement, was pleased with the account of the place, showed it to his wife, and the two concluded it was just what they wanted, and that they would secure it at once. So he went to the office of the auctioneer and told him the place he had advertised was such a one as he desired, and he would purchase it. The auctioneer burst into a laugh, and told him that that was the description of his own house, where he was then living. He read the advertisement again, pondered over the "grassy slopes," "beautiful vistas," "smooth lawn," etc., and broke out, "Is it possible? Well, make out my bill for advertising and expenses, for, by George, I wouldn't sell the place now for three times what it cost me."

HOT FILTERING.—The apparatus consists of a tube of soft sheet lead which can be wound around the funnel containing the filter in the form of a spiral. One end of the tube passes through a cork in the neck of a flask, in which water, or other liquid of higher boiling point, is boiled; the other end dips into a receiver into which the condensed liquid flows.

Final Test and Opening of the St. Louis Bridge.

The final test of the strength of the St. Louis bridge was made on the 2d of July, under the supervision of Capt. J. B. Eads, the chief engineer. He was assisted by Col. Henry Flad, Oscar Scheultze, Messrs. Klemm, Varrelman, Schmidt, Cooper, and Devon, with ten assistants, and Mr. Schaler Schmidt, of the Baltimore Bridge Company. Col. H. B. Carrington, United States Army, Professor of Dynamic Engineering at Wabash College, was also present, and expressed his satisfaction at the result of the tests. At a given signal there were fourteen locomotives ready to obey the command of Capt. Eads and Col. Flad and their assistants. At about 10 o'clock seven locomotives, crowded with people on pilot, cab, and tender, moved in a body, coupled together, and ascended the approach; and when arriving on the two 56 feet spans over Front street and the levee, east of the abutment pier, they halted, and by a signal notified the other caravan of seven iron horses to come up to the rack; and they followed up, and the test was begun in earnest.

The following is Capt. Ead's summary of the result of tests made upon the Illinois and St. Louis bridge with fourteen locomotives:

"Seven locomotives were placed upon one track of each span. This produced a deflection of 2¼ inches on center span and 2¼ inches on each side span. Seven locomotives were then placed on each track of the west approach, and both trains of locomotives, fourteen in all, were moved out out abreast and simultaneously over each one of the three spans. The locomotives weighed from 35 to 51 tuns, averaging 40 tuns each, making 560 tuns in all. The two trains thus formed were stopped on each span, and the effects of this load carefully noted. The deflection of the middle span was 2¼ inches; of each side span, 3 inches. The two trains moving abreast upon each arch was the severest possible test to produce distortion of the curve of each arch. Ten locomotives were then coupled together, and these were run over each track on each side of each arch of the entire bridge, covering the entire track of each span, and throwing the whole weight of the train, 400 tuns, on one side of each span. This test was applied to each side of the bridge, and produced the severest twisting strain to which each arch can be subjected. The vertical deflection produced by this test on the center span was two and one half inches. The locomotives thus coupled were run at a speed of ten miles per hour. The local traffic on the upper roadway of the bridge was uninterrupted during the progress of the tests. Various other observations in detail were made, noting the effects of the load on the arches as it entered upon and left the different spans, but this possesses no special interest to the general public. The result of the tests agreed almost exactly with the theoretical computations previously made, and the whole trial proved eminently satisfactory. The instruments failed to detect any side motion whatever during the tests."

The river is spanned by three arches, of which the central arch has a span of 520 feet, the other two of 502 feet each. The arches are composed of cast steel, and the bridge is really a double structure, consisting of two arches placed side by side. The arches are made of steel tubes, each twelve feet in length.

The formal opening of the bridge was celebrated on the 4th of July, with great enthusiasm. The display was finer than ever before witnessed at St. Louis. The procession was five hours in passing a given point. Addresses were made by Mayor Brow, ex-Senator Gratz Brown, Governor Woodson of Missouri, and Governor Beveredge of Illinois.

Contraction of Tyres.

M. L. Merlet proposes the following method of reducing the inner diameter of a tyre which has been unduly enlarged by the hammer or the rolls, so that it cannot be put on when hot in the usual manner. The plan consists of heating it to redness, and then plunging it horizontally but only to half its breadth in water, and leaving it there till quite cold. The operation is then repeated in the same position, after which the tyre is turned over and the heatings and plungings applied to the other half of the ring. The first cooling produces a contraction of which the half not immersed partakes, and thus undergoes a molecular retraction resulting in a reduction of diameter; of course the same is produced in the other half during the second operation. In this way a tire has been reduced 7 in 895. Four immersions instead of two will double the shrinking. In the same manner, a ring of Bessemer steel, which had not only enlarged under the hammer but had also become conical in form in the interior, was brought to the exact diameter by means of heating and immersing thirteen times successively, first the side that was contracted, and afterwards that which had become enlarged. In this case the correction amounted to nearly four inches, but the diameter of the steel ring is not given.

The Wear of Car Axles.

The standard car axle journals are 3¼ inches in diameter by 7 inches long. The old style was 3¼x5¼.

The superiority of the standard axle is illustrated by Mr. C. E. Garey as follows: "Two pairs of wheels, one with 7x3¼ journals, and the other with 6¼x3¼ journals, were left under the car in constant service, when I found it necessary to remove the wheels, as they were worn out, having run 65,734 miles. On examination, I found that the large journals had been worn off $\frac{1}{32}$ of an inch in diameter and ¼ in length, but were perfectly straight, smooth, and equal in size, while of the smaller ones, namely, 6¼x3¼, one was worn off $\frac{1}{16}$ in diameter and the other a little less, and both were smaller in the center than at the shoulders; while the lateral wear was the same as that of the large journals. I find by experiment that bearings on 5¼x8¼ journals will run from 30,000 to 35,000 miles, while the standard bearings, judging from the past twelve months' experience, will run with safety 100,000 miles or more, and with much less liability of heating, as we have several cars running with standard axles, and have not yet had a hot box. These experiments were made with New York and Harlem Railroad baggage car No. 10."

FROM 57 TO 86 MILES AN HOUR BY RAIL.—Fast time was recently made by the "newspaper train," which left Jersey city nearly half an hour behind time, and made it all up before reaching Trenton. This distance—a fraction less than 57 miles—was run in 59 minutes, including a stoppage of over a minute at Newark and a moderation of speed at New Brunswick. There were some portions where the speed was more than a mile and a quarter a minute. Just beyond New Brunswick, five miles were run in three and one half minutes, which is at the rate of nearly 86 miles an hour. About a dozen passengers enjoyed this extraordinary ride.

THE PRODUCTION OF PRECIOUS METALS on the Pacific Slope reached, during the last quarter of a century, $1,583,644,934, of which California mines produced three fourths, nearly all of which latter was in gold. The amount obtained is now increasing yearly, partly from the opening of new mines, but chiefly from the introduction of improved methods of extracting the precious metals from the ores. The yield of the Pacific Slope, last year, was $80,287,436, against $70,236,914 in 1872. The increase is mostly in silver, a much more useful metal than gold, except for coinage.

NEW BOOKS AND PUBLICATIONS.

EARTHWORK MENSURATION, ON THE BASIS OF THE PRISMOIDAL FORMULA, containing a Simple and Labor-Saving Method of Obtaining Prismoidal Contents Directly from End Areas. By Conway R. Howard, Civil Engineer. Illustrated. Price $1.50. New York: D. Van Nostrand, 23 Murray and 27 Warren streets.

The author of this book has developed a new system of finding the contents of earthwork by prismoidal mensuration, and accompanied the treatise with tables and rules of application of admirable simplicity, so that any one who can approximate cubic contents by the rough method of average areas can obtain a more exact result by the use of the prismoidal formulæ here given.

REPORT OF THE BOARD OF OFFICERS ON GATLING GUNS OF LARGE CALIBER FOR FLANK DEFENSE. Ordnance Memoranda, No. 17. Washington: Government Printing Office.

In this document, the views we have expressed as to the efficiency of the Gatling gun are fully endorsed by a board of experts in artillery. Detailed accounts of very many trials are given, and the results, illustrated by target diagrams, once more prove the terrible destructiveness of the weapon, especially in open country and as a means of defense.

A NEW METHOD OF AMALGAMATING THE PRECIOUS METALS. By John Tunbridge. Newark, N. J.: Pierson, Brother, & Co., 188 Market street.

Mr. Tunbridge is an expert in metallurgy, several of whose communications have appeared in our columns, and we refer our many readers who are interested in the subject to the little pamphlet now before us, as detailing some original views of a most important subject.

THE ELECTRO-ASTRONOMICAL ATLAS. By Rev. J. W. Spoor, A.M. Illustrated. Price $2. Rochester, N. Y.

The object of the author of this work has been to present the elementary principles of astronomy in a simple, popular form, as readily comprehensible by children as the ordinary primary text books on geography. We think that his efforts have been attended with excellent success. The volume before us is beautifully illustrated, written in a clear, concise style, in questions and answers, and presents the newest and most authentic information regarding the science. The diagrams are unusually complete and accurate, one exhibiting, at a single view, the entire solar system; while the other illustrations, original and selected, some of which plates are colored, are well calculated to convey correct ideas of the science of astronomy, in which, of late, there is so much interest.

Recent American and Foreign Patents.

Improved Sash Pulley.

Stiles E. Maxon, Long Branch, N. J.—The pulley case is cast in one piece and is made oval, to fit in the oval end of a mortise. The lower end is made concave to fit the fastening screw, which is tapered and has a small beveled head to arrest it when it comes flush to the stile of the frame; also to secure the lower end of the case. The screw being tapered, its threads will be pressed into the wood by the case when it comes into position, so as to insure its holding firmly.

Improved Loom Picker Spring.

William E. N. Potter, Lewiston, Me.—This invention relates to mounting a spring pulley (around which is wound the strap that connects it with the picker stick) on a crotched stand having a slotted base to adapt it to be secured to a screw stud in a vertical or horizontal position. It also relates to the means of securing the strap to the pulley case by a hook fastened in the slot in the face of the pulley by its bent portion and the straight extension, said extension being pressed in between the two coils of the spring, and kept in place by them. This arrangement allows of readily putting in the hook and taking it out, so that a broken or worn out hook can be readily replaced.

Improved Watch Regulator.

Joseph W. Hurd, Grand Crossing, Ill.—The object of this invention is to furnish means for regulating watches by the application of a micrometer screw, so as to vary the hair spring, and consequently the running of the watch, in the most delicate and precise manner.

Improved Apple Crib.

James M. Chaplin, Middleport, N. Y.—This is an improved apple house or crib for use in the orchard, for the purpose of keeping or storing apples therein as they are picked from the trees until they are to be sorted and barreled for market. Hitherto it has been the custom with orchardists to pick their apples and put them in large piles on the ground, or directly into barrels. In the latter case, the apples will sweat, mold, and mildew, and, therefore, not keep as well, so that considerable loss is caused in both cases. The present invention consists of a crib constructed of a raised bottom with detachable ends, and intermediate cross sections, and adjustable sides covered by a roof, the whole being connected in suitable manner, so as to be readily put up and stored away after use.

Improved Toy.

Mortimer C. Lee, New York city.—This is a toy cart with a figure of a horse's head and neck (one or more) attached to the axle thereof, propelled by means of a tongue, and guided by means of reins. A pull upon either line changes the direction, and the effect is very similar to that of guiding a live horse, which makes the toy exceedingly interesting to the juvenile driver.

Improved Heating Apparatus.

Gustavus Stevens, East Tawas, Mich.—This invention consists in a new and improved method of heating and ventilating rooms, by drawing pure air from outdoors by means of a bellows actuated by a large clock gearing, and of forcing the same through heating coils enclosed in a cylinder. Said cylinder is provided with a flue in its center, up which passes the flame of a large lamp, by means of which the coils are heated, and is also enclosed in an outer case which may contain either water or air. By means of this arrangement the air in a room is maintained at a uniform temperature and a constant ventilation secured.

Improved Fence.

Jacob Haish, De Kalb, Ill.—This invention consists of a sheet metal fence rail spirally twisted and provided with spikes excised from the body thereof, and turned on opposite sides; also in a fence post made of two closely joined metallic rods bent outward at corresponding points near the base.

Improved Hay and Straw Cutter.

John A. Cornish, Marshfield, Mo.—This invention consists in improving hay and straw cutters by the application thereto of a grinding plate that takes up the wear on the knife as fast as it occurs, a peculiar support for the cutter blade, and also novel means for operating the feed rolls. These cause the machine to operate with less labor and to cut the hay or straw more uniformly than is usually done.

Improved Piston Packing.

Stillman E. Chubbuck and Isaac Y. Chubbuck, Boston, Mass.—This invention consists in the improvement of steam packing for pistons, by combining, with the spring pressers that hold the cut rings in place at their proper expansion, non-radial hub arms and overlapping ring studs to prevent lateral displacement, and also in the peculiar construction of the heads of spring pressers, so that they may act at right angles to one ring and exert also a lateral pressure upon the other, the two sets of rings that break joint with each other being thus held perfectly steamtight against the piston cylinder.

Improved Circular Saw Planing Knife.

Joseph T. Tunis, St. Michael's, Md.—This invention consists in a new and improved method of planing down the kerf upon sawn material during the operation of sawing, by inserting in grooved holes near the circumference of the saw detachable planing knives having symmetrical sides and projecting alternately on opposite sides of the saw just far enough to plane down the kerf without wasting the material, the said knives being made with symmetrical sides so that they may be taken out and reversed when one edge becomes dull or blunted.

Improved Bed Lounge.

Frank Johnson, Omaha, Neb.—The seat is hinged at the front part. The head part is hinged to an inclined head piece of the lounge frame, and is to be swung in an outward direction like the seat. The inside of lounge frame and seat are provided with suitable mattresses, the cushioned head and seat being at the under side when the lounge is used as a bed, and thereby not exposed to rapid wearing out. The hinged section is provided with folding legs. The face board is detachable, and has to be taken off when the lounge is folded into a bed. It closes the open part between the seat and frame, and is firmly applied to lugs which enter recesses, and pass along extension grooves by sliding a board sidewise toward the head of the lounge, retaining it firmly thereon till detached by sliding it in opposite direction for opening the lounge. The lounge is quickly and easily changed into a bed, and *vice versa*.

Improved Binder Attachment for Harvesters.

Willis Wheelock, Decorah, Iowa, assignor of one half his right to William T. Baker, same place.—This is an automatic raking attachment for harvesters, so constructed as to collect the cut grain into a gavel and raise it to the binders' table. Suitable construction enables the binder to equalize the gavels by allowing the rake to operate only when a proper amount of cut grain has fallen upon the platform. The rake stands still for a short time at each end of the platform and then moves across the platform in a straight line, sweeping the cut grain before it. As the rake head moves back its forward part is raised out of the falling grain. The forward part of the rake head, while sweeping the grain before it, is kept from rising. To the inner edge of the platform is pivoted an apron, which is connected with the spring so as to be lowered as the spring is forced down by the advancing rake, and allow the gavel to pass to the receiver. As the rake head rises to return, the apron is raised by the spring to prevent the grain from falling from the platform, while the receiver is raised to deliver the gavel.

Improved Carriage Wrench.

Wilbur F. Rowe, Minneapolis, Minn.—The object of this invention is to provide, for the removing and replacing of the axle nut of carriages, an improved wrench by which the same can be done without soiling the fingers or letting the nut come in contact with dirt. A carriage wrench slides on the shank of an axle nut socket. The shank is partly polygonal, partly round, and is provided with a button or knob, by which the nut and socket may be turned, while the starting or finishing turns of the nut are given by the lever part of the wrench.

Improved Burial Case.

Jacob H. Forshay, New York city.—By an improved mode of fastening the lid may be applied and taken off in a few minutes without difficulty, the connection being made by fastening clamps which are provided with tapering grooves, and placed over the dovetailed wedge strips at the sides and ends of the body and cover of the case. The adjoining parts of the body and cover are provided with interlocking grooves and tooth-shaped projections, which extend around the whole circumference of the case, and have rectangular extension recesses, into which corresponding continuous strips of rubber are applied. By placing the cover on the body of the case, the apexes of the projections embed themselves tightly into the rubber lining, and form thereby a perfect and hermetically sealing joint as soon as the fastening clamps are applied.

Improved Mode of Connecting Pitmen to Fly Wheels.

James M. G. Mouck, Drakeville, Iowa.—A wheel has curved arms, one of which is provided with a slot. This construction adapts it for attachment of a pitman, by means of a wrist pin which passes through the end of a bar that is pivoted to the rim of the wheel, and is clamped in any adjustment by a screw nut. The slot is constructed upon a curve of a circle whose radius is the pivot of the bar. The object of the latter is to compensate for the loss, and prevent the breaking or giving way of the slotted arm, and also to overbalance the wheel on one side, so that it has no dead center.

Improved Toy Gun.

John C. Todd, Toronto, Can.—This invention consists of a disk-shaped piece of suitable material, provided with a groove along the circumference in which, by suitable fastenings, an elastic band is placed. A diametrical perforation of the disk serves as a guide chamber for the dart, the disk being provided at one end thereof with a segmental recess for easily taking hold of the end of the dart and the elastic band, and thus, by suddenly extending and then freeing the latter, sending out the projectile.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From June 12 to June 18, 1874, inclusive.

COOKING, ETC., BY LIQUID FUEL.—J. H. Thorp, New York city.

COMPOUND ENGINE.—W. Baxter, Jr., Newark, N. J.

DISTILLING EXTRACTS.—F. Walton *et al.*, New York city.

DRESS PATTERNS.—E. Butterick & Co., New York city.

FIRE ARM BAND HOOK.—E. Gaylord, Chicopee, Mass.

MAKING ICE, ETC.—C. P. N. Weatherby (of New York city), London, Eng.

OXIDIZING ANTHRACENE.—C. Rumpff, New York city, *et al.*

PROTECTION FROM FIRE, ETC.—J. A. Coleman, Providence, R. I.

RAILWAY CAR SPRINGS.—J. S. Barney, New York city, *et al.*

SEWING MACHINE ATTACHMENT.—J. J. Thompson, Goshen, N. Y.

SPIKE MACHINERY.—N. Tay, Medford, Mass.

SUPPLY VALVE.—W. Craig, Newark, N. J., *et al.*

TEMPERING STEEL.—[illegible] *et al.*, Fitchburg, Mass

Business and Personal.

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

For Sale—The patent for the American School Black-board Rubber, not yet issued. Work light, profits large. Sample and particulars, by mail post paid, on receipt of 25c. Joseph B. Walker, Inventor, Louisville, Kentucky.

For 2d hand Boilers, &c., see Logan's adv't.

No Keys, Key-seats, Set-screws, Bolts, or Pins used in fastening the Taper-Sleeve Belt-Pulley. Holds firmly; can't be thrown out of balance; easily moved; can't injure shafting. One pulley sent on trial to any part of the U. S. See last issue Scientific American. Address A. B. Cook & Co., Erie, Pa.

For Sale—One new side wheel Steamboat, 50 feet long—one propeller (new), 25 feet long, by S. E. Harthan, Worcester, Mass.

The Pickering Governor, Portland, Conn.

Tuck's Patent Piston Packing. Address Gutta Percha & Rubber M'f'g Co.," 26 Warren St., N.Y.

Cobalt and Nickel Salts and Anodes, the best coating for all metals, with instructions for Electro-plating. Chromium negative plates for batteries, three cents per square inch, and batteries for all purposes; the best known for power and constancy. G. W. Beardslee, 122 Plymouth St., Brooklyn, N.Y.

Portable Engines 2d hand, thoroughly overhauled, at ⅔ Cost. I. H. Shearman, 45 Cortlandt St., N.Y.

The Haskins Machine Co. Boilers are all tested and insured by the Hartford Steam Boiler Inspection and Insurance Co. Warerooms 46 Cortlandt St., N.Y.

Babbitt Metals—For the very best, send to Conard & Murray, Iron and Brass Founders, 30th and Chestnut Sts., Philadelphia, Pa. Write for Circulars.

For Small sizes of Screw Cutting Engine Lathes, address Star Tool Co., Providence, R. I.

Mechanical Expert in Patent Cases. T. D. Stetson, 23 Murray St., New York.

Sure cure for Slipping Belts—Sutton's patent Pulley Cover is warranted to do double the work before the belt will slip. See Sci. Am. June 21st, 1873, P. 389. eCirculars free. J. W. Sutton, 96 Liberty St., N.Y.

Linseed Oil Presses and Machinery for Sale. Perfect order. Very cheap. Wright & Lawther, Chicago, Ill.

Gas and Water Pipe, Wrought Iron. Send for price list to Bailey, Farrell & Co., Pittsburgh, Pa.

Forges—(Fan Blast), Portable and Stationary. Keystone Portable Forge Co., Philadelphia, Pa.

Boilers and Engines, Second Hand. Egbert P. Watson, 42 Cliff St., New York.

Taft's Portable Baths. Address Portable Bath Co., 156 South Street, New York city.

For Surface Planers, small size, and for Box Corner Grooving Machines, send to A. Davis, Lowell, Mass.

For economical Vertical Steam Engines, go to the Haskins Machine Co., 46 Cortlandt St., New York.

The "Scientific American" Office, New York, is fitted with the Ministure Electric Telegraph. By touching little buttons on the desks of the managers, signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price $5. F. C. Beach & Co., 263 Broadway, New York, Makers. Send for free illustrated Catalogue.

All Fruit-can Tools, Ferracute, Bridgeton, N.J.

Brown's Coalyard Quarry & Contractor's Apparatus for hoisting and conveying materials by iron cable. W. D. Andrews & Bro., 414 Water St., New York.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Lathes, Planers, Drills, Milling and Index Machines. Geo. S. Lincoln & Co., Hartford, Conn.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., or lithograph, etc.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 470 Grand Street, New York.

Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Ms

The French Files of Limet & Co. are pronounced superior to all other brands by all who use them. Decided excellence and moderate cost have made these goods popular. Homer Foot & Co., Sole Agents or America, 20 Platt Street, New York.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement. Andrew's Patent, inside page.

Automatic Wire Rope R. R. conveys Coal Ore, &c., without Trestle Work. No. 34 Dey street, N.Y.

A F. Havens Lights Towns, Factories, Hotels, and Dwellings with Gas. 34 Dey street, New York.

Best Philadelphia Oak Belting and Monitor Stitched. C. W. Arny, Manufacturer, 301 & 303 Cherry St., Philadelphia, Pa. Send for circular.

Temples & Oilcans. Draper, Hopedale, Mass.

Dean's Steam Pumps, for all purposes; Engines, Boilers, Iron and Wood Working Machinery of all descriptions. W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

Hand Fire Engines, Life and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

Pattern Letters and Figures, to put on patterns of castings, all sizes. H. W. Knight, Seneca Falls, N.Y.

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J. N. F. can copper his iron castings by using the recipe on p. 155, vol. 26.—L. C. will find a recipe for a good cement for leather on p. 119, vol. 28.—C. M. C. can repair his rubber bladder by following the directions on p. 268, vol. 30.—S. M. B. will find the wire gages described on p. 363, vol. 28.—Y. C. R. and all other readers of this journal ought to know that there is no machine for indicating buried gold, silver, or other treasure.—P. & F. B. are informed that the issue containing the account of the henery is out of print.—L. H. I. M. does not send data enough for the solution of his equation.—A. S. will find an explanation of the revolving wheel question on p. 27, vol. 28.—J. W. S., who enquires as to lenses and telescopes, has omitted to send his full address.—S. R. H. will find descriptions of tool steel on p. 21, vol. 31.—C. B. L. will find recipes for aquarium cement on p. 374, vol. 30.—F. H. C. will find directions for molding rubber on p. 363, vol. 30.

L. A. G. asks: Can you give me a good and cheap plan for constructing a cistern to gather soft water? I propose building one 30 feet long, and 10 feet wide and deep, laying bottom and sides with a 4 inch brick wall, laying the bricks in mortar of sand and fire clay (in equal quantities, mixed) with an arch on top, of 4 inch brick. A. A cistern built in this manner would not stand; a side wall 4 inches thick and 10 feet high, if built in a straight line, would be thrown down by the pressure of the earth on the exterior when the cistern is empty. A better way is to build it circular, say of twenty-two feet diameter, erect a brick pillar in the center of two feet diameter, and then throw the arch from the pillar to the exterior wall, extending around in a circle; in which case the span will be only ten feet, and the outside wall will resist the pressure of the earth. The crown should be some distance down from the surface of the ground, in order that the sides of the arch may be properly loaded. But even in this case it will be better to lay the bottom in two courses of brick, one on edge, and make the arch 8 inches thick.

G. C. R. asks how to remove ink stains from paper? A. Try a solution of chloride of lime in water.

W. A. D. asks: 1. Is there such a metal as Chabanneau metal, an alloy invented by one M. Chabanneau, to imitate gold? A. Yes, metal so called is used in the manufacture of cheap jewelry. 2. Will it wear equally as well as gold with the same care? A. We cannot say, having no positive knowledge. Probably not 3. How can I tell pure gold from an article that is merely washed or lightly plated? A. By its specific gravity, that of gold being 19·34. The imitation will be much less. 4. What fluid is used by the tinmen to make solder stick to tin? A. Hydrochloric acid saturated with zinc.

J. H. C. asks: 1. What would be the result if the star Arcturus should strike the earth? A. The earth, as an earth, would probably be destroyed. 2. Can you give me a recipe for a varnish for canvas which will not be affected by the heat of the sun, or make the canvas stiff? A. We know of no varnish that will answer your purpose.

S. C. H. says: 1. I wish to paste common tracing cloth on a paper background. What kind of paste can I use? I have tried albumen, which admits of the cloth peeling off. A. Gum tragacanth might be used. 2. I also wish to varnish the glazed surface. What kind of varnish can be used? I have tried white dammar varnish, and it does not dry. A. Mastic will probably answer your purpose.

W. S. V. says: Can you tell me what the enclosed substance is? It was found floating in the water in large quantities near Montauk, L. I., last summer. Fire and acids seem to have no particular effect on it. I tried acids, hot and cold, and left it in a coal fire under the coals for two hours, and in a wood fire about the same time, and it came out of the coal fire a little more brittle than this specimen which I send, broken from the same specimen before trying it. This specimen has not been tested. It melts before the blowpipe with soda. A. It consists of a siliceous skeleton which loses a certain amount of organic matter on ignition. Distributed through the mass are particles of sand. It is likewise impregnated with saline matters. It appears to be the *debris* of marine organisms compacted together by the action of the waves.

D. O. C. asks: 1. How many ounces of blood will 1 gallon of rich fresh cow's milk make? A. No reliable computation has been made. 2. How can I make the common sulphur match? A. Take phosphorus 4 parts, water 10 parts, fine glue 6 parts, red ocher or lead 5 parts, smalt 2 parts. Mix the glue with a little water, and convert by a gentle heat into a smooth jelly; put it into a slightly warm porcelain mortar to liquefy; rub the phosphorus down through this gelatin at a temperature of about 146° to 150° Fah. Add the niter, then the ocher or lead, and lastly the smalt, until the whole forms a uniform paste. The sulphur match should be dipped into the mixture in the usual way.

W. J. S. asks: 1. Which is the best way to regulate the temperature of an incubator by means of balanced valves? I have tried to work them by mercury in a bottle, and a float up the neck connecting with the valve; but the mercury does not expand enough to work it. A. Lengthen your tube of mercury and the result will probably be more satisfactory. 2. What are the shells of eggs composed of, besides lime? My hens eat their eggs as soon as laid if not watched, shells and all. I think that they do not find enough lime in their food to make shell. A. Take a quantity of bones, burn and pulverize them, and mix with the feed; this will give the requisite quantity of phosphate of lime.

B. T. G. asks: 1. Do candy manufacturers use poisonous articles in the coloring of candies? A. It has been stated on good authority that nearly half the candy manufactured contains, in the form of coloring matter and otherwise, really poisonous matter, and this is principally in what is called French confectionary. 2. Are our commercial teas (called China and Japan teas) adulterated in this country? A. Yes, but to a somewhat limited extent. 3. Is beet sugar manufactured to such an extent in the United States as to be called an article of commerce? A. The manufacture of beet sugar in this country is as yet comparatively in its infancy, but it promises much. 4. Are there any manufactories of sirup by a chemical process, with muriatic or other acid, out of old rags, etc.? A. For many years chemists have made sugar in the laboratory in this way as a curiosity, but we know of no one who makes a business of manufacturing sirup by this method. 5. Is it probable that an expert can invariably tell (by a decoction), within one cent, the commercial value of any kind and grade of tea? A. We have very little doubt but that such men can be found.

O. N. asks: Is not the grass left on lawns cut by lawn mowers injurious to the lawns? Wherever the cut grass remains, the lawn looks thin, dry, and dead. If the decaying grass destroys that on which it falls, in time it would exhaust the soil. The lawn looks much better before being cut than after. A. The change is probably due to the atmosphere of gases, heat, etc. generated by the decaying or fermenting vegetable substances, grass, etc., also to the partial absence of light.

A. asks: How can I make a cheap microscope? A. Every convex lens is in itself a microscope; the only difference between it and the larger or compound instrument is that, instead of viewing the first formed image, a second and still more powerful lens is used, which receives the image and still further magnifies it. The cost of microscopes is due to the necessary extreme perfection of the lenses used.

J. P. L. asks: How can I test a cellar for dampness? A. The easiest way for you to test for moisture in your cellar will be to provide yourself with a thermometer, a glass tumbler filled with water, and a piece of ice; then notice how low your thermometer, when placed in the tumbler, has to sink before any moisture begins to show itself on the outside of the vessel of cold water. The lower the temperature to which the thermometer has to sink before moisture is precipitated, the less there is of it in the moisture of the cellar.

M. M. asks: In refitting the bearings of an engine lathe, how can I best set the mandrel and face plate in the right position to the bed plate? The face plate is 29 inches in diameter. A. If the bearings of your lathe head are to be Babbitted, as your question indicates, set the lathe head in position by placing a parallel bar of iron between the centers of the lathe and apply a large square to the rod and the face plate of the lathe, which will denote the exact position for the lathe head. If the journals are of brass and require renewing, mark off their hight (from the bed of the lathe) by a trammel made from the hight of the center of the poppet spindle to the bed, and then mark them sideways by means of a square placed across the face of the bed of the lathe, placing the edge of the square exactly even to the bearing of lathe bed wherein the lathe head fits. Or, in the latter case, you may use the old brasses as a guide for marking the new ones, making such allowances as practice or the lathe demonstrates to be necessary.

W. S. W. asks: What is the principle of Bude lamp invented by Benjamin Taompson (Count Rumford)? A. The Bude lamp is an argand lamp, through the center of the burner of which a current of pure oxygen gas is passed, which enormously increases the brilliancy of the flame.

A. N. H. says: 1. In plating with nickel, it sometimes chips off. What is the cause and how can I remedy it? A. Extreme care should be taken to thoroughly cleanse and coat evenly with copper, by immersion in solution of blue vitriol for a short time. If properly prepared, you will probably find no further trouble. 2. How is the solution kept always neutral? A. By keeping sufficient surface of the anode exposed in the solution. 3. How is ivory dyed blue? By keeping the ivory immersed in a dilute solution of sulphate of indigo, partly saturated with potash, for some time. This will give you a fine blue.

W. B. V. says: Parties selling gasoline burners sell also a formula or recipe for preparing the gasoline, to render it safer: powdered alum, soda, salt, etc. But the seller also offers it already prepared at 40 cents per gallon. Is all that stuff necessary to render the gasoline safer or better, or is it to insure the sale of it at 40 cents? Is not pure gasoline as safe as the mixture? A. No mixtures of this character impart safety. No burning oils are safe except those of high specific gravities and boiling points.

W. F. W. asks: Will a band saw take the place of a common straight mill saw for sawing lumber from hard and soft wood? A. Band saws are used for the above purpose with much success. See illustrations of ship timber band saws in SCIENTIFIC AMERICAN, p. 175, vol. 28.

O. C. L. asks: 1. How can I make a simple self-registering anemometer? A. There are several forms of this instrument; the most usual consists of a small vane with fans, which the wind turns; the velocity is deduced from the number of turns made in a given time, which is measured by an endless screw and wheel work. 2. How can I prepare paper which will be discolored at any point by the simple passage of a moderate current of electricity through it? A. Soak the paper in a solution of iodide of potassium and starch. 3. Will you give me a recipe for making lemon sugar that will not injure the health? A. Use tartaric acid and powdered sugar in the proportion of one to four.

J. J. H. asks: Can you give me a good and cheap recipe for making laudanum? A. Take of opium (moderately fine powder, dried) 2½ troy ozs., water and alcohol each, 1 pint; diluted alcohol sufficient quantity. Macerate the opium for three days with the water with frequent agitation, then add the alcohol and continue maceration for three days more. Introduce the mixture into a percolator, and, when liquid has ceased to pass, pour the diluted alcohol upon it until 2 pints have been obtained.

W. W. asks: What is the length of 8 centimeters in inches? A. 3·1496+ inches.

F. M. B. says: I have a self-inking job printing press; and when I undertake to print a large form (the type being evenly planed and impression screws being evenly adjusted), I get an impression on only one side of the form, and the same is true when I undertake to print a small address card. Is there a simple method by which I can ascertain if the plate is perfectly parallel with the platen? A. The fact that your form gives an impression on one side only is proof that the platen is not set parallel with the bed, and the fault can only lie in the adjustment screws of the platen. The maker of the press can undoubtedly supply you with a gage to set the platen, but proper adjustment of the platen screws will (if the faces of the bed and platen are true) set them perfectly parallel to each other and give an even impression.

T. D. asks: Is there any market for sumac in bales, unground, and is there a way to get its properties in a liquid form? A. There are many varieties of this shrub, some of which are used in tanning and dyeing, and some in medicine. It is used also instead of galls in the manufacture of ink. Rhus wine is also made from this. The market for it is very limited, and the supply exceeds the demand.

G. M. asks: Is there any such thing as a mermaid living in the sea? If so, where can it be found and to what class of fish or animals does it belong? A. Descriptions of several such monsters were anciently published, but Sir Humphrey Davy asserts that a human head, *mamma*, and a fish's tail are absolutely incompatible in one body.

A San Francisco gentleman says (in commenting on our reply to C. H. M., who asked: "Which is the healthiest State in the Union?" in which we said: That State in which the greatest regard is paid to religion, law, and education. In respect to physical advantages most are in the first rank): "You bigoted asses, what has religion to do with health to a sensible man?" A. Our correspondent will peruse for his enlightenment the death rates of ministers of the Gospel, of Quakers and of communities professedly following a religious life, with those of his acquaintances among the various "hells" for which San Francisco was at one time mostly celebrated.

A. J. S. asks: Does the wind ever change directly from the east to the north, or does it always go around by south and west to the north? A. The wind may change from the east to the north, or from east to south and thus to the west. If it follows the latter course, the clearing of the weather is regarded as permanent. If it changes from east to north, the weather is regarded as uncertain.

W. H. W. asks: To what uses is verdigris applied? A. Verdigris in an impure state is much used as a green pigment. In the pure state, it is employed in medicine.

N. H. says, in reply to a correspondent who asked how to take the dirt off a machinist's hands, some time ago: I find that sawdust is good. Put on a coat of good soap, then rub it off with pine sawdust.

J. S. K. says: I cured a rusty tea kettle as follows: I got a piece of quick lime about as large as my fist and slacked it in the tea kettle that evening, filling the kettle full of water and letting it stand on the warm stove; the next morning I emptied the lime water into a bucket and rinsed the kettle, and it was used during the day as usual; at night the lime water was poured back into the kettle and warmed, and the next morning again poured out, and so repeated, the next night making three nights in all, and that teakettle was cured: It has not shown a symptom of rust in the water since. I will state that every night the kettle is emptied and left open to dry.

C. R. says, in reply to a correspondent who asked for explanation of "jerked" beef: The whites who settled Central and South America found beef, used by the Indians, dried in long strips, and it is so prepared by the Guachos and others to this day. The native name for it is *charqui*, and *charqui* beef in English speech very soon and easily became "jerked" beef.

P. D. R. says that the spoon and tumbler experiment can be tried with the same tumbler by first trying the tumbler with the spoon in it, and then, if the hot water does not break the glass, trying the same glass (after it has returned to its normal state) without the spoon. If it breaks then, the inference would be that the spoon saved the glass.

F. C. R. says that poke root (*phytolacca decandra*), sliced thin and laid about a house, will destroy cockroaches quicker than any other poison. It never fails.

T. D. says: Your answer to P. D. R., p. 396, last volume, about the spoon and tumbler, has placed you in a dilemma from which you might be extricated by trying first the spoon in the tumbler and then pouring in the hot water: and if the glass did not break, then try the tumbler alone. If it broke, then find out the reason why. This spoon and tumbler business is an instance of how remarkably prone men are to take up half an idea without trying to find out the principle involved. Why does hot water break a tumbler at all? Answer: Because the glass heated at one place expands too rapidly for the unheated part and breaks. But if you take a spoon, or anything else, and prevent the sudden heating of the bottom of the tumbler by gradually pouring the hot water and heating the sides as fast as the bottom, you will probably save the tumbler.

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

A. says: Enclosed is a specimen of what seems to be one rose growing out of the center of another. There is another example of the same on the same bush. A This abnormal rose is not of a character sufficiently unusual to rank it among monstrosities. The second rose is upon a continuation of the stem. In some instances the second flower is found upon a shoot issuing from below the calyx. This is sometimes noticeable among rhododendrons.—F. M.—One specimen consists of delicate crystals of carbonate of copper. The other consists of a quartzose rock, stained with silicate of copper and containing a little magnetic oxide of iron.—J. H.—It is basanite or touchstone. It is a flinty jasper, used on account of its hardness and black color for trying the purity of the precious metals. The color left on the stone after rubbing the metal across it indicates to the experienced eye the amount of alloy.—M. F. F.—No. 1 is specular iron ore. No. 2 is blende or sulphid of zinc in quartz.—C. H. B.—It is a variety of brown hematite, or the hydrated sesquioxide of iron.

F. K. asks: Can you give a recipe for making good Bologna sausages?—G. W. F. asks: How are the suction bellows placed in a parlor reed organ? By what mechanism are the pedals kept in an upright position? How is the tremolo fan made, and where is it placed?—C. asks: Is there anything in the shape of green japan in use, or what is the green paint that will stand baking?—G. F. L. asks: Will some one tell me how to bud rosebushes?—A. J. asks: How many square feet of surface should a parachute have to sustain a man's weight, say 150 lbs., in the air?—W. W. asks: What is Spanish wax?—J. F. A. asks: How thick is the helmet used by divers? How is the water kept out? How is it fastened to the diver's head?

COMMUNICATIONS RECEIVED.

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

On a Boiler Explosion in Michigan. By M. A. K., and by K. P. C.

On Electricity and Magnetism. By C. E. G

On Solar Attraction, etc. By S. W. R.

On an Arrow Head. By C. M. B.

On a Lunar Atmosphere. By W. F. Q.

On Light, considered Metaphysically D. H. B. Jr.

On Early Steamboats. By D. R. P.

Also enquiries and answers from the following:

J. E.—D. E.

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.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

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

[OFFICIAL.]

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June 16, 1874,

AND EACH BEARING THAT DATE.

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Plow, F. Renak	152,007
Plow, W. Warriner	152,201
Plow and cultivator, sulky, D. A. Smalley *et al.*	152,018
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Wheat scourer and cockle extractor, L. Arentsen	152,061
Whiffletree, Lewis & West	151,990
Window bracket and shelf, B. F. Wyman	152,207
Wire, measuring and cutting, E. Manley	152,139
Wrench, D. P. Foster (r)	5,914

APPLICATIONS FOR EXTENSIONS.

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

20,100.—TRANSFERRING CARS.—W. Wharton, Jr. Sept. 2.

20,103.—HARVESTER RAKE & REEL.—McClintock Young, Jr. September 2.

20,234.—PLANING VALVE SEATS.—C. B. Long. Sept. 16.

EXTENSION GRANTED.

28,755.—PORTFOLIO.—J. Nelson Jacobs.

DESIGNS PATENTED.

7,491.—OYSTER DISHES.—J. W. Boteler, Washington, D.C.

7,492.—GAS BURNER.—E. Evans, Lynn, Mass.

7,493.—GLASS BOWLS.—A. H. Heisey, Pittsburgh, Pa.

7,494.—SHOW CASES.—A. Holthaus, St. Louis, Mo.

7,495 & 7,496.—CENTER PIECES.—S. Kellett, San Francisco, Cal.

7,497.—HEATING STOVE.—A. Wemyss, Philadelphia, Pa.

TRADE MARKS REGISTERED.

1,831.—CIGARS.—R. C. Brown, New York city.

1,832.—COTTON DUCK.—Brinckerhoff & Co., N. Y. city.

1,833 & 1,834.—BAGS AND DUCK.—Brinckerhoff & Co., New York city.

1,835.—PREPARATION OF TRIPE.—Gall & Co., Cincin., O.

1,836.—CEMENT.—J. C. Harris & Co., Philadelphia, Pa.

1,837.—STEAM ENGINE.—Herchelrode & Hill, Dayton, O.

1,838.—STOVE POLISH.—Hoppings, New York city.

1,839.—LUBRICATING OILS.—Wells & Co., Parkersburg, W. Va.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade Mark	$25
On filing each application for a Patent (17 years)	$15
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On application for Design (7 years)	$15
On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA JUNE 10 to 15, 1874.

3,541.—W. L. Horne, Chicago, Ill., U. S. Machine for regulating the pressure of gas and other fluids, called "Horne's Pressure Regulator for Gas and other Fluids." June 10, 1874.

3,542.—J. W. Ricker, Sherbrooke, P. Q. Improvements on a washing machine, called "Ricker's Washing Machine." June 10, 1874.

3,543.—Y. M. C. Johnson, Franklinsville, Randolph county, N. C., U. S. Improvements in shoemaker" combination tools, called "Johnson's Improved Combination Tool for Shoemakers' Use." June 10, 1874.

3,544.—T. Hazard, Wilmington, Clinton county, O., U. S. Extension of No. 2,598, first period. "Hazard's Straw and Hay Cutter." June 10, 1874.

3,545.—T. Hazard, Wilmington, Clinton county, O., U. S. Extension of No. 2,598, second period." "Hazard's Straw and Hay Cutter." June 11, 1874.

3,546.—I. P. Magoon, St. Johnsbury, Caledonia county, Vt., U. S., and H. Fairbanks, same place. Reissue of No. 2,736, for "Magoon's Locomotive Feed Water Heater." June 15, 1874.

3,547.—J. H. Wentworth, Boston, Suffolk county, Mass., U. S. Improvements in portable ranges and cooking stoves, called "Wentworth's Portable Range or Cooking Stove." June 15, 1874.

3,548.—H. Jefferson, Toronto, York county, Ont. Composition of matter to be used in the manufacture of artificial stone or marble, called "Patent Victoria Stone." June 15, 1874.

3,549.—C. H. Hutchinson, Manchester, N. S., U. S. Improvements on balanced valves for steam engines, called "Hutchinson's Improved Balanced Valve." June 15, 1874.

3,550.—D. H. Packard, Brockton, Plymouth county, Mass., U. S. Improvement on boxes for the toes of boots and shoes, called "The Packard Molded Box Toe." June 15, 1874.

3,551.—J. T. Jones, Ilion, Herkimer county, N. Y., U. S. Improvements in treadles for sewing machines, called

3,552.—J. Gould, Clinton, Allegheny county, Pa., U. S. Improvement in animal traps, called "Gould's Animal Trap." June 15, 1874.

3,553.—M. B. Marcum, Cameron, Clinton county, Miss., U. S. Improvements on car couplings, called "Marcum's Car Coupling." June 15, 1874.

3,554.—B. T. Babbitt, New York city, U. S. Improvements on processes for coating caustic alkalies, called "Babbitt's Process for Coating Caustic Alkalies." June 15, 1874.

3,555.—B. T. Babbitt, New York city, U. S. Improvement in caustic alkali packages, called "Babbitt's Caustic Alkali Package." June 15, 1874.

3,556.—W. H. Bond, Syracuse, Onondaga county, N. Y., U. S. Improvements on a hot air furnace, called "Bond's Hot Air Furnace." June 15, 1874.

3,557.—J. C. Waterhouse, Sherbrooke, P. Q. Improvements on sewing machines, called "The Climax Sewing Machine." June 15, 1874.

3,558.—E. H. Murray, St. Paul, Ramsey county, Minn., U. S. Improvement on food from wheat, and process for preparing the same, called "Murray's Granulated Wheat." June 15, 1874.

3,559.—C. C. Barnes, Sackville, Westmoreland county, N. B. Improvements on rotary pumps, called "Barnes' Rotary Pump." June 15, 1874.

3,560.—J. D. Patton, Treverton, Northumberland county, Pa., U. S. Improvements on apparatus for manufacturing gas, called "Patton's Apparatus for Manufacturing Gas." June 15, 1874.

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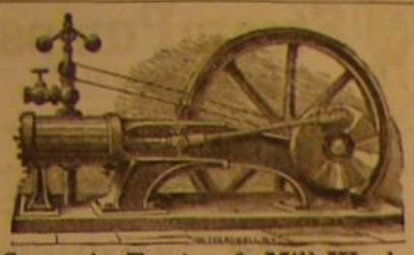
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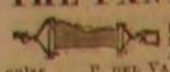
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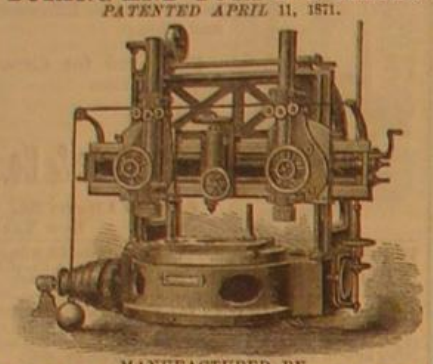
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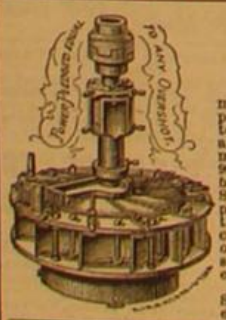
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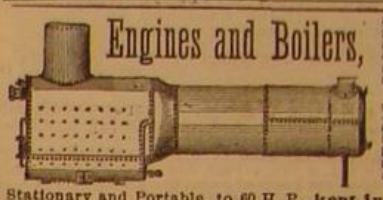
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Vol. XXXI.—No. 4. [NEW SERIES.] NEW YORK, JULY 25, 1874. [$3 per Annum, IN ADVANCE.

IMPROVED HOISTING MACHINE.

The machine illustrated in the annexed engraving is the result of a series of experiments in adapting the friction clutch pulley, of the same manufacturers, as a means of transmitting the power, in combination with a new improved shipping apparatus and stop motion. All parts of the machine are inclosed in a single iron framework or hanger, so constructed that the bearings are less liable to get displaced or out of line than when bolted in separate parts to the wood framework.

We represent the device in perspective, Fig. 1, and in section, Figs. 2 and 3. The frame of the apparatus consists of the two main standards, A, Fig. 1, connected and held in their position by means of the three studs or bolts, B, the two upper bolts or studs having shoulders inside, against which the standards bear when the outside nuts are screwed up; and the lower bolt being incased by the sheath or pipe, C, so that, when the nut is taken off either end, the bolt may be drawn out. The sheath, C, can be removed in case of necessity, for repairs or renewal of any portion of the machine in case of accident or wear. D is the main shaft, having its bearings in each end of the frame standards, A. Upon the former are the worm gear, E, drum, F, and the small gear, G, which meshes into the gear, H, Fig. 2, which drives the stop motion disk, I. This disk has a V scroll cut from a point near its hub or center to its circumference; and when the drum, F, revolves, also rotates by reason of the gearing described. On the face of the scroll are adjustable stops for the purpose of striking the shoe, J, which traverses the radial slot in the shipper wheel, K. When the shoe is moved by the stops on the scroll wheel, this actuates the shipper rock shaft, L; and its crank, on its inner terminus, moves the sliding shipper bar to unship the clutch which is driving. This stop motion is independent of the stop motion usually provided in the hatchway on the shipper rope, being provided to prevent accident in case the latter should become disarranged or inoperative, as quite frequently happens.

Another important feature of this invention relates to stopping the revolving worm shaft, M, promptly at the same time the clutch is unshipped. This is accomplished by means of a brake, shown bearing against the worm in the oil receptacle, N, attached to one side of which is a bolt, O, adjustable by two check nuts to regulate the pressure of the shoe against the worm and a set screw on the opposite side. The top of the bolt is provided with a cam strap, which encircles the shaft adjoining the crank (which throws the shipper bar). The same movement of the shaft, L, which operates the shipper bar, also operates simultaneously to draw up the brake shoe against the worm to stop the revolution of the shaft, M, and thereby it prevents the platform from traveling by the point where it should stop, at the top or bottom of the hatchway, or at any intermediate point where it is required to stop. These machines are furnished with platforms when desired, the latter being constructed of new patterns, and extra strong in their safety parts.

All further information required, with circulars, may be obtained by addressing the inventor, Mr. Volney W. Mason, post office lock drawer 33, Providence, Rhode Island.

FIG. 1.

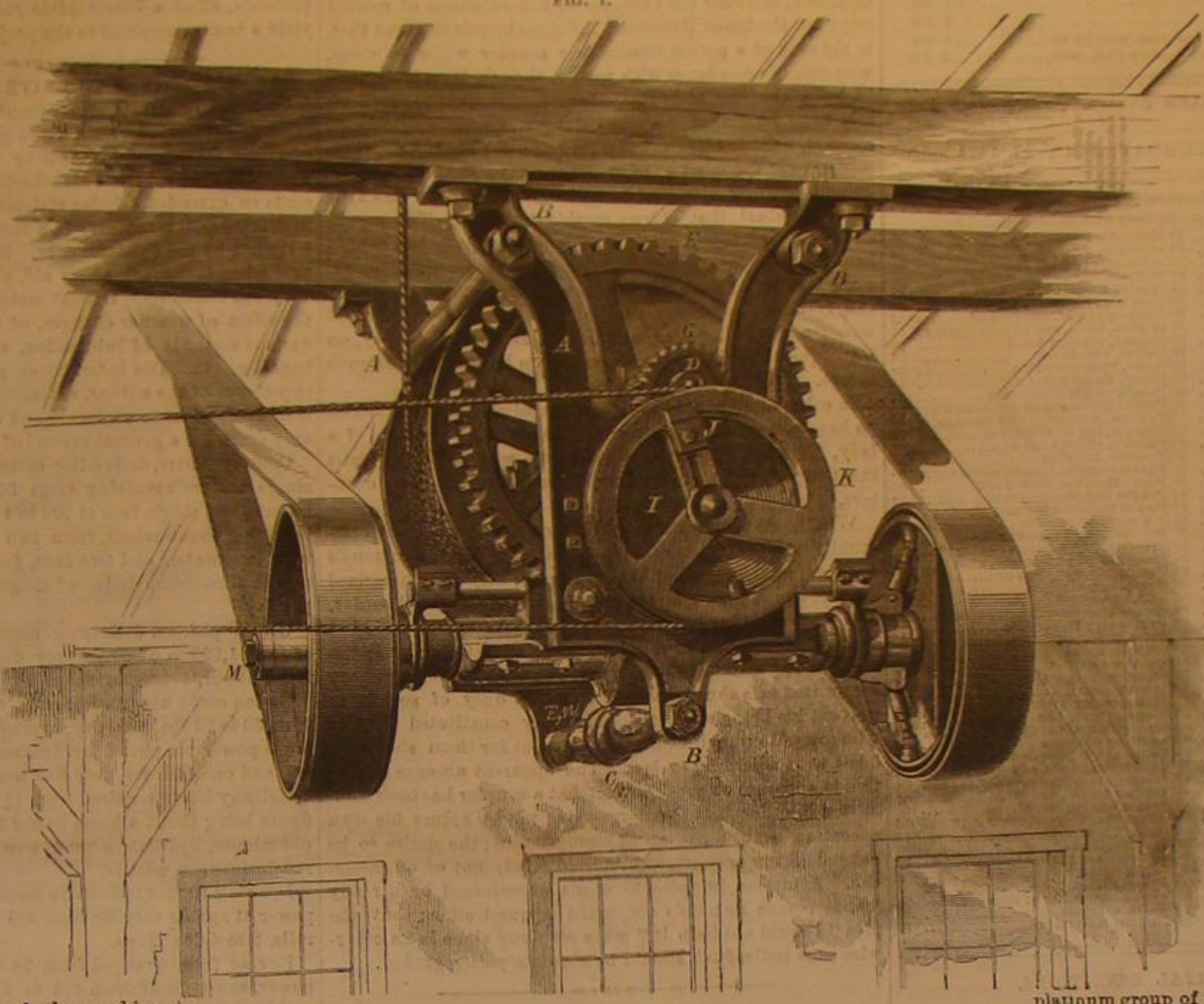


Fig. 2

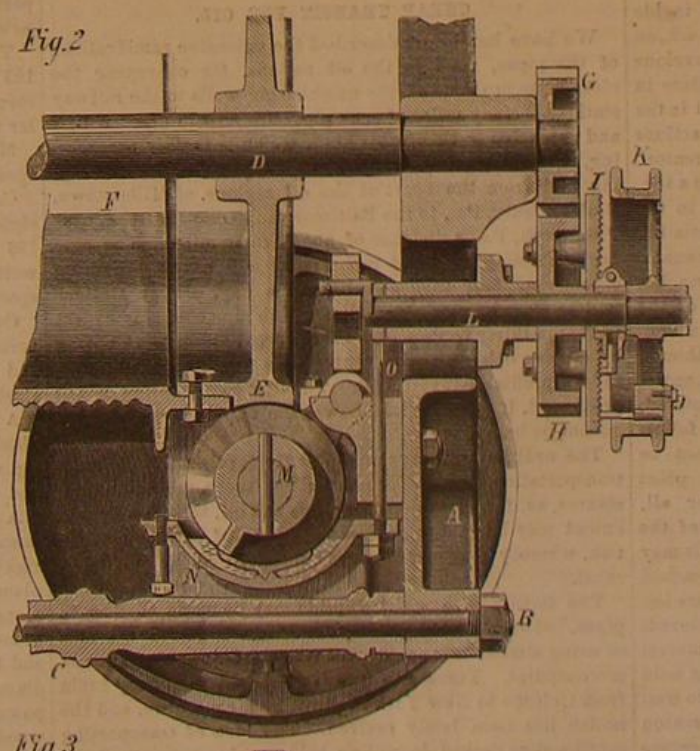
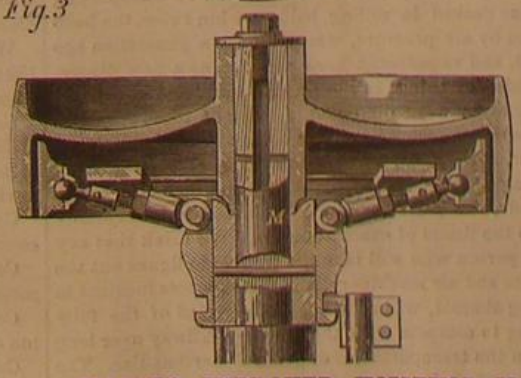


Fig. 3



MASON'S IMPROVED HOISTING MACHINE.

The Magnetic Metals.

It is well known that, besides iron, there are a few other metals possessing magnetic properties, namely, nickel and cobalt in a strong degree, manganese and chromium in a feebler one. Mr. W. F. Barrett, in an article in the *Philosophical Magazine*, has pointed out the similarity of these metals to each other in their physical and chemical properties.

Thus, as to specific gravity, that of the thirty-eight known metals ranges from lithium, 0 50, to platinum, 21 5, a difference of nearly 21; whereas those of the three strongly magnetic ones are iron, 7 8, nickel, 8 3, cobalt, 8 5, where the extreme difference is only 0 7. Their specific heat is nearly identical; their atomic one is the same; so also their conductivity for sound, heat, and electricity. Their dilation by caloric, and the amount they lengthen by mechanical strain, are also identical. The enormous cohesive power of iron, nickel, and cobalt, in the solid state, signalizes these substances as the most tenacious of metals, and their melting point is only exceeded by the platinum group of metals. They are not volatile at the temperature of the hottest furnace, but only by the electric spark, when they yield very similar spectra. As to their chemical properties, the combining weight of iron is 56 0, nickel, 58·5, and cobalt the same. Chemists class these three metals in the same group, from the similarity of their chemical behavior, and also the identity of their combining energy or atomicity.

What has been said concerning the likeness of iron, nickel, and cobalt, in many respects holds true of manganese and chromium. The former has latterly been used to replace nickel in the alloy of German silver. The compounds of all these five metals are conspicuous for the brilliancy of their colors. This uniform coincidence suggests the practical inference that nickel and cobalt might be obtained in a malleable and ductile condition when submitted to a process similar to that by which wrought iron is produced.

Gas Pipes Fatal to Trees.

J. Boehm says: Cuttings of willow, the lower ends of which were placed in flasks containing a little water and filled with coal gas, developed only short roots, and the buds on the upper parts died shortly after unfolding in the air. Of ten plants in pots (varieties of fuchsia and salvia), among the roots of which coal gas was conducted through openings in the bottoms of the pots, seven died in four months. To show that the plants were killed, not by the direct action of the gas, but in consequence of the poisoning of the soil, several experiments were made with earth, through which coal gas had passed for two or three hours daily for two and a half years. The rootlets of seeds sown in this soil remained very short, and soon rotted. A plant of dracæna was re potted in the soil; in ten days the leaves dried up and the roots died. The author thinks these results sufficiently account for the fact that trees planted near gas pipes, in streets, so often die; and recommends the inclosing of gas pipes in wider tubes, having

openings to the air, and through which currents could be maintained by artificial means. Such a plan is still more to be recommended on hygienic grounds, since it has been shown, by Pettenkoffer, that infiltration of coal gas, through the soil, takes place even into houses not supplied with gas.

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 $3 00
One copy, six months 1 50
CLUB RATES { Ten copies, one year, each $2 50 ..... 25 00
Over ten copies, same rate, each 2 50

VOLUME XXXI, No. 4. [NEW SERIES.] *Twenty-ninth Year.*

NEW YORK, SATURDAY, JULY 25, 1874.

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MORBID MENTAL CONDITIONS.

There is an old saying that "every man has a bee in his bonnet," which, being translated, means that we are each, on some one topic, slightly insane. Somewhere in the marvelous organism of the brain there is a weak spot; some place in the connection between mind and body is at fault; and in the exercise of certain faculties, as a consequence, our actions are less governed according to the dictates of a sound reason. We are not prepared to vouch for the accuracy of such a theory, or to adduce scientific proof in its support; but in the daily life of every one, instances apparently substantiating the notion may be constantly encountered. Take, for example, the search for perpetual motion, which in some reaches a mania, or, indeed, the efforts made for solving any of the problems which Science demonstrates to be beyond peradventure insoluble. This is not confined to the ignorant, though perhaps such a class are in excess; for there are men, scores of them now living, some we have ourselves encountered, who, while well versed in philosophy, and who will follow the mathematical demonstration that a circle cannot be squared or a perpetual motion constructed, point by point admitting the truth of every step, will yet, after all, nevertheless find it impossible to divest themselves of the idea that, by some hook or crook, the wished-for result may be obtained. Or, conversely, they may see results reached which their reason and knowledge must teach them are impossible, either in principle or from the means employed, without the addition of hidden or extraneous circumstances, and yet they will grasp at the apparent proof, and even hold it out to the world as genuine, simply because it goes to confirm their secret and cherished ideas which their very reason prevents them openly avowing. Such cases, mere ignorance being eliminated from consideration, we may term the mildest form of the "bee in the bonnet," and starting from them, as it appears, may be traced a whole series of mental defects, reaching perhaps up to actual monomania.

We mention the above as a common and harmless instance of the triumph of will or desire over reason and judgment. As the beginning of a special category of human actions, which, did we believe in the doctrine used by some, that spiritual beings unseen govern men's every doing, we should say were directed by a demon of perversity. Passing through all intermediate grades, considered in their ascending order, in proportion to their hurtful effects upon society, the end seems to be found in morbid impulse, in that strange condition which Professor Hammond, in his recent able lecture on the subject, defines as a state "in which the affected individual is impelled consciously to commit an act which is contrary to his natural reason and to his normal inclinations." We would not have confounded the feelings which impel an educated man to seek the perpetual motion, and those, which perhaps all of us have felt, when on the verge of some high eminence, to cast ourselves down; but while they differ in point of time, one extending over years and the other over seconds, there appears, in certain cases, in both a morbid element which, in its result of overcoming reason, lends to them a similarity sufficient to class them as extremes of a like mental action.

At the present time, however, when the plea of insanity is so frequently interposed in courts of law to shield the criminal from the consequences of his guilt, too great care cannot be exercised in approaching or admitting the existence of a mental state which tends to destroy the responsibility of a person for his own actions. How fine a distinction may be drawn, showing the existence or non-existence of morbid impulse, Professor Hammond indicates by pointing out that, in the case of a person committing murder while delirious, who acts in accordance with reason, though it may be perverted at the time, and in that of another who, supposing himself to be imminent to a great danger, commits suicide to avoid it, neither acts from morbid impulse; but if a delirium acts so over the mind as to convince a man that some one is going to murder him, and hence he lies in wait for and kills that individual, that is true morbid impulse. The person suffering is perfectly aware of his wrongdoing, but cannot help performing the action. Dr. Hammond mentions repeated cases of such impulses impelling men to murder, and instances especially that of Jesse Pomeroy, the child who recently killed his playfellow in Boston. The boy, on being questioned, asked to be put where he could not do such things.

In other cases people have been impelled to throw vitriol on handsome dresses, and we are aware of an instance of a lady, for some time known in society, who could not resist the temptation of stealing small articles from shop counters.

What to do with such people is a question which the community sooner or later must solve, and Dr. Hammond's answers, as the result of his experience, may be summarized as follows: A person aware of the influence of the disorder, and knowing that he cannot resist it, is bound to put himself under suitable physical restraint, so as to render it impossible to yield. If he does not, then, when shown to have committed acts thus impelled, it is the duty of society to prevent his being at liberty. Morbidly constituted persons who commit crime because it is pleasant for them should be dealt with according to law. The apparent absence of motive is apparent only. The fact that a murder has been committed in order that the perpetrator might secure his own execution is not a palliating circumstance; the desire to be hanged is the evidence of a morbid mind, not of an insane one. A morbid impulse to crime experienced by a really insane person demands continued sequestration; but the plea "I could not help it," when standing alone in an otherwise sane individual, should be absolutely disregarded.

CHEAP TRANSIT FOR OIL.

We have heretofore described the extensive ramifications of the pipes, used in the oil regions, for conveying the oleaginous products of the neighboring wells to the railway stations. Many miles of such pipes are now in use. A new and extensive work of this kind, which is rapidly progressing, is the oil pipe of the Pittsburgh Pipe Company, now being laid from the heart of the oil regions, at Millerstown, Butler county, Pa., to the Baltimore and Ohio Railroad, near Pittsburgh, Pa., a distance of about forty miles. The pipe has a dismeter of three inches, and will have a delivering capacity of four thousand barrels a day. Relay stations will be placed every five miles. The pipe company expect to charge thirty cents a barrel for pipage, the present charge by railway being fifty-five cents. This will, doubtless, prove to be a profitable investment. The first cost of pipes is not great, and, if properly laid down, the expenses of working cannot be heavy.

The ordinary railways undoubtedly furnish the cheapest transportation for most products; but there are some substances, as, for example, water, gas and oil, that to a certain extent may be said to possess the power of self-transportation, whereby they can be moved cheaper than by railway or canal.

The facility with which liquids may be made to flow in pipes, between distant places, has often suggested the idea of using similar means for the transportation of grain and merchandize. Years ago it was proposed to convey grain from Chicago to New York in pipes, by air pressure, and the notion has been lately revived. The idea of transporting merchandize packed in rolling balls, within tubes, the balls to be driven by air pressure, was patented a generation ago in England, and re-patented here recently, as a new discovery. Wonderful things in the way of speed and cheapness of transportation were predicted in favor of these schemes. But the predictions were not based upon the mathematics of the subject. After all, whether the project relates to so ideal a thing as music, or so practical a matter as the carrying of goods, the performances of mankind are inexorably confined to the limits of exact numbers. We think that any intelligent person who will take the trouble to figure out the cost of pipes and air machinery, and the expenses incident to the working thereof, will soon become satisfied of the folly of expecting to compete with the ordinary railway over long distances in the transportation of general merchandize. The pneumatic system is a good motor for short lines in cities. But it stands no chance with the common railway, economically considered, on long lines through the open country.

Oil, water, and gas are exceptional commodities. These, when placed in pipes, will flow of themselves; and if the apparatus is properly arranged, of the right size, almost any extent of distance can be easily overcome. Thus, the city of New York is supplied with water which flows through an underground tube from Croton Lake, Westchester county, a distance of some forty miles, while the street piping, by which the water is locally distributed, has a total length of some two hundred miles. In view of the cheapness and facility with which liquids may be transported in pipes, it would seem as if this method might be employed with great advantage to convey oil, from its fountains in Western Pennsylvania to Philadelphia and New York. The present cost of transporting oil by rail from Venango and Butler counties to New York is $1.20 per barrel. The pipe system would, probably, effect a considerable reduction over this cost, and yield a handsome profit to the projectors.

POWER REQUIRED TO DRIVE COTTON MACHINERY.

The New England Cotton Manufacturers' Association have recently performed a good act in publishing a little "Manual of Power," prepared for them by the well known engineer, Mr. Samuel Webber, of Manchester, N. H. Mr. Webber presents an extended tabular statement of the power absorbed in driving mill machinery in a large number of mills, as determined by the dynamometer. Some of the machinery was new when tested, some very old, some in good and some in very bad condition. Special tests were made to determine the effect of weather changes, of different kinds of oils and various methods of lubrication, of altering the method of banding, etc. The information given is derived from the experience of the author, extending over several years, and is of great value to engineers and manufacturers. We have only space for a general *résumé* of results.

Cotton openers, delivering cotton loose on the floor, with single beaters revolving from 532 to 820 revolutions per minute, and single fans at 700 to 1,600 revolutions, required, including countershaft, from two to over six horse power: with two beaters and two fans, four and a half to six horse power. The cotton delivered ranged from 3,000 to 10,900 lbs. per day.

Cotton pickers, delivering cotton in the lap, at the rate of from 1,000 to 5,000 lbs. per day, required from 3 to 13½ horse power, averaging about 2½ horse power per 1,000 lbs.

Cotton cards absorbed from 2 to 9 horse power, carding from 30 to 76 lbs. per day, averaging about one twentieth horse power per pound for finishers, a third more for breakers, and one fifth for very fine work.

Railway heads required from 1¼ to 2½ horse power, a usual figure being about a horse power for 9 inch rolls at 10 yards per minute, and half a horse power for 1¼ inch rolls at 300 revolutions per minute.

Drawing frames indicated a resistance of from ¼ to 1¼ horse power at speeds varying from 200 to 400 revolutions, 3 to 5 rolls, 2 to 4 doublings.

Roving frames ranged from 28 to 276 spindles per horse power, at speeds of from 475 to 1,350 revolutions. A fair performance would seem to give about 150 spindles per horse power, at 1,200 revolutions.

Throstle spinning required a horse power for from 65 to 165 spindles, the latter at 2,685 revolutions of the flier, the former at 5,000. Ring spinning absorbed very nearly similar power.

Mule spinning gave 200 to 280 spindles per horse power, speeds of spindles ranging from 3,000 to 5,000 revolutions.

Cotton looms required usually about one sixth or one eighth horse power, at 120 picks per minute. Looms making 156 picks per minute, on Nos. 15, 16, and 20 warp and weft, ran 5·1 per horse power. Others, at nearly the same speed, on finer goods, ran 9 and 10 per horse power.

Cotton spoolers, at 100 revolutions, required 0·2 to 0·3 of a horse power, twisters about three fourths of a horse power, and warpers 0·11 to 0·17; dressers 2 horse power, and slashers 1½ horse power.

A circular saw, 18 inches in diameter, sawing 3 inch hard plank, gave 1·27 horse power; and a saw, 9 inches in diameter, cutting 1 inch pine board, 1·6, their speeds being 1,300 and 4,000 respectively.

A small lathe, turning ⅜ inch iron, took 0·09 of a horse power, and a larger lathe, turning 1 inch iron, 0·21. An upright drill, boring a ¾ inch hole, absorbed 0·16. A crank planer, cutting with a two inch stroke, required 0·23, and a planer with a five feet table took, when making 4 feet length of cut, 0·25. Three polishing wheels, of 12 inches diameter and 1½ inches face, absorbed 1·15. A grindstone, 6 feet in diameter and 12 inches face, grinding axes, took 3 horse power, while another, 6½ feet diameter, grinding axes, in wooden boxes, absorbed 11; and a stone, 3 feet 10 inches in diameter and 11 inches face, required 7·8.

Wool cards absorbed 0·9 to 1·27 horse power, at 96 to 130 revolutions; jacks, at 2,457 revolutions, 0·65 to 0·78; and looms, making 65 to 95 picks, took 0·4 to 0·6.

Coefficients of friction on shafting ranged from 0·0336 to 0·759, a good average result being about 0·05.

Reviewing the whole series of results, we deduce the following as fair approximate rules for estimating power:

Cotton openers, one horse power per thousand pounds cotton delivered.

Cotton pickers, three horse power per thousand pounds cotton delivered.

Cotton cards, one twentieth horse power per pound cotton delivered per day.

Cotton cards, best practice, one fortieth horse power per revolution per minute.

Railway heads, breakers, one horse power per each ten yards per minute.

Railway heads, finishers, 0·501 horse power per revolution per minute.

Drawing frames, 0·002 horse power per revolution per minute.

Spindles, 0·008 horse power per spindle per 1,000 revolutions.

The very great irregularity of the results given in the pamphlet indicates how vast are the losses experienced in every mill where machinery, badly made, out of repair, or badly lubricated, is allowed to run. We have little doubt that there are many mills in the United States where a knowledge of these facts may lead to a reduction of running expenses within their walls, which will go far toward compensating the proprietors for their losses incurred in these dull times outside their mills.

A SWITCH ACCIDENT.

A very unfortunate switch accident recently took place on the Shore Line Railway, near New Haven, Conn. The switchman shifted the switch just before the last truck of the last car of the train had passed. This threw the truck from the rail, and the truck bumped along over the sleepers for a short distance to a trestle work bridge, when the rear car fell off the trestle, drawing with it the next car ahead, then the next, and the next, and then the baggage car. The coupling then broke, leaving the tender and the locomotive on the track. The superintendent of the road, Mr. William Wilcox, was in the baggage car and jumped out, but only to be crushed and killed by that car. His was the only life lost, though many passengers were more or less injured. The train was moving quite slowly, or the loss of life might have been serious, as the trestle was some fifteen feet high. The coroner's jury found that the switch was in perfect order, both before and after the accident; and there appears to be no other way to account for the catastrophe than as stated, though the switchman avers that he did not move the switch too soon, as alleged. The switch was of the caboose style, the switchman being obliged to enter a round house and close the door, in order to shift the switch, the switch being connected with the door. The object of this arrangement is to compel the switchman to remain at his post so long as the main track is open. A window is so placed in the house that the range of view of the switchman is confined almost entirely to the switch points, thus compelling him, as it were, to pay attention to his duty, that is, observe the switch.

This device has been in use for several years on the Connecticut railways, and has hitherto been an effective and valuable auxiliary in the prevention of switch accidents. It is, perhaps, as good a contrivance of the kind as can be provided. But what the public require is an easy plan of shifting cars from one track to another, without subjecting passengers to the risk of injury if a switchman is sleepy or careless. One plan of this kind was mentioned last week in the SCIENTIFIC AMERICAN, whereby switches are done away with altogether.

It is pleasing to be able to state that the Shore Line Railway is a comparatively well appointed institution, in respect to the ordinary means of safety. The rails are of steel. To prevent a repetition of the telescoping horror which occurred on this road a few years ago, the cars have been provided with the Miller platform and its strong couplings. Had the cars at the time of this last accident been coupled with the old style of couplings, it is probable that the coupling of the first car that left the track would have snapped, and the other cars would not have been thrown down. The strong safety couplings appear to have been productive of evil in this case. But experience shows that, in the ordinary run of accidents, in nine cases out of ten, this device may be relied upon to prevent injury.

Superintendent Wilcox was one of the most careful, experienced, and able railway officials in this country, highly esteemed in every walk of life. His loss is deeply deplored.

THE MANUFACTURE OF GEM STONES.

What boxwood is to the wood engraver—the means without which his finest art would be impossible—that chalcedony is to the engraver of gems. Hard without brittleness, susceptible of a fine and endurable polish, tinted by Nature with beautiful and at times strongly contrasted hues, or capable of taking on such colors at the hand of man, it has been from the earliest period of art not only the favorite medium but the only possible medium of the gem engraver's most striking effects.

In its simplest state, chalcedony is an unattractive white stone, nearly transparent, and chiefly useful for making spear heads and arrow tips, or their more modern representatives, gun flints. Sometimes it has a striped or banded appearance, due to alternations of more or less translucent layers, ranging in color from whey white to the white of skim milk, still not very serviceable for gems or jewelry. When stained by metallic oxides, however, chiefly those of iron, it rises to the dignity of gem stone, as sard, cornelian, chrysoprase, etc., when uniformly tinted brown, yellow, red, or green: as agate, onyx, sardonyx, etc., when the colors lie in bands or strata, or are separated by layers of white. The natural formation of these flowers of the mineral world is recorded in their substance. Though commonly found in lavas and other igneous rocks, or in the *débris* remaining from their disintegration, gem stones are substantially an aqueous product, and require the agency of fire simply to develope their fine colors, a step in their production more the work of Art than of Nature.

At high temperatures, especially under pressure, silica, the basis of all these stones, is dissolved to a limited extent by water, and thrown down in a more or less crystaline form when the temperature falls or the pressure is lowered. Illustrations of this process may be seen on a grand scale in the hot springs of the Yellowstone country and elsewhere in the Great West, where immense masses of siliceous sand and rock, sometimes chalcedonic, have been brought up from the heated depths by the flowing or spouting water, and deposited around the orifices of the springs. When water similarly impregnated with silica finds passage through rocks containing cavities, bubble holes, and the like, a portion of the mineral is deposited in the cavities, gradually filling them from circumference to center, the variable rate of deposit showing in concentric rings or bands of more or less opacity. Frequently the supply of silica-bearing water appears to have been prematurely cut off, leaving a crystal-lined druse or geode; and occasionally the cavity remains filled with water hermetically enclosed, forced in possibly under pressure and unable to escape when, by some geologic change, the pressure has been removed. In case the siliceous water is also charged with iron, nickel or other metal, the stone may be more or less impregnated with the foreign material according to the degree of its crystalization, the more amorphous layers naturally taking the most and consequently developing the deepest color when subjected by Nature or Art to the action of heat, sunlight, or other agent of chemical change. Or after the deposition of the stone, the enclosing rock may be washed by chalybeate or other mineral waters supplying the coloring matter necessary to convert the unattractive gray chalcedony into the highly prized sard, cornelian, onyx, or other gem stone. It is in these latter processes that Art steps in to complete or improve upon the work of Nature, either by developing the latent color of naturally impregnated stones or, going further back, by supplying the coloring material also. Probably the majority of gem stones, thus owe part if not all their beauty of color to Art, as well as their beauty of engraving and finish.

The simplest process is the development or hightening of dull or latent color by the action of heat. The celebrated cornelians of India, for example, are largely produced from dull brown stones, by a native process of roasting in a matrix of camel's or cow's dung, which prevents the stones from being too highly or too rapidly heated. A temperature sufficient to char wood is enough, the effect being like that observed in the burning of bricks: the brown oxide of iron is changed to red oxide, and the color of the stone is correspondingly improved. At Oberstein, the great manufacturing place of gem stones in Germany, carefully regulated ovens are employed for the same purpose. Similarly treated lumps of unimpregnated chalcedony are converted into white cornelian, the texture of the translucent stone being sufficiently disturbed by the heat to make it opaque. The snow-white bands of onyx, to which we owe the art of the cameo engraver, are almost always artificially produced in this way, the heat which improves the color of the darker layers, serving to develope the white ones at the same time.

But Art, as we have said, goes a step further back, and introduces as well as developes the colors of these stones, sometimes producing effects which Nature is unable to rival. In all cases the staining process involves, first, the introduction of a substance capable of producing color on precipitation, by heat or chemical action, second, the precipitation of the color. As the stone is too finely grained to absorb any colored solution, the coloring liquid must itself be colorless. To convert gray chalcedony into cornelian, the stone is soaked in a solution of pernitrate of iron, roughly made by dissolving old nails in dilute nitric acid; then the colorless pernitrate is changed into red peroxide of iron by roasting, the resulting color being faint or dark according to the amount of the solution absorbed. The more translucent the stone, the longer the period of steeping required; and when layers of unequal translucency exist, unequally colored bands result, giving sardonyx or cornelian onyx instead of simple sard or carnelian. Black onyx, that is, black stones crossed by bands of pure white, are always artificial. The coloring matter is carbon introduced in a colorless solution and blackened by fire or sulphuric acid. By the oriental and most ancient method, the stones are first boiled in honey or oil, sometimes for weeks, then heated to a temperature which chars the vegetable matter in the pores of the stone, producing black or brown according to the amount absorbed. This method produces the finest and most permanent black; but as the heating is liable to check or crack the stones and so destroy them, the western practice is to darken the carbon by the action of sulphuric acid. Inasmuch as the oriental black resists the action of nitric acid, while that produced by sulphuric acid is readily "drawn" thereby—that is, reduced to the iron mold tint of natural sardonyx—it has heretofore been regarded as a natural color. Billing has discovered, however, that it is merely a question of time in soaking, a sufficiently protracted bath in nitric acid drawing the oriental as well as the western black color. He has found also that any stone made pale by nitric acid, if properly heated, will recover its color by the charring of the carbon remaining in its pores, and that the color so produced will resist nitric acid as well as the best oriental black, which in fact it is.

The yellowish brown, orange, and lemon tints of sards are artificially producible by methods the same in principle as those already described, the last being developed by the action of hydrochloric acid on nearly transparent stones slightly impregnated by Nature with oxide of iron, the other two by the protracted soaking of the stone in the neutral solution of pernitrate of iron, afterwards exposing them to the action of sunlight.

The pale green of chrysoprase is imparted to translucent chalcedony by a bath in the saturated solution of nitrate of nickel, the best effect being produced with the unpurified metal, which always contains a trace of cobalt. The stone must remain a long time in the bath—three or four weeks or more—as it is nearly crystaline and the process is comparatively slow.

A blue color is more easily produced, but it is not permanent. The dye is Prussian blue, precipitated in the pores of the stone by the action of ferrocyanide of potassium on the peroxide of iron, introduced as for the production of red. A better effect is secured by soaking the stone in the ferrocyanide solution first, then treating it to a bath in the peroxide solution.

SCIENTIFIC AND PRACTICAL INFORMATION.

BLEACHING IVORY AND BONES.

The curators of the Anatomical Museum of the *Jardin des Plantes* in Paris have found that spirits of turpentine is very efficacious in removing the disagreeable odor and fatty emanations of bones or ivory, while it leaves them beautifully bleached. The articles should be exposed in the fluid for three or four days in the sun, or a little longer if in the shade. They should rest upon strips of zinc, so as to be a fraction of an inch above the bottom of the glass vessel employed. The turpentine acts as an oxidizing agent, and the product of the combustion is an acid liquor which sinks to the bottom, and strongly attacks the bones if they be allowed to touch it. The action of the turpentine is not confined to bones and ivory, but extends to wood of various varieties, especially beech, maple, elm, and cork.

SOFTENING VIOLIN NOTES.

M. Laborde states, in *Les Mondes*, that the disagreeable rasping tone peculiar to some violins may be avoided by placing a small strip of wax on the upper portion of the bridge. The notes are immediately rendered sweet and soft, and can be suited to the ear by regulating the size of the piece of wax.

RABIES IN ANTS.

Corrosive sublimate, it is said, has the most remarkable effect upon ants, especially the variety of insect which we lately described as living upon fungi found on leaves of trees. The powder, strewed in dry weather across their path, seems to drive every ant which touches it crazy. The insect runs wildly about and fiercely attacks its fellows. The news soon travels to the rest, and the fighting members of the community, huge fellows some three quarters of an inch in length, make their appearance with a determined air, as if the obstacle would be speedily overcome by their efforts. As soon, however, as they have touched the sublimate, says the narrator in the *Naturalist in Nicaragua*, all the stateliness leaves them; they rush about; their legs are seized hold of by some of the smaller ants already affected by the poison, and they themselves begin to bite, and in a short time become the centers of balls of rabid ants. As these insects are one of the scourges of tropical America, destroying vegetation in immense quantities, it is probable that this extraordinary remedy may be of considerable service to agriculturists.

A REMARKABLE HAILSTORM.

A hailstorm of extraordinary nature recently took place in the northern portion of New Jersey. The hailstones, it is stated, in some instances, measured as much as five inches in circumference, and resembled common rock candy, being of oval form bristling with cubical crystals. The ice was very hard and difficult to break, but when broken presented the appearance of the section of an onion, in its concentric rings. The damage done to buildings and crops was excessive, windows being smashed by scores, roofs torn, and fruit trees completely denuded.

FOSSILS OF THE DEPARTED.

A German inventor, Dr. Von Steinfels, seems to have hit a happy medium for disposing of the dead, which is at least free from the objections urged against burial, while it does no violence to the feelings which naturally shrink from destroying by fire the corpse of a beloved friend. It is proposed to place the body in a sarcophagus made of stone, and to pack around the corpse artificial stone or cement in a plastic state. The latter being allowed to harden, the remains become like a fossil embedded in the solid rock, and, if need be, the deceased finds his grave and his monument in one and the same mass.

COCOA NUT TREPANNING.

There is a well known trick performed by the clowns in pantomimes, to the mystification of the juvenile portion of the audience, which consists in shooting a hole in a man's head, and then artistically plugging up the orifice with a carrot, thus completely curing the apparently assassinated individual. While this is, of course, very ridiculous, it is not more so than a somewhat similar operation practiced by the inhabitants of Uvea, an island in the Loyalty group. These queer people have a notion that when a person gets a headache his skull is cracked, or that the bone is pressing down on the brain. Consequently they proceed to cure the trouble by cutting open the scalp, and scraping a hole in the cranium with a bit of glass, and then stopping the aperture with a piece of cocoanut shell rubbed smooth. Sometimes the surgeon scrapes too far and injures the *pia mater*, when the patient is killed; but ordinarily the boring proceeds to the *dura mater*, leaving a hole in the skull. It seems that few adults are without perforated heads, and that the cocoanut patch is common.

Our Iron Rail Products.

In 1873 the United States produced 850,000 tuns of rails and imported 207,986 tuns, making an aggregate consumption of 1,057,986 tuns. Comparing these figures with those of 1872, there is shown a diminution of production of 91,992 tuns, and of importation of 372,864 tuns. From this it appears that the effect of the stoppage of railroad construction, due to the panic, must have resulted far more disastrously to foreign producers of rails than to those at home. The figures of importation for 1873 are less than those of any single year since 1867, while the aggregates of 1873 are larger than at any period during the past twenty years. Our production during the last mentioned space of time steadily increased, rising gradually from 108,016 tuns in 1854 to 941,992 tuns in 1872, while on the other hand importations have widely fluctuated, running as low as 10,185 tuns in 1862.

The coal product for years past shows an enormous development, every year, with one exception (1867), indicating an increase. For 1873 about the usual rate of augmentation was maintained, 45,413,000 tuns being produced, against 42,749,000 tuns in 1872 and 22,500,000 in 1864.

The Chemical Centennial.

We have already alluded to the proposition of Dr. H. Carrington Bolton, of Columbia College, of a reunion of chemists to celebrate the hundredth anniversary of the birth of modern chemistry, that event being fixed as in the year 1774, owing to the discoveries, at that time, of oxygen by Priestley, chlorine by Scheele, and other important investigations by Lavoisier having simultaneously taken place. The day set apart for the meeting, we understand from a circular lately received, is August 1st next, and the place, Northumberland, Pa., where Priestley's remains are buried.

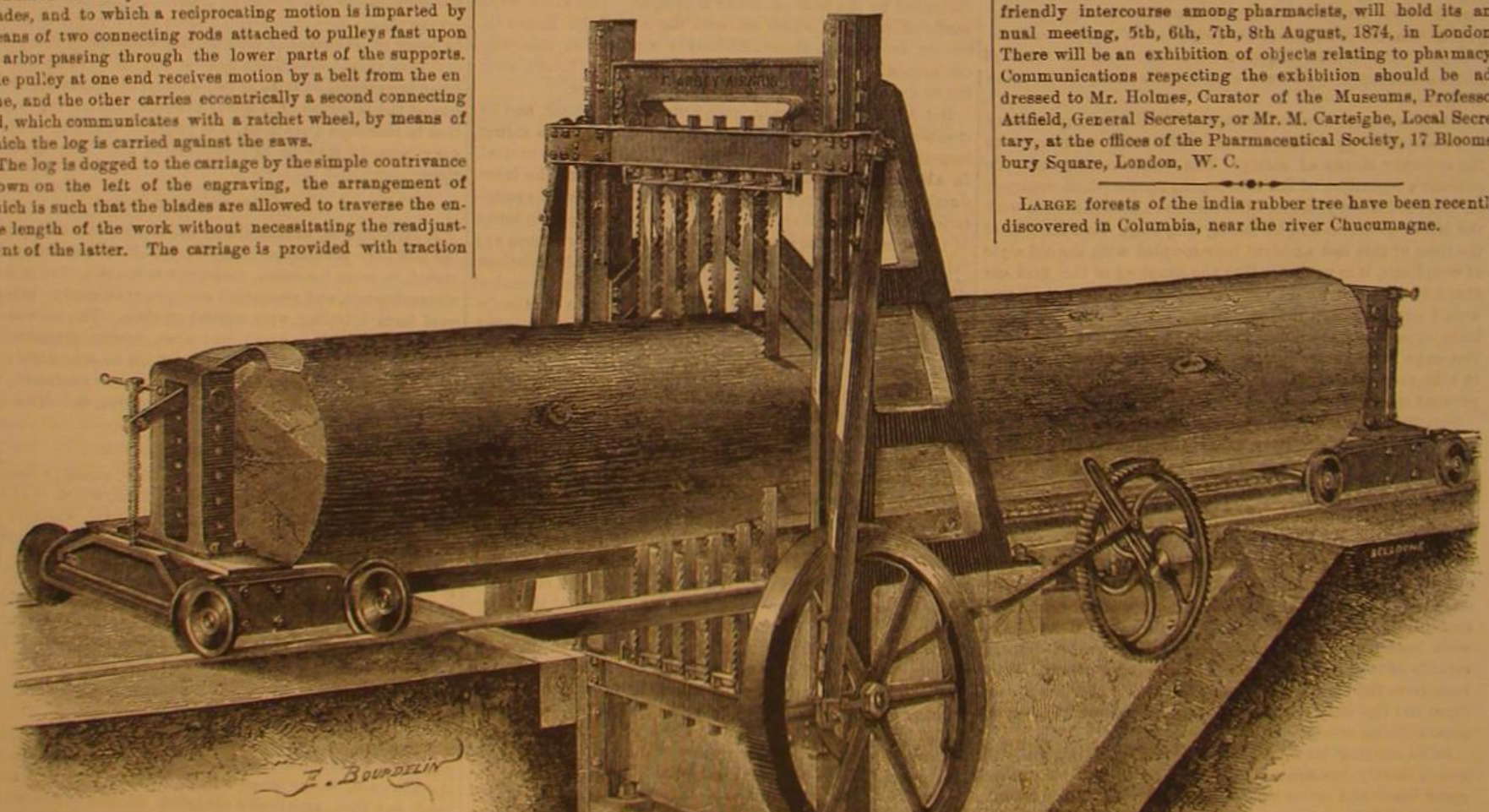
The programme of the celebration will include an address by Professor Joseph Henry; a sketch of the life and labors of Joseph Priestley, by Professor Henry H. Croft, of Canada; a review of the century's progress in theoretical chemistry, by Professor T. Sterry Hunt; a review of the century's progress in industrial chemistry, by Professor J. Lawrence Smith, and an essay on American contributions to chemistry, by Professor Benjamin Silliman. The books, manuscripts, etc., of Dr. Priestley will be exhibited, together with other objects of historical interest.

GANG SAW IMPROVEMENTS.

We extract from the *Moniteur Industriel Belge* the annexed engraving of a new gang saw, manufactured by M. Arbrey, of Paris. The machine, which appears to be of very simple, and doubtless effective, construction, is composed of two heavy standards of cast iron, joined above by a crosspiece and bolted below to a heavy bed of stone. Between the standards vertically travels a frame which carries the saw blades, and to which a reciprocating motion is imparted by means of two connecting rods attached to pulleys fast upon an arbor passing through the lower parts of the supports. The pulley at one end receives motion by a belt from the engine, and the other carries eccentrically a second connecting rod, which communicates with a ratchet wheel, by means of which the log is carried against the saws.

The log is dogged to the carriage by the simple contrivance shown on the left of the engraving, the arrangement of which is such that the blades are allowed to traverse the entire length of the work without necessitating the readjustment of the latter. The carriage is provided with traction hooks which, when the former is in any position, engage with an endless chain. This chain is actuated by a cog wheel, not shown, connecting with the ratchet wheel, and completes the mechanism for driving the carriage.

Any number of saws may be attached to the frame by the usual means, and so that trunks of the largest diameter may be divided into as many boards as desired, all of which, by suitable adjustment of the spaces between the blades, may be of uniform thickness.



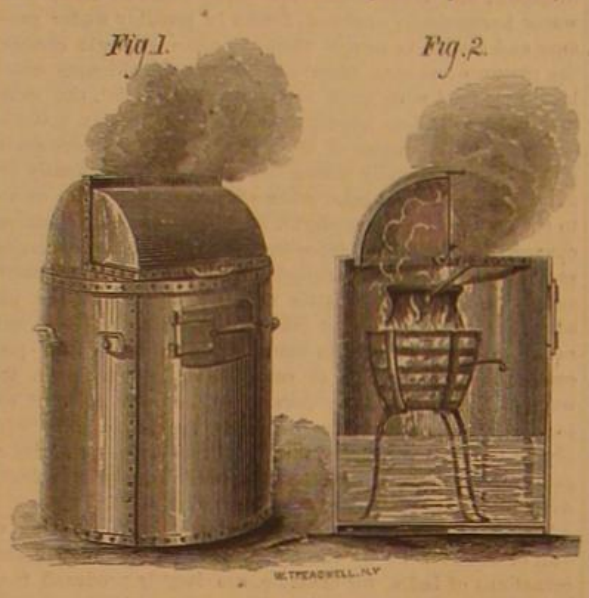
A FRENCH IMPROVEMENT IN GANG SAWS.

Moles.

M. Flourens and other naturalists have experimented with moles to ascertain their habits. It has been found that they will starve to death in presence of abundant vegetable food, refusing to touch it, but that they will greedily devour cutworms, earthworms, mice, and even small birds, when nearly starving in an enclosed jar. Of the birds they only devour the inside; but they devoured, indiscriminately, their own weight each day of snails, insects, larvæ, chrysalides, caterpillars, adders, slow worms, and lizards. M. Carl Vogt relates an instance of a land proprietor in France who destroyed every mole upon his property. The next season his fields were ravaged with cutworms, and his crops totally destroyed. He then purchased moles of his neighbors and preserved them as his best friends.

A SAFETY FURNACE.

We extract from the London *Building News* an illustration of a furnace for the use of plumbers in repairing roofs, an operation attended with considerable danger to the building itself, and (from the distribution of sparks by the wind) to others in the neighborhood. It is the invention of Messrs Shand and Mason, engineers, of London; and its use would probably have saved the roof of Canterbury cathedral from the destruction recently caused by fire.



In Fig. 1 is seen the furnace when closed, the only outlet from which is the slot in the cover, through which the smoke passes. The basket containing the fire is placed some distance below and at one side of this opening, so that immunity from the escape of sparks is secured. The tripod, on which is the fire basket, stands in nine inches of water; and a side opening, at the hight of the fire, allows of the introduction and removal of ladles and soldering irons. The cowl of the furnace can easily be removed when required.

The New York Post Office.

The new Post Office in this city is rapidly approaching completion, and the department will move therein during the latter part of the present year. About 100 workmen are now employed, principally upon the basement, first and second floors. In this part of the building, every improvement which invention can suggest will be utilized. Arrangements are in progress for pneumatic tubes from all the daily newspaper offices to the paper mailing room, by the use of which hardly an instant will be wasted in the dispatching of daily journals. The basement portion of the building has been arranged with special reference to the admission of railway postal cars from the tracks of the Broadway Underground Railway; and when that road is built, the mail cars will run directly down from Forty-second street into the Post Office building. The Underground Railway is to pass directly along the Broadway front of the edifice. One of these days, when the Hudson river is tunneled or bridged, the postal cars of all the railways that center in this vicinity, such as the New Jersey Central, the Pennsylvania Railway, the Erie, the Delaware and Lackawanna, will all be brought down on the Broadway Underground Railway, directly into the basement of the Post Office. This will greatly facilitate the receipt and dispatch of the mails. The new Post Office is a magnificent building, imposing in appearance, and well calculated, by its location and construction, to be the great postal center of the country. The estimated cost of the building is over five millions of dollars.

Results of Improved Weapons.

Improvements in missile weapons have, partly by keeping the combatants wider apart, tended materially to reduce the cost of victories in their most costly element—human life and suffering. The French War Office has worked out the statistics of this question and the following are some of the results: At the battle of Friedland, the French lost fourteen per cent and the Russians thirty per cent of their troops; and at Wagram, the French lost thirteen per cent and the Austrians fourteen per cent. At Moscow, the French lost thirty per cent and the Russians forty-four per cent. Again, at Waterloo, the French lost thirty-six per cent and the Allies thirty per cent of their forces engaged. Forty years later, when the new weapons were employed, the loss of the French at Magenta was seven per cent, that of the Austrians the same. At Solferino, the French and Sardinians suffered a loss of ten per cent, and the Austrians of only eight per cent.

THE British Pharmaceutical Conference, for the encouragement of pharmaceutical research and the promotion of friendly intercourse among pharmacists, will hold its annual meeting, 5th, 6th, 7th, 8th August, 1874, in London. There will be an exhibition of objects relating to pharmacy. Communications respecting the exhibition should be addressed to Mr. Holmes, Curator of the Museums, Professor Attfield, General Secretary, or Mr. M. Carteighe, Local Secretary, at the offices of the Pharmaceutical Society, 17 Bloomsbury Square, London, W. C.

LARGE forests of the india rubber tree have been recently discovered in Columbia, near the river Chucumagne.

APPARATUS FOR TRANSPLANTING TREES.

In order to reconstruct the Bois de Boulogne, the great pleasure ground of Paris, which, during the late war, suffered almost total demolition at the hands of the contending forces, it has been necessary to transplant a large number of trees to replace those cut down. This work being found very costly, as well as difficult to perform with existing means, a less expensive method has been devised for its accomplishment, which consists in the use of wagons especially built for transporting the trees bodily from place to place.

Our illustrations show two forms of the apparatus, Figs. 1 and 2 giving different views of the small one horse vehicle, and Fig. 3 of the largest machine, requiring the power of several horses. The former is constructed of wood and the latter of iron. The mode of operation consists in first digging an annular trench around the tree, so as to leave sufficient earth about the roots of the latter. As the excavation progresses downward, the exterior of the clod is enveloped in branches or with barrel staves encircled by iron hoops held by binding screws. The tree is sustained by guys from falling. When a sufficient depth is reached, the earth under the tree is cut away and planks shoved beneath.

Timbers are next laid on the surface to serve as ways for the vehicle, which is run thereon. The rear crosspiece of its frame is detachable, so that the machine can be placed directly over the hole and surrounding the trunk. Chains are then carried down from the two windlasses and led under the planks beneath the roots. The windlasses being turned, the tree, roots, and clod are lifted bodily up between the wheels, and there remain suspended while the wagon is dragged off to the point at which the tree is to be placed. There, a hole being dug, and its interior well watered, the tree is lowered in and the earth packed around, thus completing the operation. The smaller vehicle is used for moderate sized trees; but with the larger one and its more powerful machinery, trees of considerable magnitude, it is stated, may be readily transported.

It may be added that vehicles for transplanting large trees have long been in use in this country. In the Central Park, in this city, and Prospect Park, Brooklyn, many large trees have thus been transplanted with much success.

Fig. 1.

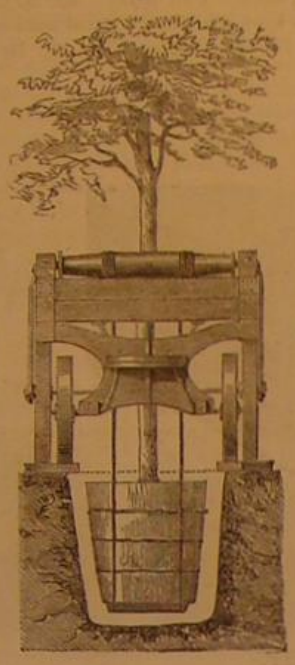


Fig. 2.



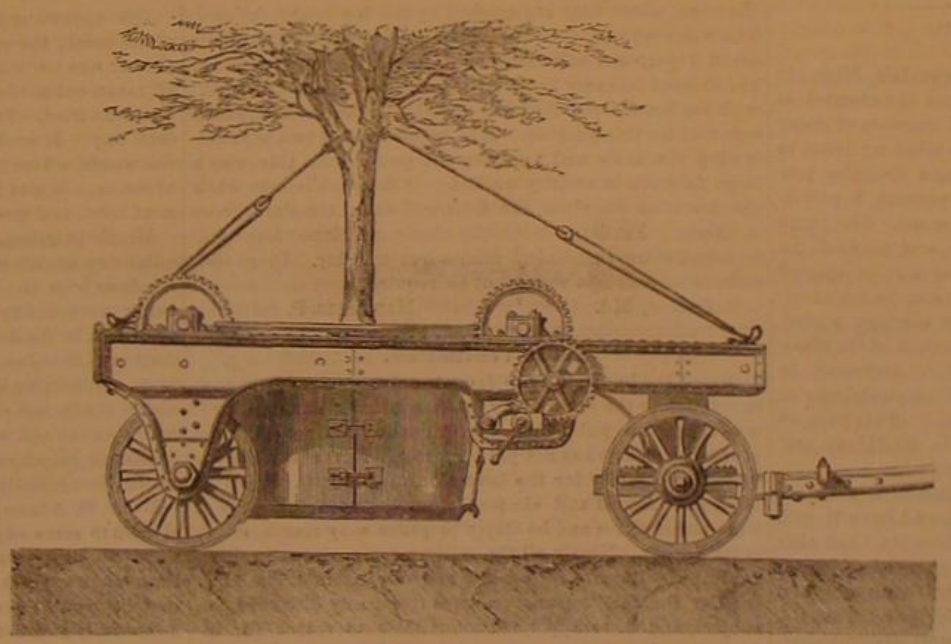


Fig. 3.—APPARATUS FOR TRANSPLANTING TREES.

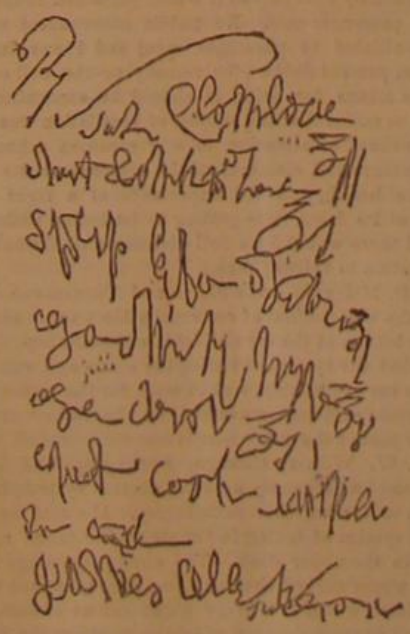
Sad Fate of a Nevada Inventor.

The coolest and most refreshing item we have read since the commencement of the heated term lately appeared in the Virginia City (Nevada) *Enterprise*. The story runs thus: A gentleman who has just arrived from the borax fields of the desert regions surrounding the town of Columbus, in the eastern part of this State, gives us the following account of the sad fate of Mr. Jonathan Newhouse, a man of considerable inventive genius. Mr. Newhouse had constructed what he called a "solar armor," an apparatus intended to protect the wearer from the fierce heat of the sun in crossing deserts and burning alkali plains. The armor consisted of a long close-fitting jacket made of common sponge, and a cap or hood of the same material, both jacket and hood being about an inch in thickness. Before starting across a desert this armor was to be saturated with water. Under the right arm was suspended an india rubber sack, filled with water, and having a small gutta percha tube leading to the top of the hood. In order to keep the armor moist, all that was necessary to be done by the traveler, as he progressed over the burning sands, was to press the sack occasionally, when a small quantity of water would be forced up and thoroughly saturate the hood and the jacket below it. Thus, by the evaporation of the moisture in the armor, it was calculated might be produced almost any degree of cold. Mr. Newhouse went down to Death Valley, determined to try the experiment of crossing that terrible place in his armor. He started out into the valley one morning from the camp nearest its borders, telling the men at the camp, as they laced his armor on his back, that he would return in two days. The next day an Indian, who could speak but a few words of English, came to the camp in a great state of excitement. He made the men understand that he wanted them to follow him. At the distance of about twenty miles out into the desert, the Indian pointed to a human figure seated against a rock. Approaching they found it to be Newhouse, still in his armor. He was dead and frozen stiff. His beard was covered with frost, and, though the noonday sun poured down its fiercest rays, an icicle over a foot in length hung from his nose. There he had perished miserably, because his armor had worked but too well, and because it was laced up behind where he could not reach the fastenings.

THERE are Pullman palace cars on all lines in Upper Italy.

A Queer Looking Prescription.

For all that might be recognized, after careful examination, the scrawl which we give in facsimile herewith might indicate either the vagaries of planchette or the tracks of a spider whose legs had been dipped in ink. It happens, however, to be neither, but, on the contrary, a physician's prescription, printed in the London *Chemist and Druggist*—a formula for a medicine which, if wrongly compounded, might produce death directly, or be indirectly injurious by failing to better the sufferer. We publish it as a specimen of the difficulties and doubts which dispensers of drugs are too often called upon to decide. It is not an uncommon thing for physicians, lacking knowledge of chemistry, to order compounds the ingredients of which exercise their mutual affinities in some unlooked for manner, tending perhaps to neutralize the remedial effect sought in the mixture; but where ignorance may be palliated, carelessness may not be,



and for a doctor to emulate the caligraphy of Rufus Choate or Horace Greeley is a fault which cannot be condoned. Druggists receiving illegible prescriptions, or those in which there is the least ambiguity in the terms, should return them; promptly to the patient with reasons.

The Sanitary Condition of Water.

There is no more prolific source of disease than bad water; but to distinguish whether the fluid is unfit for consumption or not is somewhat difficult. Water from a certain river, spring, or well may be repulsive to the senses, and yet harmless to the stomach, in comparison with other water which has a much more attractive appearance. Perhaps the best mode of determining the question is to examine the condition of the organisms dwelling in the proposed source to be utilized. If, for example, an industrial establishment or a collection of dwellings empties refuse into the stream, and as a result fish disappear or are found dead upon the surface, it is certain that the water is strongly and injuriously affected. The gradual infection may be noted by the fish first rising to the top, apparently ill at ease, and subsequently dying.

In vitiated water also mollusks perish, and their bodies decompose rapidly. In the air they merely seem to dry up and retain life, though torpid for some time, becoming revivified by return to water. Cresses cannot live in corrupt water, and their existence is a sign of purity in the fluid. White algæ deprived of their green color indicate absolute corruption.

M. Gérardin, in referring to this subject, in a recent note to the French Academy, states that the best method of measuring the degree of purity or of infection in water is by determining the amount of oxygen in a given quantity. Water containing a large per centage of the gas is pure and good; but when little of the latter is present, the water is decidedly deleterious to health.

A New Alkaloid from Morphine.

G. Nadler has obtained an alkaloid by the action of ammoniacal solution of oxide of copper on morphine, the chlorine compound of which is dazzlingly white, sparingly soluble in cold but easily soluble in hot water, and insoluble in alcohol and ether. The aqueous solution gives with ammonia a dense, white, amorphous precipitate, which does not alter in the air while moist, but dries up, like aluminum hydrate. Ferric chloride produces in the aqueous solution an amethyst red color, which rapidly darkens. Strong sulphuric acid dissolves the alkaloid on warming, forming a dark green solution, which does not alter when heated sufficiently to volatilize the acid. Blue ammoniacal copper solution assumes a splendid green color. Potash, like ammonia, produces in the aqueous solution a curdy precipitate, which however, dissolves in excess in the cold. In this respect the alkaloid resembles morphine. The potash solution, when heated to boiling, deposits the alkaloid in silvery scales. The alkaloid rapidly reduces silver nitrate, and gives with platinic chloride a pale yellow platinum salt. Dilute sulphuric acid throws down from the solution in hydrochloric acid a white amorphous sulphate. The new alkaloid is distinguished from morphine by being precipitated in the amorphous state by ammonia, by its behavior with ferric chloride, ammoniacal copper solution, potash, and strong sulphuric acid, and by the sparing solubility of its sulphate; and from apomorphine by the fact that in the moist state it does not become colored on exposure to the air, but remains perfectly unaltered.—*Journal of the Chemical Society.*

THE manufacture of cast iron nails and shoe pins is peculiar to the South Staffordshire (Eng.) district, although, curiously enough, the demand for one description, known as lath nails, is almost entirely for Scotland. The smallest nail made is ½ inch in length, and of these a good workman will mold upwards of 750,000 in a day. The largest measure 2½ inches long, and of these a good day's work is about 52,000. The yearly production of cast nails is about 1,000 tuns.

A new air machine has lately been put in operation in the House of Commons, London. By means of this apparatus a constant supply of air, cooled to any required degree even in the warmest weather, can be supplied at the rate of from 60,000 to 90,000 gallons per minute. The House contains about 900,000 gallons of air, so that, when the apparatus is working at its maximum, it is possible to renew the air without sensible draft every six minutes.

M. TOMMASI, inventor of the hydro-electric cable, a device by means of which signals are transmitted through fine tubes filled with water, has lately succeeded in sending ten signals per second over a distance of two miles and a half. A full description, with illustrations of the invention, is contained in *Science Record* for 1872.

Correspondence.

Aerial Navigation.

To the Editor of the Scientific American:

The accompanying engraving shows a boat which, it is asserted, can be propelled and guided through the air by means of surplus buoyancy (in rising) and weight (in falling) without any machinery, except the two rudders and the weight exhibited.

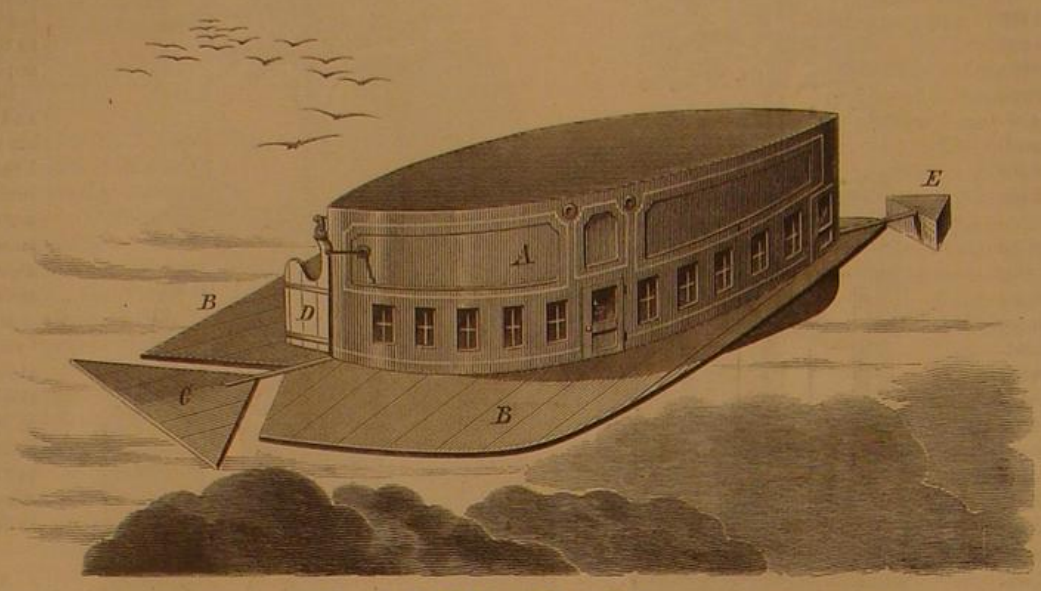
A is a boat of fixed form, inside of which is placed a gas bag. B B are stationary resisters or wings, projecting on each side, on a plane with the bottom of the boat. D is an ordinary rudder attached to the stern of the boat, to guide it in a horizontal direction; C is a horizontal rudder, connected by a rod with E, which is a weight; these, pushed fore or aft, will elevate or depress the bow of the boat.

The two rudders, the weight, as also the valve for the escape gas, and sand bags, if any, are all to be controlled by a man in the pilot house at the bow; and when ready for starting, the center of gravity is through the cabin.

Suppose we have a surplus buoyancy of 500 lbs.: this, I claim, will lift the boat with the same force as if it were so many pounds falling, and the air will press downwards, so the boat will take the course of least resistance—a diagonal—the resultant of the two forces. Besides, after ascending upward and forward some distance, a force will be developed which, on depressing the bow of the boat, will drive it some distance downward, or further on a horizontal. The same action as described in rising will take place in falling, after 1,000 lbs. of buoyant force is thrown off, leaving the weight 500 lbs.

D. L. RHONE.

Wilkesbarre, Pa.



A NOVEL AIR SHIP.

The Mississippi River.

To the Editor of the Scientific American:

The letter of Mr. Sidney Cook, of Presque Isle, Mich., in your issue of June 27, proposing to deepen the channel at the mouth of the Mississippi by means of currents of water forcibly discharged on the bottom, calls to mind my letter to you under date of July 30, 1868, describing a dredging process invented by me, in which I said: "I propose a powerful pump on a vessel (steamboat, ship, or scow). The pump to be propelled by steam or other power, and conduct the water through pipes to near the bottom, there to be ejected downward, vertically, or at such angle as may be found advantageous. The force of the water, shot through a pipe, will rouse up all the mud or earth at the bottom of the river, and the natural current will carry it away." And again in my letter of August 6, 1868: "to be used on steamboats or other vessels to remove bars when aground." This plan of operating was secured by letters patent (No. 95,213) to me, in 1868, you being the agents and attorneys.

In 1869 I had a tin model made of a section of a vessel to operate at the mouth of the Mississippi, and have it yet, which, together with patent 95,213, will show Mr. Cook that he has been anticipated. My patent machine (on paper) is now under consideration by United States engineers, and ought to be put into a substantial form for use. That the mode of operating proposed by me is the most philosophical, the most in harmony with natural laws, and the most economical, I have never doubted; but I have not been in a fret to have it put to use. Everything must bide its time; and inasmuch as water, put in motion rapidly enough, will stir up mud more effectually than any other agency at the same cost, the time will surely come when my mode of removing bars—where there are currents—will be resorted to. Dredging is not, in my opinion, the proper remedy at the mouth of the Mississippi. I would build jetties, and make the river keep its own mouth open. But if people will try to keep a channel deep by dredging, let them do it in the best way.

Kirkwood, Me. R. S. ELLIOT.

The Shadow Sail.

To the Editor of the Scientific American:

In your issue of May 16 is an illustration of a shadow sail, spoken of as being patented. I have used one on my boat for the past two years; but instead of the clumsy arrangement described by *Land and Water*, I use one of the American fashion, namely, a lug sail nearly as large as the mainsail.

I need scarcely say that the shadow is useless except when going dead before the wind and when the jib can be of no service unless boomed out. I bend the fall end of the jib halyards to the yard, which saves the expense, or what is worse, the encumbrance, of a special halyard. The boom can be attached to the mast by a gooseneck; and in the case of boats with standing masts, a small stay from the hounds to the deck amidships could be fitted with a hook traveler to keep the sail in place aloft. A top sail could be as easily set over a lug as a gaffsail. The fore and aft guys or vangs are superfluous, as this sail needs them no more than the mainsail.

I am induced to make these remarks, thinking they may be useful to some person as fond of boating as I am.

Hermitage Bay, Newfoundland. I. LEWIS KNIGHT.

The Colorado Potato Bug.

To the Editor of the Scientific American:

The Colorado bug has appeared in Maryland, doing serious damage to the potato crop. I have tried every remedy suggested in print or by my own observation with the following results: Guinea fowl, recommended in a late issue of your paper, are ineffectual. The birds will eat a few, but soon become surfeited. Hellebore, sulphur, soot, ashes, whale oil soapsuds, carbolic acid, and many other methods give no positive relief.

I succeeded in saving my crop by shaking the larvæ from the vines and then dusting with Paris green. The simplest way to work is to cut a round log with the bark on, about 4 feet long, and 12 to 18 inches diameter. Sharpen one end and drive in a staple, to which harness a mule. Two boys with stout leafless bushes pass down the rows, striking the vines briskly and knocking the bugs into the space between the rows, where they are crushed by the log which follows. The vines should then be immediately dusted with Paris green 1 part and common flour 9 parts, thoroughly mixed and dressed on every point of the vine. A 3 lbs. fruit can, with the bottom punched full of holes, makes a handy and safe tool for this purpose. It is better to have two boys following the mule and applying the poison. In this way a large field can be rapidly worked. If the work is done while the dew is on the vines, the flour will cause the Paris green to adhere. For large fields the above mentioned force will be found more economical than a less number. In garden culture, of course it would not be required.

Baltimore, Md. MARSHALL P. SMITH.

Car Ventilation.

One of the hardest of problems to solve appears to be that in relation to the satisfactory heating and ventilating of railway cars. The public demand for such appliances increases year by year, but has not yet been met. Never was there a better opportunity for the invention of effective devices in this line. A good and simple improvement would have a wide introduction and be likely to prove very remunerative to its author. Nearly all the railway companies are calling for improved means for heating and ventilation. The Master Car Builders' Association have frequently discussed the subject, and have appointed committees to search for information, but they cannot reach a satisfactory result. Different members have different views as to how ventilation should be accomplished. Here is an example of how minds differ on the subject, taken from the report of the proceedings of the Association at their recent session:

Mr. L. Garey, New York Central and Hudson River, said that the subject of the report was one of the greatest importance, especially that part of it which pertained to the ventilation of passenger cars. No public conveyances were so poorly ventilated as passenger cars; and if any improvement upon present devices for remedying the evil could be made, the means for doing it should be ascertained. He was glad to notice that the subject of ventilation was receiving a due share of attention in our common schools, and that the nature and elements of the atmosphere, its effects on physical health, and the importance of a right understanding of its laws, were getting to be better understood. He hoped there would be a full discussion of the subject in its application to railway cars.

Mr. J. D. McIlwain, Lake Shore and Tuscarawas Valley, thought the best method of car ventilation was to admit the air at the bottom of the car and let it out at the top. He did not find that the system of letting the air in and out at the top of the car exclusively worked well, for the reason that it did not create sufficient movement of the volume of air in the lower part of the car, where it was most needed.

Mr. W. W. Wilcox, Chicago, Burlington, and Quincy, said his road had formerly used the Ruttan system, but did not find it to be altogether satisfactory. His road was now using the system of taking in the air at the frieze and exhausting in the upper deck. The supply openings in the frieze, or upper part of the car sides, were protected by perforated plates, which to a very great extent excluded the dust. He had tried the plan of taking in air at the bottom, but it did not prove to be a success.

Mr. Ambrose Ward, Pennsylvania Railroad, had abandoned the frieze plan on account of the dust. He had found that the best point for admitting the air was under the hood at the end of the car, with an automatic arrangement on the roof for exhausting it.

Mr. W. R. Davenport, Erie Car Works, said that it was one of the most perplexing and difficult problems ever presented for solution. One important fact, which is very apt to be overlooked, is that a kind of ventilation which will do for summer will not do for winter, and *vice versa*. To get pure air, it must be taken in high up and not low down. Ventilation from windows in winter was not to be thought of. The air must be warmed in some way before it enters the car. This we have got to do. The top of the car must be closed in winter, and there must be a free outflow from the floor.

Mr. M. P. Ford, Pittsburgh, Cincinnati and St. Louis, said that none of them were satisfied with the methods they were using. He thought that, for summer, Foote's plan was as near perfect as any he had seen tried, which consisted in ridding the inflowing air of dust and other impurities by causing it to pass through a spray of water. This water was carried in a reservoir underneath the car, holding about two barrels, and the impurities contained in the air were shown by the color of the water, which was nearly black as ink after being used for any considerable time. He believed that in winter the air must be exhausted at the bottom. The great obstacle to the working of any effective plan was the movement of the car. This set nearly all theories at defiance.

Mr. John Kirby, Lake Shore and Michigan Southern, said that his road, as long ago as 1854, put the Foote ventilation into 24 new cars. The box reservoir under the car held between two and three barrels of water, and was 16 or 18 feet long. It was found objectionable, however, for several reasons.

The apparatus occupied too much room in the center of the coach, the spray injured the seats, and in wet weather the car was too moist for comfort. These ventilators were all taken out at the end of the season, and Westlake's plan was next tried. This consists of a hood on the roof facing each way. It worked very well in the open country; but in the woods, where the smoke and cinders follow in the wake of the cars, it was less satisfactory. The Ruttan system was next tried, and was found to work well for short trips.

Mr. F. D. Adams, Boston and Albany, favored the plan of admitting the air into the end of the car by means of wicket windows over the door, the entrance of dust and cinders being prevented by a projecting hood on the outside. The drop sash in the door was objectionable, as it disfigured the door, was liable to rattle, and was more or less difficult to raise. Admitting air through the frieze was also objectionable, as it exposed passengers to a direct draft. The wicket sash over the end windows could be regulated by the conductors or passengers, and the projecting hood outside obviated the necessity for using wire screens.

Mr. F. D. Adams, Boston and Albany, said: "Mr. Garey has alluded to some experiments that were made on our road; these experiments were tried very thoroughly. The committee have taken a great deal of pains to ascertain all the facts that they could; and yet neither they nor any of the rest of us are fully satisfied yet. Some things, however, have been demonstrated beyond contradiction, and among these things are these exhaust ventilators talked about so much today. To speak in plain words, the whole thing is a humbug. I have got up on the seats and smoked, and in many cases I have found no air that would take the smoke out at any of these ventilators. If there happened to be an eddy, the smoke would go out with the air, and perhaps the next mile the air would come in. It does not create a steady draft out of the car. Practical demonstration shows clearly it does not do so.

I will allude to one other test that we are trying now. The air is conveyed into the car by a blower driven from one of the axles of the truck, at a speed of twenty miles an hour; about a thousand turns a minute, drawing the air into the car through a side window. This side window is covered with gauze wire, which is supposed of course to keep the cinders all out. The air is designed in the winter to pass over a hot stove, and in summer over an ice box. It is then taken immediately up to the top of the car and carried completely around in a tube perhaps six inches in diameter. That tube is at various points, as often as is deemed necessary, perforated with fine holes, allowing the air to pass out into the car, distributing it equally and evenly as far as possible. We found that, at a high rate of speed, this worked very finely. I might say, in addition, that they exhausted the air through the floor by registers. Unfortunately our road is very heavily graded, and we found that, when we came to go up a long grade of 75 to 80 feet to the mile with a heavy express train, we did not make very rapid speed, and consequently got no air. That trouble occurred on hot days, and we felt like knocking the windows out with our elbows. There is no difficulty in devising a plan to ventilate a house, yet the various circumstances under which railroad trains are placed make the difficulties to be overcome almost insurmountable."

Mr. S. Griffith, Indianapolis, Cincinnati, and Lafayette: "I think the time for exhausting the foul air is much less

than any person would suppose,and I will state that we have a practical test of it by every train that passes over our road. There is a fertilizer factory established a few miles below the city on the road, which causes the air to be very offensive. The moment the train strikes this stench, the car appears to be entirely filled wtih it, but I don't think it requires half a minute after the car passes through this stench before it is entirely clear of it, to all appearance. We have nothing except the ordinary exhaust ventilators and perforated plates; and this is the case in winter, when the doors and windows are closed. I think that people generally are mistaken with regard to the time required to change the air.

Mr. J. M. Leech, Pittsburgh and Connellsville, said: "I think that what we require is something that will force the air from the floor up, and not something overhead. The ventilation that we have had heretofore has been either on the end of the car, forcing the draft into our faces, or else over our heads,forcing the air down. I think that what we require is something below. We don't propose to fasten down the windows. We propose to fetch the air in, and every person can regulate it to suit himself. We also propose in the winter season, by forcing the air over the fire box in the engine, to make it warm. In case the train is not in motion, there is a small stationary engine which will work a fan and supply air, either warm or cold, to fill the cars, giving all the air needed. I think something of that kind is what is required by the public."

PRACTICAL EDUCATION.

Professor John Sweet, of Cornell University, is a practical man, if there ever was one. It will be seen from the following address to the students that he considers the practice of the manipulations of the art which the student intends to follow to be of as much value in an educational sense as the study of text books, and thinks the time spent in the shop ought to count, hour for hour, equally with class room periods:

Mr. President and Gentlemen:—Every man's value, aside from his value to himself, that is, his value to his employer, if he be an employee, his value to his family, if he has one, and certainly his value to the world, depends upon what he can do rather than upon what he knows. Unless he can do, what he knows is nowhere. The more we know, the better we ought to be able to do. Education fills its mission only when it aids us in accomplishing our life work better or more readily.

However well a minister may be versed in theology, Scripture, morals, religion, rhetoric, and elocution, unless he has the power to hold an audience, to increase his congregation, to build up his church, to loosen the purse strings of his flock, he is not a success; he is of limited value. The first is to know, the last is to do. Many men possess the former without the latter, and doing is something accomplished without any very great stock of education. A physician, however thoroughly versed in his profession, if all his patients die, is a failure; while a quack who cures is so far a success; and in this matter of doctoring, which is especially one of the learned professions, so much depends upon practice, so much on good judgment, so much on the character of the patient and the influence of the physician in the sick room, that the knowledge which they acquire from books is on the short end of the lever; and the more successful the physician, the nearer the fulcrum gets to the book end. With the surgeon it is as with the physician. One might have the ability to make a manikin with his eyes shut; but if he lacks even the nerve, which is acquired only by practice, to cut off a finger, he would be, as a surgeon, a failure. A lawyer, were he an unabridged edition of Blackstone, bound in calf, if he had not the ability to convince the judge and jury, would be a failure.

Now, if this is true with professions professedly intellectual, is it not equally true of the profession of mechanical engineering? The question is not: Do you know how a carding machine works, but can you make a machine to trim teasel? Less likely are you to be familiar with threshing machines, cotton gins, locomotives, wood-working machinery, portable engines, clocks, gun-making machines, scythe making, gimlets, fish hook machinery, pin machinery, machines for setting carding machine teeth, rolling mills, hooks and eyes, blast furnace machinery, carpet tacks, machinist tools, nail machines, agricultural implements, and sugar machinery. The question is more likely to be: Have you done either, than have you seen it done, or do you know how it is done? More likely to be, can you do, than have you done? Are you to step from your graduating classes into positions of master mechanics, managing directors, superintendents, professors, or foremen? Is your sheepskin degree to be that which will enable you to get a high salary, a commanding position, a passport to every workshop you may walk up to? I hope none of you are so childish as to suppose it. Your education and the opportunities, if we can make them what I hope we can, will enable you to take leading positions; if you make the best use of your advantages and are judicious in selecting companions, you can lead. According to the natural order of things, not more than five out of every twenty will ever be mechanical engineers, and not more than two or three out of that five will ever acquire distinction. Five, ten, fifteen years, yes, even a lifetime, is to be devoted to work, work to which our two hours a day, in comparison, is but child's play, and not only work but study. Study with a new significance Sudy to achieve, not to acquire; study to do, not to know. Study to accomplish, and none of this long day, late night, temporary "cramming" to pass. If you have entered on the study of mechanical engineering with a view of becoming mechanical engineers, which it is fair to presume the most of you have, and as the success of a mechanical engineer most assuredly depends upon what he can do, the question of all others which most nearly concerns you is: How can you best fit yourselves for doing? One might spend his entire freshman's year in drawing 60° angles, free hand and by drafting instruments; he might spend the remaining three years of his college life in seeing a journeyman grind diamond-pointed lathe tools; and without practice, to which his four years drafting and observation would add nothing except to shorten the time required to learn, he could no more grind a tool for cutting screw threads than he could copy the statue of the Venus di Medici. No one knows how a piece of steel will "wiggle" on a grindstone until he tries it.

Handling a file even excellently well is an art acquired by years of practice only, and those of you who take to the glory of making a dead true surface with shadows of reluctance find even in that there is something gained by practice; or rather that, simple as it appears in itself, it is an art no more to be learned without practice than the art of writing. And further, when the time comes when you can say: "I can do it no better than I could yesterday; I can do it as well as any man:" then, if you will count up the time it has taken you to scrape a flat surface, you will find that it falls not much short of the time which it took you to learn to write. I expect you to ask why are we to learn to grind and file and scrape at all? Cannot we be mechanical engineers without going through the drudgery of a common workman? Let us see. Did you learn to read and write and cipher before you came to the university? Yes. And what headway would you have made had you not? Do you expect to run a lathe and keep a cheap hand to grind the tools for you? Do you expect to be a judge of a workman and his work without having been a workman yourself?

One cannot take a leading position unless in his own shop, without becoming an employee. Employers do not place their affairs in the hands of men without some evidence of competency, and inexperience in the minor affairs shows itself when one is least conscious of it.

You came to the university to get a higher class of instruction than you could at the common schools. I had hoped and still hope to make the Sibley College machine shop a place where you can get a kind of experience which you cannot get at the ordinary establishments, but you must learn to chip and file and grind before you are fitted for it. Some of you may reasonably inquire, then, why are not those who have learned the trade before coming here compelled to take shop practice and do by their work as they do by their studies? That is exactly what I had hoped to do, not by rules and proclamations, but by force of example. Those who are doing so, I believe, will have less reason to regret it at the end of their college life than those who are not.

The glory of winning the Woodford prize is only equal to the glory won by another the year before, and may be eclipsed by him who comes after; while the glory of making the first measuring machine of America is the glory of a longer time; a glory not to be divided. There may be a good many Woodford prize winners; there can be but one first measuring machine. I regret that, in carrying out my plan to let each and every one do what he wanted to do, so far as possible, there should be even so few who, it would seem, have wanted to take the advantage of it. I regret that I have failed in getting more interest taken in the care of the tools; but I regret, far more than all, that I have failed in getting a greater interest taken in our work, by the larger part of you who are most to benefit by it. While I would not question the value of theoretical knowledge, as you may some time in your life find a use for every item of knowledge you can possibly acquire, that certainly will be of the most use to you which you can use the most frequently, and you most assuredly have got to gain a prominent position before your theoretical knowledge will be of special value. Suppose you were to leave here without any practical experience whatever, your only chance then for a situation would be side by side with the boy of no education. It is now a work of hands, not heads; and the boy, while you have been storing the mind for four years, has been skilling his hand for two; and although you may be two years his senior, he will at this handicraft outstrip you two to one. You will be paid for what you do, and not what you know; and if on Saturday night you go home with your little four dollars and a half in your pocket and not conclude that your college life has been half thrown away, I for one will be mistaken.

It is claimed that we give theoretical and practical instruction in the mechanic arts. The words are equal—how about the fact? It requires no greater knowledge of mathematics than to be able to count your finger ends, to find the ten hours a week spent in the shop is not half your working time; besides, the ten hours is not taken from your working time at all, but just so much out of your hours of recreation. To assume shop practice is recreation, is boy's play indeed. To put the practice on an equal footing with the study: While some of you choose to come here for an education, with the privilege of getting a smattering of the trade, others, if they so choose, should be allowed to come here and learn the trade, with the opportunity of gaining so much of theory as they have time and capacity for.

I, myself, should have liked to have had the shop practice put upon its true basis,that is that what you learn in the shop is and by right ought to be considered just as much education as that which you learn in the lecture room. But we have become so accustomed to dividing the theoretical from the practical—so used to call the one education and the other work—that as yet, it is past our power to change it. But whether we call it work or study, trade or education, I wish to convince you of its importance. I wish to show up the insignificant position it holds compared to what it deserves. Let us see. The spirit of the law, giving Government and State aid to the university, if it means anything, means to encourage practical education. Mr. Cornell with his endowment, if he "would found an institution where any man can receive instruction in any study," did not intend to exclude practice; and knowing the interest he takes in our progress, it is well enough known that he meant to include it, while Mr. Sibley's gift was unquestionably intended to establish the work shop. Now these gifts and endowments, and land grants, were given for what? To pay the superintendent of the machine shop and business managers? No, not at all. They were given wholly and solely for your instruction and the instruction of others like you. The executive committee are but guardians; the faculty, from president to instructor, are but instruments or agents for its execution.

It is but right that the students of one class should stand upon an equality with the students of any other. At present the candidates for the degree of B.M.E. are not so situated. I would have the work and study equally divided, or optional, and credited hour and hour alike. I know this will necessitate the abandonment of some of your studies. What one of you has not at least one study that you would like to abandon? Besides you cannot learn all there is to be learned, nor all that is both advantageous and desirable in four years, and what is to hinder your learning after leaving the university, as well from books as from your practice? You will find many things to learn which are of the greatest value, in fact things indispensable in a leading position, which you are getting neither in your studies nor the shop. You must learn to lead, command, or direct men. That sometimes takes years of experience; to get that experience is easy if you begin right. The key note is this: "Always let your ability be superior to your position," for while you are superior to your associates you can lead them. Attempting a position you are not capable to fill is fatal. You are all supposed to be competent to write a good business letter; if you are not, let me tell you you will want that qualification one hundred times for every time you find use for your French and German. You are also supposed to understand bookkeeping; if you do not, you will find it is something you will want three hundred and sixty-four times to every time you find use for your calculus.

In conclusion, allow me to say that this is the opinion of but one man, in opposition to the opinion of twenty. It is based on firm conviction, after as due deliberation as I have been able to devote to the matter; and while no principles relating to business will hold good in all cases, I trust you will not find more exceptions to the rule than enough to prove it true.

Dangers of Nitro-Glycerin.

Nitro-glycerin is a thick colorless oil, and appears to be as harmless, to look at, as lard oil or petroleum. People are so accustomed to the handling of oils of all kinds that it is almost impossible to make them realize the danger that lurks even in the smallest quantity of nitro-glycerin. It explodes when gently struck, and is ten times more powerful as an explosive, weight for weight, than gunpowder. The other evening, in Jersey City, a gentleman and lady were taking a moonlight stroll on the hights, in the vicinity of one of the shafts of the new Delaware and Lackawanna railway tunnel. The man saw on the ground the glimmer of a small tin tube, picked it up, and slapped it from one hand to the other, when a terrific explosion ensued. His eyes were destroyed, his flesh lacerated, his limbs broken, while his lady companion was dreadfully injured. It was a discarded nitro-glycerin tube, such as are used in blasting, and is supposed to have been thrown away by workmen at the tunnel shaft.

In Parker City, Pa., recently, a young man was carting six cans of nitro-glycerin over a rough road in a wagon, when, from some cause which will never be explained, it exploded. The man, horse, and cart were literally blown to pieces. The man's head and part of his breast were found three hundred feet distant, having been blown over the tops of the highest trees. Fragments of his limbs were scattered in different directions, and his right hand was found half a mile from the spot. Even the horse's shoes were torn from his feet.

Copyrights.

The new law in respect to copyrights, by which the official fees for copyrights on labels are increased, goes into effect in August. Until that date, however, copyrights can be had at the old rates, and all who desire to avail themselves thereof should have their applications filed at once. Further information can be obtained at this office.

G. L. M. says: To make a nest egg, take an ordinary hen's egg, break a small hole in the small end, about ⅛ of an inch in diameter, extract the contents, and, after it is thoroughly clear inside, fill it with powdered slacked lime, tamping it in order to make it contain as much as possible. After it is full, seal it up with plaster of Paris, and you have a nest egg which cannot be distinguished by the hen from the other eggs, and one which will not crack (like other eggs) by being frozen.

AN automatic feed arrangement, for supplying boiler and other furnaces with fuel in a pulverized or granulated state, is the invention of Mr. J. Martin Stanley, of Sheffield, Eng. The powdered or granulated fuel, suitably prepared, is injected into the fire space by means of a jet of steam, the quantities being regulated by suitable valves, and the supply of steam and fuel being automatic.

PROFESSOR C. A. YOUNG, of Dartmouth College, is on his way to China to observe the transit of Venus.

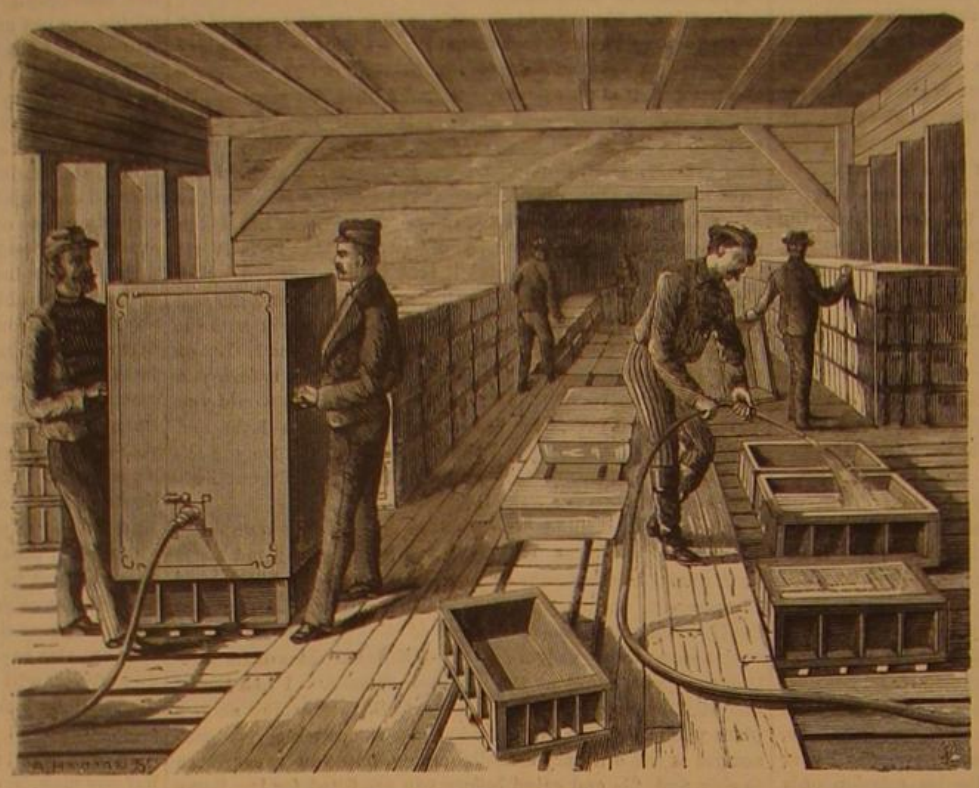
NEW ICE MAKING PROCESS.

Cool subjects, during hot weather, have an appropriateness peculiarly their own. Hence the reader will doubtless, during the present heated term, experience a refreshing satisfaction in not only perusing the following account of a new and simple manner of manufacturing ice, but in contemplating the annexed engraving of workmen engaged in that refrigerating occupation.

The process is one which is calculated to render the user independent of the monopolies which now control the ice supply, by affording a simple means whereby every one, having the requisite facilities, may easily manufacture his own ice, or enough to maintain as large a trade in the commodity as may be desired.

The prominent feature of the plan is that no pond or river is necessary. The requirements, however, are a good supply of water; a rough, strong frame building, open on all sides, for a freezing house, provided with suitable shutters which may be opened to allow the free passage of any light breeze; a well constructed ice house for storing the ice, and some simple appliances, which we proceed to describe.

In the wooden cribs or frames, shown in our engraving, are placed tanks made of strong cotton canvas especially woven for the purpose. These are filled with water, and are placed in piles of four each, as represented on the left, thus exposing a larger surface of water to the action of the atmosphere. They are then left until their contents become thoroughly frozen. In order to detach the blocks of ice, a cover is provided which is inverted over the set of four tanks, and steam admitted into it for a few moments. The cover is then removed, when the ice blocks may be readily turned out of the boxes. The latter are made with sides sloping inward toward the bottom, in order to facilitate the above operation, and are of such a size as to be readily handled, while containing the ice, by two men.



NEW ICE MAKING PROCESS.

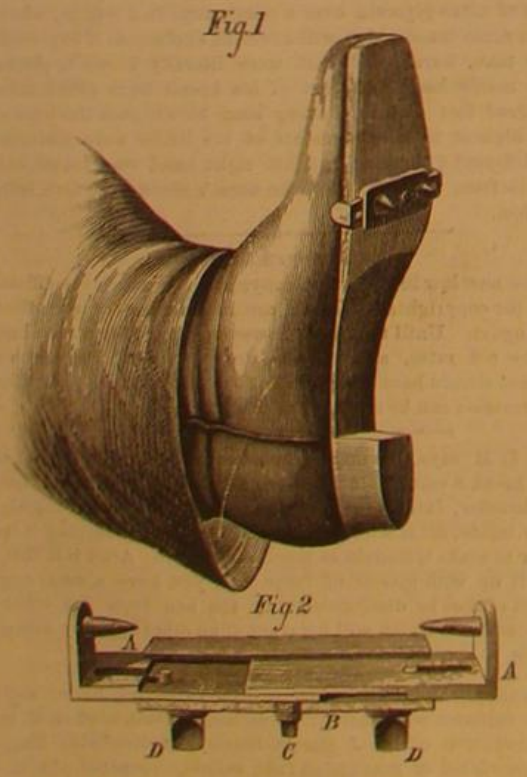
In our engraving the various operations peculiar to the process are clearly depicted. The freezing is done under the shade of a roof, and hence will not be interrupted by the sun, so that it can be continuously carried on in weather when ponds and rivers are usually open. The ice house can be used as a freezing shed when it is necessary to economize space.

We are informed that the average amount of ice produced by this process, from November 1, 1873, to April 1, 1874, was two tuns to each tank, the dimensions of the blocks being 30 inches long, 26 inches wide, by 10 inches thick. By making preparations so as to be ready by November 1 next, it is stated that purchasers of rights under this patent will have the advantage of making and using their own ice through the winter, as the present high prices will probably be maintained until the opening of the rivers next spring.

Patented November 1, 1870. For further particulars address Messrs. Newsham, Haynes, & Henson, 108 Pacific street, Newark, N. J.

EARLE'S IMPROVED ICE CREEPER.

Mr. Reginald H. Earle, of St. John's, Newfoundland, has patented through the Scientific American Patent Agency, December 9, 1873, a novel and simple form of ice creeper, an engraving of which is herewith presented. A patent has also been applied for in Canada through the same medium.



The device consists of two sliding plates, A, Fig. 2, the outer extremities of which are turned up at right angles, and are provided on the inside with spikes. The inner ends of these plates are suitably formed to overlap, while the side edge of each enters a groove in a main plate, B, the length of which is about equal to the width of the sole of a boot. Plate, B, has projections on its upper side, which enter slots in, and thereby serve as guides for, plates, A. Through the under side of plate, B, passes a set screw, C, and to the same portion are attached short spikes, D, which take hold of the ice and prevent the wearer from slipping.

In using the invention, the set screw is loosened and the plates, A, drawn outward. The creeper is then placed upon the sole of the boot, as shown in Fig. 1 and the plates, A, are pushed inward, forcing the spikes thereon into the edges of the sole. The set screw, C, is lastly tightened, thus completing the adjustment. For further particulars address the inventor, 216 Water street, St. John's, as above.

Preparation of Ether.

The most efficacious process is to heat to 140° a mixture of 9 parts sulphuric acid at 66° B, and 5 of 90 per cent alcohol, alcohol being allowed to run in so that the level remains constant. By direct firing the vessel is apt to be destroyed, and accidents are rendered likely through the inflammability and volatility of the ether; superheated steam is far more safe as a means of heating, though a little more costly. Iron vessels lined with lead appear to be preferable to copper or lead-lined copper vessels. When the operation is properly conducted, 66 per cent of ether (sp. gr. 0 73) is obtained. For 100 lbs. of ether, ½ lb. sulphuric acid is required.

The crude ether is washed with water and rectified. This washing and rectification may, however, be dispensed with by passing the vapors first through a jacketed receiver, the jacket of which contains water at about 35° (alcohol and water condense in this, but not ether), and next through purifiers containing lumps of quick lime and trays of charcoal or coke soaked in caustic soda and well dried, whereby sulphur dioxide is removed. The purification simultaneously with the preparation is, however, open to several practical objections.

The conditions of success and of a good yield consist in keeping the temperature constant, and the flow of alcohol regular.—*O. Süssenguth.*

Strange Stories Confirmed.

Some months ago, Darwin wrote to his disciple Fritz Müller, now in Brazil, directing his attention to the habits of the leaf-cutting ants. The reply contains a confirmation of Mr. Belt's observations to the effect that these ants do not feed on the leaves they gather in such vast quantities, but on the fungus which grows on the leaves in their underground chambers. On examining the stomachs of these ants, Mr. Müller found no trace of vegetable tissue which might have been derived from the leaves, but only a colorless substance, showing under the microscope some minute globules, "probably the spores of the fungus."

Again, as to the protective partnership between certain plants and their ant inhabitants, Mr. Müller says he has cut down hundreds of *cecropiæ* and never missed the ants, and adds: "I wonder that it had never occurred to me that the trees are protected by the ants; but there can be no doubt that this is really the case, for young plants of *cecropiæ*, not yet inhabited by ants, are often attacked by herbivorous insects."

Manufacture of Chloral Hydrate.

Chloral hydrate is now manufactured on an enormous scale, some German makers supplying over 500 lbs. daily. Chlorine is passed into alcohol of at least 96 per cent. For 120—150 lbs. of alcohol the current of chlorine must be maintained for 12—14 days, in which time the temperature rises to 60°—75°, and the liquid acquires the density of 41° B. The crude product thus obtained is purified by heating it with an equal weight of strong sulphuric acid in copper vessels lined with lead. Considerable quantities of hydrochloric acid escape at first, and afterwards chloral distils at 95°—100°. This distillate is redistilled, collected in glass flasks, and mixed with water; and the hydrate then formed is either poured into large porcelain basins, in which it solidifies in cakes in half an hour, or it is poured into vessels one third full of chloroform, to crystalize.

Rain Water Impurities.

In a recently published work on "Sanitary Arrangements for Dwellings," Mr. Eassie points out the precautions to be adopted by householders in cases where rainfall forms the chief or only source of water supply. Generally it will be found convenient to store rain falling on the roof in an underground tank, formed of brick or concrete, puddled outside with clay and covered inside with Portland cement. But care must be taken that the down spouts conducting the rainfall to the tank do not drain either zinc roofs or lead flats. Even on tile or slate covered roofs, the water will have passed over lead flashings, ridges, hips, and valleys, charging it with a small percentage of lead, but not more than one twentieth of a grain to the gallon. With a greater proportion than this, water becomes dangerous to use, being more or less poisonous. Since rain acquires certain impurities, even while passing through the air, it should always be carefully filtered before being used for drinking or cooking purposes.

In the case of a house supplied with an underground receptacle, filtration could be easily managed, by placing an earth filter on the delivery side of the down spout, at its exit from the tank. An eminent authority on sanitary subjects, Dr. Angus Smith, believes rain water can be so completely filtered through earth as to remove all impurities. Whenever rain water is stored for drinking purposes, the eaves of the roof, troughs, and down spouts should be enameled, and the supply ought to be carried to the tank through glazed earthenware pipes. This prevents leading, but other deleterious ingredients will still remain. In manufacturing towns, soot, oil, and sulphuric acid form some constituents of rain water. With these facts in view, most people will agree with Mr. Eassie, in his conclusion that "generally speaking, rain water should be excluded from the kitchen," although extremely useful in laundries and conservatories.

IMPROVED FURNACE FOR MELTING BRASS.

Mr. Ira D. Bush, of Detroit, Mich., has patented, through the Scientific American Agency, a novel form of furnace for melting brass or other metals, an engraving of which we herewith present. The apparatus is mounted on trunnions in a suitable frame, and is divided interiorly into three compartments by partitions, two of which are shown at A A. B is the crucible, supported by the said partitions, and having a spout running along the top of one of the latter, terminating at C. The furnace cover is detachable, and has a chimney at D. To a central pivot on the furnace bottom is confined the grate plate, shown separately in the foreground. By this means each of the apertures in the lower side of the device is provided with a separate grate; and as all are connected, by turning the plate the air ports may be quickly opened to discharge the cinders and refuse formed during the melting process. A suitable lever connects with one of the bearings for convenience in tilting the furnace.



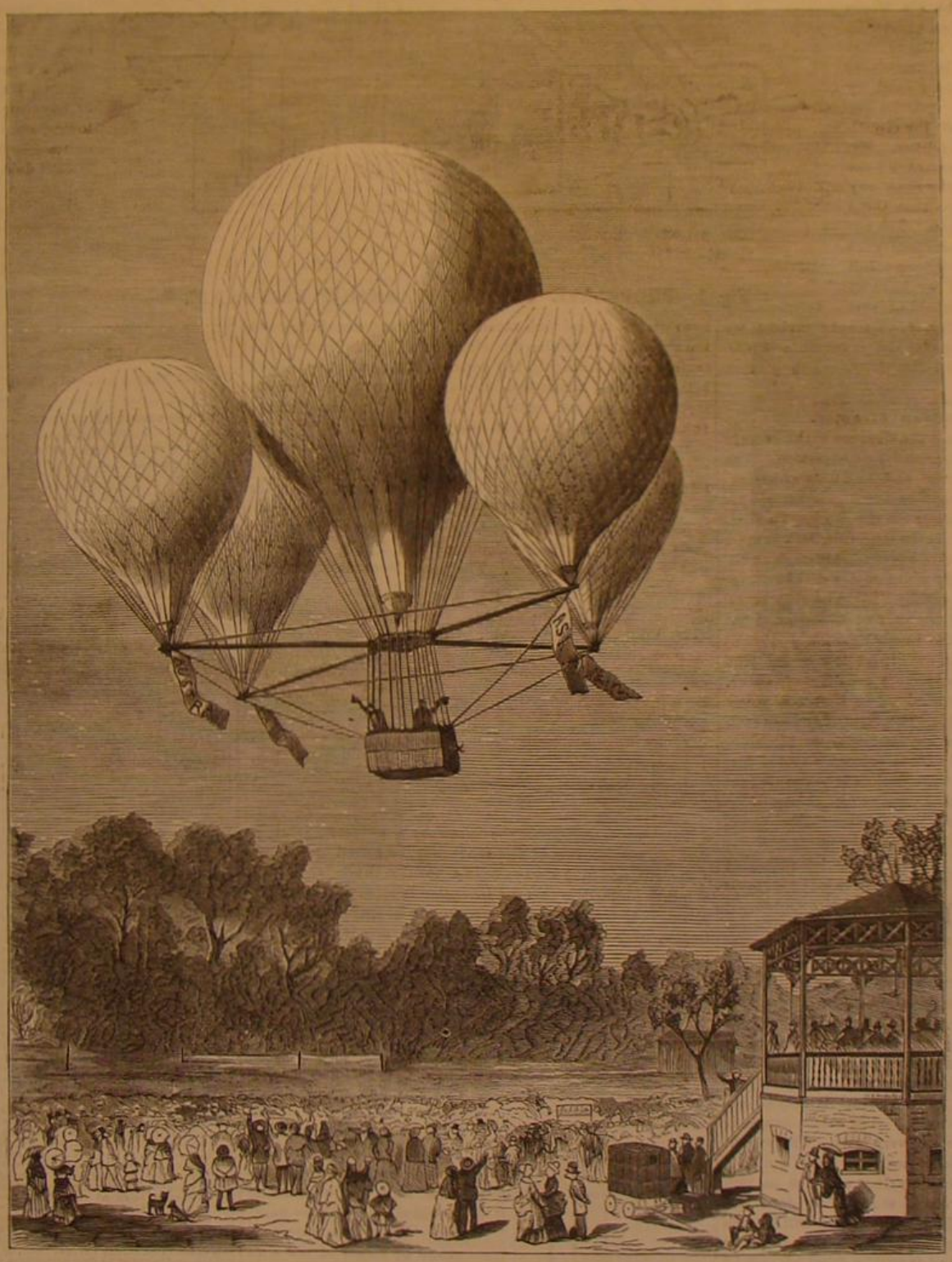
A SHAFT, weighing 50,000 lbs., and some cranks that weigh 31,000 lbs. each, have just been made at Bridgewater, Massachusetts, for the Fitchburg water works.

A NOVEL BALLOON ASCENT.

The French nation has long been foremost in aerial navigation. Pilâtre de Rozier became famous as the first who ventured to ascend in a fire balloon, the invention of the renowned Montgolfier. This was on October 15, 1783, a few animals having previously been sent up, which safely returned to earth. Soon after, Pilâtre again went up, taking with him the Marquis d'Arlandes; and gradually it became so fashionable to take a trip into the higher regions that many persons fell victims to the aerial fever. Pilâtre himself lost his life, being precipitated into the Channel in attempting to cross. It is to him that the idea of using balloons for war purposes is to be ascribed, as on his suggestion the Convention authorized the formation of a company of *Aerostiers*, who were employed in reconnoitering the enemy. Two officers made the observations, and communicated with earth by means of flags, or by messages written on paper and weighted to prevent their being lost. The last experiments of this kind were made in Algiers, in 1830, but with so little success that the company was dissolved.

Aerial navigation, however, assumed great prominence again in the late war, especially, as we have often described in these columns, during the siege of Paris. It was in this excellent school for aeronauts that Theodore Sivel, one of whose remarkable ascents forms the subject of our illustration, was educated. He traveled after the close of the war, with his beautiful balloon *Koloss*, in Sweden and Denmark, and then in Germany. His mother-in-law, Madame Poitevin, a well known aeronaut, was probably his instructress. The ease and elegance of Sivel's balloon in ascending created a general sensation.

In Leipsic (in the fall of 1873) he was descending rapidly, with five other voyagers; and seeing a great danger, he boldly discharged the gas at once (by a suitable mechanism for slitting up the balloon), after the anchor had taken hold, and obtained thereby full control over the empty balloon, without any loss or accident. His most remarkable ascent, however, was made on May 20, 1874, from Leipsic, when he ascended with five balloons, fastened together, which was, as he himself stated, "the grandest experiment ever undertaken in this line." This ascent is the subject of our picture. Around the main balloon, *Europa*, were secured the four smaller ones, named Asia, Africa, America, and Australia. The ascent was made at 5:30 P. M., Sivel and one passenger being in the basket. The strong wind carried the balloons, which turned playfully around on their axes, in a westerly direction; and they were visible at an elevation of 9,000 feet, as their great bulk made them very obvious at that hight. At about 7 o'clock Sivel detached the smaller balloons, and succeeded in drawing them down to the basket and hooking them thereto. He then opened their valves simultaneously, and descended, safely and majestically, to the earth near the railroad station at Dürrenberg. A few days after this ascent a double ascent was undertaken, Sivel rising in the before mentioned *Koloss*, and Madame Poitevin traveling in the balloon *Zenith*, making an almost unique display in aeronautics.



SIVEL'S RECENT BALLOON ASCENT AT LEIPSIC, GERMANY.

Making Hand Organs.

On the front of a dingy brick building at the head of Chatham street, weather-beaten and dim, hangs the sign: "Hand Organs." A reporter of the New York *Sun* saw the sign and went in; and thus he describes his interview with the workmen, and what he saw. Standing at benches, leaning over old organ boxes, seated before little stands, five men were at work. In the middle of the room stood several old hand organs. On the walls hung queer patterns, numbered and diagramed; in the further corner stood a machine seven or eight feet high, looking for all the world like a threshing machine.

"Is the proprietor in?" asked the reporter of the workman nearest the door.

The workman turned, pointed toward the other end of the room, and went on cutting out long strips from a great sheet of pasteboard.

Sitting on a low chair, with a low table before him, was a short, stout, jolly-faced man, evidently a German. On the bench in front of him, mounted on two wooden rests, hung a wooden cylinder, fifteen inches long, perhaps, and five inches in diameter. Behind the cylinder was a small case, a Lilliputian type case, containing thirty-six little boxes, and every box full of little brass pins.

"What do you charge for a common sized organ?" asked the reporter.

"It depends on the kind," answered the proprietor; "I can make you a flute organ, with twenty-four keys, to play nine tunes, with a black walnut case, for a hundred dollars. If you want an organ to play ten tunes, I can make it for you for a hundred and twenty dollars. An organ of this size will weigh about twenty-five pounds. A parlor organ, with from 25 to 46 keys, will cost from a hundred and fifty to two hundred and fifty dollars. A side show organ, to play nine tunes, with 60 keys, 35 brass trumpets, large and small drums, and triangles, I can make you for two thousand dollars."

While he was talking, the jolly little man sat pegging away at the cylinder before him, driving a pin here and a peg there, straightening them with a little pair of pinchers, and flattening them with a little, light hammer.

NEW TUNES IN OLD INSTRUMENTS.

"What are you driving those pegs in there for?" asked the reporter.

"This is an old cylinder. It was made years ago," he answered; "the tunes that were all the go then don't draw out the pennies worth a cent now. I am putting new tunes in it. I take the cylinder out and paste a sheet of clean white paper around it. Then I mark it for the tunes, and drive these little pins in, and the thing is done. Its very easy to do."

It looked very easy. The cylinder was covered with hundreds of little black lines, some half an inch long, others scarcely more than a dot. The reporter asked how he knew where to draw the lines.

The little man took a handful of the little pins out of his apron on his lap, took a few dozens more out of his mouth, got on and began to turn the crank of a dismantled organ that stood near.

HAND ORGANS AND CHURCH ORGANS.

"You see," said he, "a hand organ is made like any common organ. It has a bellows and pipes and keys. When you want to play on a church organ, you push down on the keys; when you want to play on a hand organ, you lift the keys. You use your fingers to play on a church organ; these little brass pins are the fingers on a hand organ. You see these little wires that hang down from the ends of the keys? Well, every time one of those wires strikes one of the brass pins when the cylinder is going round, the key is raised and the note is sounded. If the brass pin is one of those long, half inch ones, the key stays up a good while, and the note is a long one. If the pin is just a little dot, the key falls right back, and the note is short."

"But how do you know where to mark the cylinder for the tunes?"

"That's the secret of the trade," answered the little man; "but I guess I'll show you. You see, the cylinder is covered with clean paper, and all ready; now I hang it in by the iron rod that sticks out at each end. The tune I want to mark it for I play on the keys, only I press the keys down instead of lifting them, for I know what noise they would make just as well as if they did make it. Every time one of those little wires strikes the cylinder, it makes a little dent. If I hold it down for a long note, it makes a long mark; for a short note, it makes just a dot. Then I go over the marks with a pen to make them plain. When one tune is marked, I go on with the next. When the tunes are all marked I put the pins in, as you see."

"How do the organ grinders change from one tune to another while they are playing in the street?" inquired the reporter.

"Every organ," responded the little man, "plays from seven to ten tunes. This one I am working at plays eight. Do you see these little grooves?" and he pointed to one end of the cylinder, where a piece of wood had been left, about two inches long and an inch and a half in diameter. There were eight little grooves around the projection. "When the organ grinder wants to change the tune, he lifts that little spring, shoves the cylinder in or out one groove, and the tune is changed."

"How long do the organs generally last?" asked the reporter.

"Oh, bless your soul," said the little man, "five years is no time at all for a hand organ. Why, there's many an organ travelling the streets that's been used every day, week in and week out, for the last thirty years. That's just what kills the business. They last too long."

"How many organs do you make in a year?" asked the reporter.

"Well, from seventy-five to a hundred. When times are hard, more men have to go to grinding organs, and the business is better. I shall make a hundred this year."

"That ought to make a profitable business."

"No it don't. Materials are so high that there's not very much profit on organs. I have to do some work in other branches to make it pay. I make a great many automatic figures for travelling shows, and repair 'most all kinds of musical instruments."

"Then there are a hundred new organs turned loose to prey on the public every year."

"More than that," said the little man. "This is the only hand organ manufactory in the country, but there is a firm that imports them from France. They sell about as many every year as I do, and sell them for the same prices."

"Then there is no competition?"

"No, no competition."

"Can any of your workmen mark the cylinders for new tunes?"

"No; there are only two men on this side of the Atlantic who

can put the tunes on a cylinder—the man who imports organs from France, and myself."

"Are there many Germans grinding organs?"

"No," responded the organ maker, "the grinders are nearly all Italians and old American soldiers."

Four Messages at once with One Wire---A New Telegraphic Improvement.

A new invention in telegraphy by George B. Prescott and Thomas A. Edison has lately been successfully tested at the main office of the Western Union Company in this city. The new invention is a process of multiple transmission by which two messages can be sent simultaneously in the same direction over the same wire, and either message can be dropped at any way station on the circuit. The old duplex system can be applied to the new invention, and by the combination four messages can be sent simultaneously over the same wire in opposite directions between any two terminal points. The old Morse key is used, with no duplication except as to parts of machinery. It is alleged that the invention will quadruple the usefulness of the 175,000 miles of wire now owned by the company.

Mr. Prescott is well known as the electrician of the Western Union Company. Mr. Edison has probably made more inventions pertaining to practical telegraphy than any one man now living. We hope that these expectations will be fully realized. The advances thus far made in the practical uses of electricity are many and various. But it may be truly affirmed that we have at present only reached the threshold of this great department of human industry. Except chemistry, we know no field more promising for the inventor and discoverer than that of practical electricity. Young men should study the subject.

The Bessemer Saloon Steamer.

This vessel, intended to obviate sea sickness in the passage across the Channel, is rapidly approaching completion. The vessel has been completely plated, and the fitting of her engines and boilers in place will soon be accomplished. This work will be done while the ship is on the stocks, so that, when she is launched, she may, by the same tide, be sent upon her trial trip. The vessel, so novel in her construction, is an object of great interest, and scarcely a day passes without several visitors from a distance inspecting her. The ship is 350 feet long at the water line, and for 48 feet at each end the deck is only about 4 feet above the line of flotation, so that in rough weather the sea will wash over these low ends. The decks on this portion of the vessel have a considerable curve, and the sides of the ship are rounded off so that the water may escape as speedily as possible. This form of end has been selected with a view to obviate any tendency to pitching. Above these low decks a breastwork is erected about 8 feet high. The whole of this breastwork deck is to be devoted for the use of the passengers, and that portion fore and aft of the paddle boxes will be protected with stanchions. The vessel will be propelled by four paddle wheels, and 90 feet of the space between the paddles will be occupied by the swinging saloon. Beyond this and at each end the space is occupied, nearest the saloon by the engines and next by the boilers. At one end of the breastwork there will be accommodation for the crew of the ship, and beneath their quarters stowage room for passengers' luggage, etc. At the opposite end of the breastwork the space is fitted with cabins for the special use of ladies, and below these cabins there is a saloon 52 feet long, and fitted with sofa seats all round. Along the sides of the breastwork deck, between the paddle boxes, there are other cabins for passengers, besides smoke rooms and refreshment rooms. The Bessemer swinging saloon is making good progress, and already a good idea of the principle may be obtained by an inspection of the work. The saloon proper is about 70 feet long, 26 feet wide, and very lofty. The weight of the saloon is borne by four large bearings, one at each end and two near the center. The end bearings are fixed on iron transverse bulkheads, which are well stiffened by four and aft ways to prevent them buckling. The saloon will be one of the most superbly fitted apartments afloat. The top of it will form a promenade deck, and it will be fitted all round with seats. The saloon will be entirely under control of the machinery invented by Mr. Bessemer, and it is declared that it will be kept perfectly free from rolling during the passage across the Channel, and passengers, it is expected, will not feel any more unpleasant sensation than they would in going up or down the Thames. The ship will be supplied with two very large life rafts on the plan patented by Mr. Christie, and she will be steered and her capstans, etc., worked by hydraulic machinery. She was designed by Mr. E. J. Reed, C. B., M. P., and Earle's Shipbuilding and Engineering Company at Hull are both the builders and the engineers.

A NEW THAMES TUNNEL AT LONDON.—This is intended to provide a road and railway communication from East Greenwich, across the marshes, to Blackwall Point, then straight across the river by a tunnel to Poplar, thus forming a direct communication from the East India Dock Road on the north side of the river to the Woolwich and Greenwich Road on the south side. The general gradient would be one in forty, and the length of the tunnel 600 yards. The estimated cost is $2,500,000. The distance is greater by 200 feet than the width of the East river between the towers of the New York and Brooklyn Suspension Bridge.

THE NEW STEAMER BRITANNIC—A NEW PROPELLER IMPROVEMENT.

The Britannic, a new steamer belonging to the White Star Line, recently arrived in this port, and has attracted no small degree of public attention on account of numerous modifications and improvements entering into her construction and fittings. The vessel is of exceptionally fine build, 472 feet long, 45 feet beam, and a total carrying capacity of 5,000 tuns. She has compound engines of 760 nominal, but working to nearly 6,000 actual, horse power, and eight boilers, and developed great speed, making the passage over in 7 days, 19 hours, and 35 minutes, which is within half an hour of the fastest time recorded. The interior fittings of the ship are remarkable for elegance and completeness, no improvement adding to the personal comfort of passengers being omitted. There is a blowing engine to force fresh air through the cabins, swinging berths for the sea sick, and running water and basins in every state room.

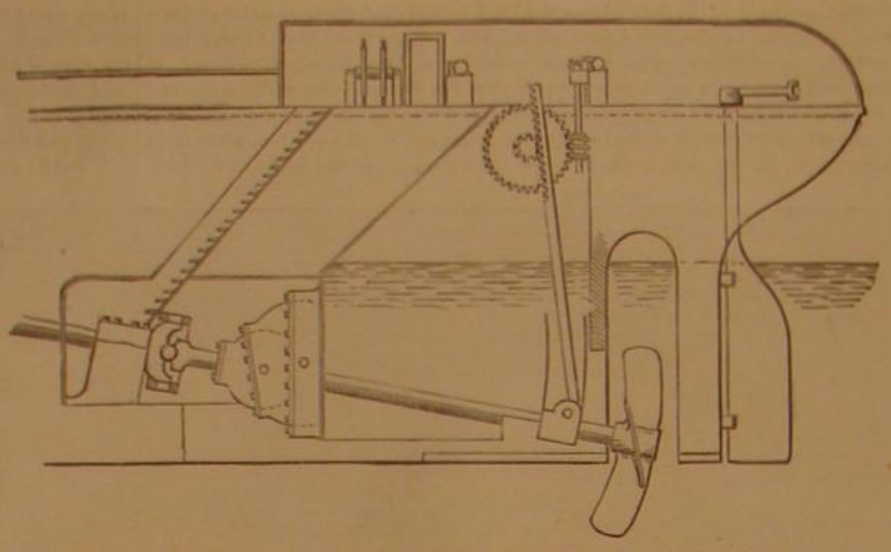
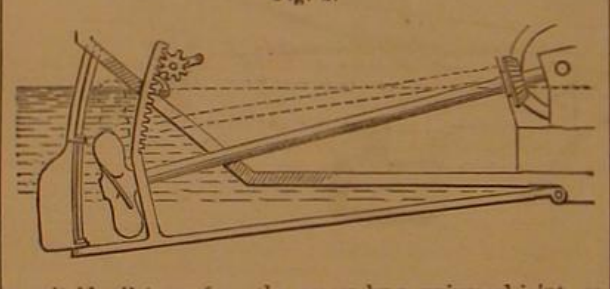


Fig. 1.—PROPELLER OF THE STEAMSHIP BRITANNIC.

To the engineering world, the novel arrangement of the propeller is of especial interest. The object sought is to obtain the maximum benefit from the wheel, and to avoid the loss of power due to its racing when lifted wholly or partially out of water by the pitching of the vessel. From our hasty sketch from the mechanism itself, Fig. 1, this device will be readily understood. The propeller shaft is jointed at

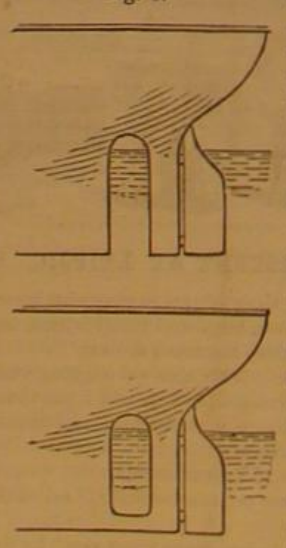
Fig. 2.



a suitable distance from the screw by a universal joint, so that the rear portion of the shaft may be raised or lowered as desired, and still always be in a position to receive motion. We may state here that the invention is somewhat similar in principle to that patented here August 3, 1872, by James M. Dodge, of Newark, N. J., of which we present a diagram, Fig. 2. How far the claims of the British and the American inventors will interfere, or which has priority of date, is uncertain.

The Britannic's apparatus has a very ingenious arrangement, shown near the universal joint, in Fig. 1, for the exclusion of water at whatever angle the shaft may be. A disk, through which passes the shaft, is pivoted within a second disk, and the latter is, in turn, pivoted within a casing forming part of the shaft well, the joints being provided with suitable packing. When the screw is raised by means of the simple gearing shown attached, the first disk is elevated bodily, carrying its point upward, and there rotating the second disk within its casing, and around the first disk, the universal joint being, of course, the center of motion.

Fig. 3.



Not only can the screw be thus lowered at sea, but it may be raised in passing over shoals, or in port, or when a blade is broken, for repairs. The difference in the stern of the vessel, necessitated by this device, is shown in Fig. 3, in which the upper diagram exhibits the construction of the Britannic, while the lower diagram shows the ordinary aperture made for the propeller. It will be noticed that, in the new invention, the strip between the keel and rudder post is necessarily cut away, though replaced, when the screw is sufficiently elevated, by a kind of bolt which slips across. As to how the rudder post, thus left entirely unsupported below, will stand the strain of the rudder and the shock of cross seas is a question which further actual experiment must decide. At first glance, we are inclined to think that this portion must eventually prove an element of weakness.

The Britannic is constructed with the eight watertight bulkheads so arranged that the water entering any compartmen will close the door and isolate it from the rest. There is also ingenious steam steering gear and a telegraphic apparatus for the transmission of signals to the helm.

New Method of Detecting Mercury.

Mayençon and Bergeret give a method consisting in placing an iron nail, to which a platinum wire is attached, in the urine, etc., acidulated with so much sulphuric acid as to cause a slow evolution of hydrogen. The mercury is deposited in the metallic form upon the platinum, which is taken out after the lapse of half an hour, washed, and exposed to a current of chlorine, to convert the mercury into corrosive sublimate. The wire is then gently drawn over blotting paper slightly moistened with a 1 per cent solution of potassium iodide. If mercury is present, red streaks of mercuric iodide, soluble in potassium iodide, are formed. The method is very delicate and rapid. The authors could always detect mercury in the urine (but not in the saliva, notwithstanding that salivation had taken place) after the internal administration of corrosive sublimate, or inunction with mercurial ointment. They also found mercury in abundance in the milk of a woman 48 hours after inunction.

DECISIONS OF THE COURTS.

United States Circuit Court.---District of Massachusetts.

PATENT SAFETY VALVE.—EDWARD H. ASHCROFT *vs.* THE BOSTON AND LOWELL RAILROAD COMPANY.

[In equity.—Before Shepley, Judge.—Decided May 8, 1874.]

Shepley, Judge:

The bill in this case charges the defendants with infringement of letters patent of the United States, reissued November 9, 1869, to the complainant, as assignee of William Naylor, of the county of Middlesex, England, for an improvement in steam safety valves.

The invention relates to spring safety valves for use on locomotive, stationary, and marine engine boilers. As the spring on common safety valves was compressed by the lifting of the valve, the force of the spring became stronger by tension, while inversely, from other causes, the tendency of the valve to rise became weaker. The spring safety valve, therefore, failed to relieve the boiler, for, as the spring was compressed by the lifting of the valve, its power to resist was largely increased; and if steam was rapidly generated, the pressure in the boiler continued to increase while steam was escaping at the valve.

Various attempts have been made, as shown by the various patents in evidence, to obviate this defect in the operation of the common spring safety valve.

William Naylor, in his specification filed in the Great Seal Patent Office of Great Britain, on the 21st day of January, 1864, described two methods of obviating this difficulty: one of these methods claimed by him as his invention, he says, "consists, when using a spring for resisting the valve from opening, in the employment of a lever of the first order, one end resting by a suitable pin upon the safety valve, and the other end of the lever resting upon the spring, being bent downward to an angle of about forty-five degrees from the fulcrum, so that when the valve is raised by the steam the other end of the lever depressed upon the spring downward, and at the same time is moved inward toward the fulcrum, thus virtually shortening that end of the lever, and thereby counteracting the additional load upon the valve as it is raised from its seat by the greater amount of compression put upon the spring." This method he claimed as his invention in the specifications of his English patent. These specifications also described another method of obviating the difficulty. This consisted of the following contrivance: A lateral branch or escape passage was provided for a portion of the steam after it passed the valve, the valve was made to project over the edges of the exit passage for the steam, and the projecting edges of the valve were curved slightly downward, so that the steam, on issuing between the valve and its seat, would impinge against the curved projecting portion of the valve, and a portion of it would be directed downward into the annular chamber which surrounded the central passage for the steam, which chamber communicated with the exit pipe, while the other portion of the steam ascended past the edges of the valve. "By this means," he states, "I am enabled to avail myself of the recoil action of the steam against the valve, for the purpose of facilitating the further lifting of such valve when once opened; *but I wish it to be understood that I lay no claim to such recoil action, nor to the extension of the valve laterally beyond its seat.*" And in the claims, at the close of his specifications, he made no claim for any such extension of the valve, or any device for effecting any recoil action of the steam. In fact Charles Beyer, in his English patent, dated October 21st, 1863, before the date of Naylor's patent, had fully described "a valve made to project over the edges of the exit passage for the steam, and the projecting edges of the valve were curved slightly downward, so that the steam, on issuing between the valve and its seat, would impinge against the curved projecting portion of the valve."

Without adverting to the patents of Henry Waterman and other devices older than Naylor's, we have seen that Naylor could not, with propriety, claim to have been the inventor of the combination, in a spring safety valve, of every form of projecting, overhanging, downwardly curved lip or periphery with an annular recess surrounding the valve seat into which a portion of the steam is directed as it issues between the valve and its seat.

Neither of the attempts to overcome the objections to the spring safety valve in common use appears to have been so far successful as to have introduced either of the inventions into common or general use.

Letters patent of the United States issued September 25th, 1866, to George W. Richardson, of Troy, N. Y., for an improvement in safety valves. The purpose of a safety valve being to open and relieve the boiler, and then to close again at a pressure as near as possible to that at which the valve opened, Richardson accomplished it so far as to invent a valve which would open at the given pressure to which the valve was adjusted and relieve the boiler, and then close again when the pressure in the generator was one hundred pounds to the inch. This practically answered to the required conditions for a useful spring safety valve. It went very soon into general use. The complainant, who is a manufacturer in this country of safety valves, then, as appears from the evidence in the record, endeavored to find something to anticipate the invention of Richardson. Finding in the Patent Office a model of the Naylor valve, with an overhanging lip and an annular chamber surrounding the valve seat, he goes to England and purchases the right to the Naylor invention, and although Naylor himself had disclaimed the recoil action of the steam consequent on the passage of a portion of the steam downward into the annular chamber surrounding the central chamber, while the other portion of the steam ascends past the edges of the valve, and had also disclaimed the extension of the valve laterally beyond its seat, the complainant caused the patent to be reissued to him, as assignee of Naylor, with the following claims which were not in the original patent:

2. The safety valve C, with its overhanging, downward-curved lip or periphery and annular recess D, substantially as herein shown and described and for the purpose set forth.

3. The annular recess D, surrounding the valve seat, substantially as herein set forth.

4. The combination of the valve C, and the annular recess D, as herein set forth and for the purpose described.

From a history of the art as previously given, and from a comparison of the original with the reissued Naylor patent, as well as from the language of the claims in the reissued patent, it is manifest that if these claims can be sustained, it can only be for the combination of the described valve with its overhanging, downward-curved lip, with precisely such an annular recess surrounding the central chamber as he describes. Naylor did not invent the overhanging, downward-curved lip or periphery, nor was he the first to use an annular chamber surrounding the valve seat into which a portion of the steam is deflected as it issues between the valve and its seat. His claims must therefore be limited to the combination of the other elements, with precisely such an annular recess as he has described, and operating in the described manner, so far as such recess, separately or in combination, differed in construction and operation (if it did materially differ in those respects) from those which had preceded it. The claims cannot be made to cover a safety valve like the Richardson valve, which, in its construction and mode of operation, is substantially different from the valve described in the Naylor patent. The Richardson valve is the one used by the defendants.

There is a substantial difference between the Richardson valve and the valve in the specifications and drawings of the Naylor patent, not merely in degree, but its increased practical utility results from a substantial difference in construction and mode of operation.

Bill dismissed.

(*James R. Robb*, for complainant.
J. G. Abbott and *Benjamin Dean*, for respondents.)

Recent American and Foreign Patents.

Improved End Gate for Vehicles.

John C. Hawker, Pana, Ill.—This is a convenient fastening for the end boards of wagons. Plates are riveted to the side boards, which hook under and support the bottom board. Hook recesses in the plates receive the ends of fastening bars, which are screwed to the end board. The parts which enter the recesses project and have each a flat bolt head, which prevent the side of the wagon body from spreading. From the two upper heads button pins project, to which are attached the ends of the chains which hook to the side boards. In unloading the wagon, in order to deliver the contents back from the wagon body, the end board is adjusted on a level with the bottom, and supported by the chains and by the two lower fastening bars, which are dropped into the hook recesses. When the end board is closed, its top is brought to a level with the top of the side boards.

Apparatus for Removing Oils fr Animal and Vegetable Substanc

George N. Phelps, Brooklyn, N. Y., assi to himself and Conrad Braker, Jr., New York city.—This is an impro apparatus for removing oils, fats, resins, etc., from solid material, by treating it with bisulphide of carbon or other suitable solvent. Shelves are arranged in connection with semi-cylindrical plates inside of a high case, so as to form a continuous zig zag passage, through which, over pulleys placed at the ends of the shelves, travel endless chains. To the latter are attached buckets made of perforated sheet metal, so as to allow the liquid to pass through them, while they retain the solid material. The oil is extracted from the solid material by bisulphide of carbon, which is introduced through an inlet pipe and withdrawn through the outlet in the lowest compartment of the zigzag passage. The inflow of the solvent is regulated to fill the lower part of the case nearly to the inlet. The solid material is carried by the buckets down through the solvent, and up from one shelf to another through the zigzag passage, and is discharged through a discharge spout. By this construction the inflowing stream of the solvent meets the solid material as it rises above the water line of the solvent, and thus removes any oil that may remain in it after passing through the solvent. The solvent and the solid material pass through the lower part of the machine in opposite directions, and the solvent flows out as it meets the solid material, as said solid material reaches the lower end of the vertical part of the passage, so that the solvent may be as near saturation as possible when it flows from the machine. The solvent and oil, as they escape from the machine, are conducted to a still, where they are separated, and the solvent may be again used.

Improved Car Coupling.

Morris E. Bromeling, Leroy, Minn.—The drawhead has two cavities for the coupling links, separated by a vertical slide piece. One cavity is larger than the other, and is arranged with tapering mouth for the entering of the free end of the coupling link, the smaller cavity taking up the head of a second coupling link. The separating slide piece runs in grooves of the drawhead, being attached to the same by a pin. A recess of the slide allows the insertion of the common coupling link, so that, on fastening the slide by its pin, cars with the common pin-and-link coupling may be attached. The links are constructed with a heavy tapering head, which is introduced into the smaller cavity and fixed there by a pin. The larger cavity serves to take up the round end of the second link, producing a twofold coupling of the cars. The automatic coupling of the links is produced by pivoted pins of the larger cavity, which are pushed back by the entering links till the pins slide over the links, and, dropping, couple the same.

Improved Hay Tedder.

James Taylor, De Kalb Junction, N. Y.—A rod passes through a coil formed in wire teeth near their forward ends, and serves as a fulcrum to said teeth. The teeth are kept in proper relative position upon said rod by tubular washers. The forward ends of the teeth project nearly to the axle, so as to be struck by cams attached to the said axle, and raised to drop the hay caught by them. The cams are so arranged that the teeth will not be operated in consecutive order, and that but one or two of them will be operated at the same time.

Improved Stamping Mill and Furnace for Roasting Ores.

Pentecost J. Mitchell, Salt Lake City, Utah Ter., assignor to himself and Joseph E. Gay, New York city.—This stamp is made in any of the known forms used in stamp mills. In the shaft are toothed racks, between which is an adjustable clutch, which receives a cam secured upon a revolving shaft, by means of which the power and motion are communicated. The form of the cam and contrivance of the clutch are such that, no matter how much or little the stem may fall, the fall of the clutch will always be the same, so that, if at one blow the stamp is checked by a large piece of ore, it will be raised, at the next operation, the hight of a full stroke. The object is to secure uniform blows from the stamp upon the material to be crushed. The same inventor has also devised and similarly assigned a furnace for roasting ores. It is an oven of rectangular structure, of fireproof material, on the side walls of which are arranged hoppers of iron, with a movable side, to be opened or closed by means of a shaft and chain. The materials for calcination are placed within the hoppers, where they remain a few hours, when they are dropped through the action of the sliding doors upon the calcining floor, which is constructed of cast iron plates supported upon brick flues, through which the heat is conducted from the furnaces and returned over the working floor through a flue, receiving an additional supply of heat. The gases are carried on by the draft of the chimney through the flues and condensers, the latter consisting of a showering apparatus, through which water is let fall, by which a portion of the escaping sulphur, arsenic, etc., are deposited in the pans and removed at pleasure.

Improved Pump.

Samuel H. Warner, Darbyville, O.—This invention consists of a double acting pump with two cylinders and alternating plungers, of which each plunger slides in a narrower tube or telescope, while its piston forms, with the tube and outer cylinder, a varying space, in which a constant body of water acts, by a communicating pipe of the pump cylinders, on the plungers, and accelerates the raising and lowering of the same. The action of the plungers and valves is claimed to be expedited, and an increased lifting capacity of the pump produced.

Improved Plow.

John W. Thomas, Silver Springs, Tenn.—This invention relates to the combination of pivoted blocks or rollers and cross bars or plates for connecting the plow beams and standards, whereby the plows are allowed movement in any direction, one relative to the other. By suitable construction, and by reversing the plows, two shovel plows may be connected with the turn plows for plowing out the row. This construction also enables two right hand plows to be used for throwing the first two furrows. The same construction enables the plows to be arranged for breaking out the middle of the row. By detaching the connecting device and attaching another handle, each plow may be used as a single plow.

Improved Mainspring Attachment.

James C. Edwards, Binghamton, N. Y.—This is an eccentric notch in the face of the arbor of the barrel to which the mainspring of a watch is connected, the notch being as deep as the thickness of the spring, and terminating with the end of the spring by a radial wall, extending to the true circumference of the arbor. The object is to so shape the arbor that the spring end will not form an abrupt projection for the first coil of the spring to wind over, which produces an extra strain and bend at that point, and weakens it so that it breaks, moreover causing an irregular action of the watch, which it is desirable to avoid.

Improved Foot Mat.

Theodore W. Ellis, Macon, Ga.—This invention consists in a number of parallel bars, either of wood or metal, confined by iron bolts or rope, and securing the necessary filling for a mat. The filling, when worn out, may be replaced.

Improved Cotton Bale Tie.

William C. Banks, Como Depot, Miss.—This invention consists in the combination of a band and buckle, the former crimped near one end and the latter having a tongue bent below the plane of side pieces to form an improved tie.

Improved Stove.

M. C. C. Church, Parkersburgh, W. Va.—This invention relates to and consists in means whereby a heating stove may be made to economize fuel and supply heat by radiation, reflection, and convection in a more thorough and effectual manner than has been heretofore used.

Improved Copying Press.

Philander S. Abbott, Bowling Green, O.—This invention relates to copying presses, and contemplates the manufacture of an article that will be less expensive and may be brought within the reach of persons in the smallest business and of ordinary private individuals. It consists in a copying press composed essentially of base and slotted standards, together with a spring retracted and driving wedge.

Improved Waterproofing Compound.

A. C. McKnight, Philadelphia, Pa.—The basic or primary compound consists of iodine, wheat starch, alum, oil, and soda. This is combined with a preparation known as acetate of alumina. Leather treated with this compound is rendered perfectly waterproof without discoloration or stiffening or other injury of fiber.

Improved Medical Compound.

J. F. Dyer, Lynchburgh, Va.—This compound is a salve for application to sores, ulcers, cancers, tumors, etc., composed of red oak bark, sarsaparilla, belladonna, hyoscyamus, honey, spirits turpentine, camphor, beeswax, and beef or mutton suet.

Improved Type Distributing Machine.

John A. Reynolds, Danville, Pa.—This invention relates to that class of machines which are used for distributing into appropriate cases the type that has been printed from, and is a new and improved arrangement for doing the same, by which the operator is enabled to effect said distribution by simply reading his matter and operating appropriate keys. It consists in an arrangement of keys which operate upon arms attached to a shaft, which is provided with a loose sleeve, pinion, and ratchet wheel. Upon the pinion moves a rack which is connected with a bar, which in turn is attached to a secure bar that presses against the line of type in the galley, and, each time a key is touched, forces a type over a passage, where it is held in suspension by a spring-seated tongue until a vertical ejector plunges down and relieves it. The type then falls of its own weight through a curved chute which brings it to a horizontal position upon the table. To a hinged sectional metallic belt, revolving around pulleys and running in grooves with its upper surface level with the table, is attached an arm which, as the belt revolves, passes over the surface of the table to the finger of the key which brought it out; said finger, having been drawn by the action of a cam groove in the hinged belt across the table, grasps the type, and, by the action of the same cam groove, draws it back over the open end of its case, into which it falls. When a line has thus been distributed, the bar which pushes the line of type out is run back, and the column of type in the galley advanced by the automatic operation of levers, cams, and pulleys. The operation of this machine is thus reduced to five mechanical sections: 1st. Forcing the type into suspension above a chute. 2d. Driving it down the same. 3d. Carrying it along the table. 4th. Depositing it in its case. 5th. Advancing the column of type in the galley when a line has been distributed.

Improved Can for Oil, etc.

Francis E. Josel, Freeport, Ill.—This invention consists of a spout, turning in a socket of the body of the can, both being provided with corresponding apertures, through which the oil is discharged when both are brought into connection with the interior of the can, closing the same when separated. The end or nozzle of the spout is placed under an angle, corresponding to the body of the can, to its lower part, turning in the socket and provided with a projection which catches into a groove of the can top, so as to be retained firmly thereon, and there closed by a small cap hinged to the can top.

Improved Slate Frame.

Joseph W. Cremin, New York city.—The common method of holding the slate by one corner of the frame, and pressing the opposite diagonal corner against the breast or stomach, the inventor has found, by thirty years' experience in the school room, to be very injurious to young children. Hence, he makes a curved notch in the frame, by which the slate can be held resting on the arm. He also uses metal caps for fastening the corners of the frame, and rivets, having projecting heads, for receiving said caps, said rivets having projecting heads to receive the shock and protect the slate from breaking when it falls.

Improved Combined Work and Spool Holder.

William W. Tunis, Easton, Md.—This invention relates to that class of devices which are intended to facilitate the holding of ladies' work, so that it may be gradually and intermittently moved in an easy and convenient manner.

Improved Ruffler for Sewing Machines.

John Irvine, Ickesburgh, Pa.—This invention is an improvement on the class of rufflers in which motion is derived from the needle post, and the feed may be changed or adjusted while the machine is in operation without interrupting the work. It relates to pivoted and parallel spring bars, combined or operating with a notched vertical plate for changing the feed of the ruffler.

Improved Ice Plow and Ram Attachment for Vessels.

D. Conrad Grant, Houghton, Mich.—The ram is constructed with a pointed, inclined, or rounded front prow, and is bifurcated to fit exactly the shape of the stem of the vessel, extending backward along the same. The whole attachment is easily adjusted from the deck of the boat. A recess in front contains a torpedo, which may be used for breaking heavy masses of ice which are not penetrable by the plow and the power of the vessel, and also, in times of war, for the purpose of destroying the vessels of the enemy.

Improved Machine for Nailing Shoe Soles.

Elton F. Richardson, Reading, Mass.—This invention has for its object to furnish an improved machine for nailing shoe soles and heels, and for various other similar purposes, with a continuous wire driven into the article to be nailed before being cut off. The invention consists of an extensible guide for the wire, which is composed of a series of bars adapted to close together, and thus support the wire in its descent into the leather.

Improved Wagon Jack.

James S. Rowland, Senecaville, Ohio.—This implement consists of a base, an upright bar and an inclined bar connecting the two. To the last and above the standard is pivoted a lever; to the same and below the standard is pivoted another bar. The ends of the lever and the bar last mentioned are pivoted to a notched bar. In using the jack, the free end of the lever is raised, and the jack is moved forward until the axle rests in one of the notches. The lever is then lowered until the load has been raised to the desired hight. The hook on the lever is then swung forward until it catches upon one of the teeth of a ratchet bar which holds the load suspended. To lower the load, the load is lowered slightly, which allows the hook to drop away from the ratchet, when the load can be easily lowered.

Improved Lamp Pendant.

William M. Underhill, Oconto, Wis.—This invention consists of a piece of wire bent in triangular form, with the base bent up in the form of two sides of a triangle toward the apex, at which point there is a little notch to hold the pendant when suspended for use. The contrivance is to be used for lowering a lamp to clean it, and for other purposes, by shifting the pendant out of the notch in the base wire of the triangle, and letting it drop down in one of the angles between the base and one of the side pieces, by which the lamp will be lowered considerably from its normal position.

Improved Sewing Machine.

Johannes Bühr, Hamburg, Germany.—The object of this invention is to provide for family and other purposes a sewing machine which allows the direct use of the common spools without requiring the spooling of the thread on the bobbin, performing the work with equal exactness and dispatch. The invention consists of the arrangement of a pivoted lever arm at the needle bar, which takes up or feeds, in connection with suitable tension devices, a sufficient quantity of thread to the thread catcher pivoted below the throat plate, so that the larger shuttle containing a common spool of thread may freely pass through the loop of the needle, and form, with the shuttle thread, the stitch.

Improved Wheel for Vehicles.

Oliver Lundin, Richland, Iowa.—By suitable construction, by screwing up a band nut, disks will be pressed against the ends of the spokes, securely clamping them in place. This construction allows any of the spokes to be removed and replaced by new ones without taking off the tyre.

Improved Horse-Detaching Device.

William Rosenbaum, Cheyenne, Wyoming Ter.—This is a device for detaching horses at any moment from carriages, buggies, wagons, reapers mowers, or other vehicles, so that not only the individuals, but also the vehicles, are protected against injury from runaway or vicious animals. The invention consists of a lever attachment to the pole or tongue of the vehicle, which may be operated from the seat so as to detach a clevis with wedge-shaped end, to which the double tree is applied. In case of any accident or danger, the horses may be instantly detached by pulling the hand lever back, which forces the sliding bar beyond its guide recess and gives sufficient play to the wedge clevis to slide out. The horses carry then the double tree along with them, leaving the vehicle behind.

Improved Liquid Vent.

Hiram W. Love and James Talley, Jr., Kansas City, Mo.—This invention relates to means by which air may be readily introduced into a barrel, keg, or vessel of liquid, in order to counterbalance the air pressure at the outlet, and thus admit a free flow of liquid from the vessel. It produces a very neat, simple, and effective device for the purpose.

Improved Derrick.

Charles Roberts, Mattoon, Ill.—This invention consists of an inclined sweep mounted on a frame pivoted on the top of the post, and also pivoted to said post at or about its middle, and braced in a simple and efficient way, so that the weight may be raised higher than the post, and the sweep may revolve entirely around the latter. The apparatus is adapted for loading and stacking hay, handling coal and the like, and may be made portable, by having the post mounted on a platform instead of on the ground.

Improved Sink Trap.

George Miller, Johnston, R. I., assignor to himself, Henry Miller, and Alfred B. Irons, same place.—This invention consists of revolving scrapers in the trap for stirring up the sediment to be carried away by the water. The scrapers are turned by a thumb bit above the strainer, and are fixed on the lower edge of the inverted cup of the trap. The cup is arranged to revolve either with or without the strainers. This contrivance saves the labor of unscrewing the strainer and screwing it down again every time the trap needs cleaning out.

Improved Drawers.

Emil Weil, New York city.—The object of this invention is to furnish for general underwear drawers which fit not only more completely to the body, but keep also the stomach warmer by taking the place of the abdominal band. This end is effected by extension flaps, which [illegible] applied, a double layer over the stomach.

Improved Compound for [illegible] tton Yarn.

Henry Wegmann, New York city, assignor to H. Wegman & Co., same place.—This is an improved compound for sizing cotton yarn, consisting of tallow, soft soap, rosin, vitriol, [illegible]on, and onions. This compound is designed to be added to twenty-five or seventy five pounds of starch, or fifty to one hundred pounds of flour, the rosin, vitriol, onions, and tallow being boiled till rendered sufficiently liquid to mix freely with the other matters; then the soap is melted in a tank separately, by hot water and steam, and the above mixture added. The ingredients are thoroughly mixed with steam, and then added to the starch or flour in another tank, together with the proportion of water requisite for making the sizing more or less stiff, according to the size of the yarn for which it is intended, the starch or flour being also varied to suit the case in hand.

Improved Harvester.

John Werner, Jr., Prairie du Sac, Wis.—This invention consists of a binder's platform and tables, attached to a tongue frame, which is pivoted on the wheel frame at or near the axis of the main wheel. There is also an adjusting lever, connecting the wheel frame and the tongue frame, for adjusting the wheel frame to tilt the cutters up or down, for cutting high or low, without tilting the platform and tables out of their proper level.

Improved Composition for Artificial Stone.

Luke W. Osborn, Youngstown, Ohio.—This is an improved artificial stone, cast in slabs or blocks of any required size and shape for laying side walks, for the foundation of iron fences, for well covers, door steps drain tile, sewer pipe, and other purposes: which will not crumble or wear through, as imperfect blocks cannot be transported and laid: which shall have a light gray color upon its surface to prevent it from absorbing the sun's rays and being softened; and which may be made of different colors or may have patterns or figures of different colors upon its surface. The upper parts of the slabs for any desired depth are made of a light gray color by the application of gum turpentine, pine resin, and aqua ammonia, in suitable proportions to the cement forming said upper portions.

Improved Chimney Top.

William Hervey Connor, Muscatine, Iowa.—This invention is a conical current-guiding chimney cap, on which is placed the vane, provided with an arc strap, perforated at several points to allow the obliquity of said cap to be changed, according to the draft required.

Improved Glass Bottle.

Thomas P. Spencer, New York city.—This invention consists of a glass bottle for perfumery, made in the form of the bust of the human figure, with certain modifications of the shoulders in form and dimensions of the same and other parts, as compared with a true bust, to adapt it to a shape that is practicable to produce in glass by blowing it in molds.

Improved Plow.

Julius Hartmann, Jefferson County, Ky.—This plow may be used to open a trench or furrow, or for cultivating certain kinds of crops. By turning the share either to the right or the left, it will cause a change in the position of the wings, so that one of them will lie parallel with the beam, and the other stand at a large angle to it, correspounding respectively to the position of the land side and mold board in the ordinary plow. The greater the angle or inclination of the share to the beam, the more land taken or the wider the furrow made.

Improved Oil Can Faucet.

Frank Spinning, Stellacoom, Wash. Ter.—This invention consists of a detachable faucet for oil cans, to be used for drawing oil from the commercial cans now commonly used for packing the oil for market. The object is to enable the faucet to be shifted readily from an empty can to a full one and save a special faucet for each can. There is a flange on the end of the faucet of such a shape as readily to be slipped into a narrow hole in the can. By means of washers, and a binding nut, it is then tightly secured in place.

Extracting Silver, Gold, and other Metals from their Ores.

James Douglas, Jr., Quebec, Canada, Thomas S. Hunt, Boston, Mass., and James O. Stuart, Georgetown, Col. Ter.—Copper pyrites is mixed with iron pyrites, in such quantities as will result in the most thorough extraction of silver. The ground ore is then calcined with common salt in a suitable furnace, as is usual in the chlorination of silver ores. The charge, when withdrawn, is to be treated by agitation or lixiviation in any suitable vessel with a bath consisting of a solution of protochloride of iron and common salt, as in the Hunt and Douglas patent copper process. The bath dissolves the copper, besides the zinc and the greater part of the silver which has been chloridized in the furnace, while the copper in the solution chloridizes the silver which escapes chloridization in the furnace. After digestion for four or eight hours at 120° to 200° Fah., the solution is drawn off and the silver precipitated by allowing it to remain for some time in contact with sheet copper, or by filtration through cement copper.

Improved Middlings Purifier.

William H. Todd and Ephraim C. Keyser, Utica Mills, Md.—This invention relates to the purification of middlings in a more convenient, thorough and perfect manner than has been usual heretofore, or possible by the machinery employed for that purpose.

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ANSWERS TO CORRESPONDENTS

W. H. F. will find engravings of electro-motors in back numbers of the SCIENTIFIC AMERICAN.—W. S. M. will find directions for soldering files on p. 90, vol. 30.—J. F. will find details of tanning sheep skins with the wool on on p. 147, vol. 30.—A. W. C. should send us a description of his plan for preventing fires in buildings.—S. J. H. will find directions for transferring engravings to wood on p. 138, vol. 30.—H. R. will find directions for waterproofing cloth on p. 90, vol. 30, and for preventing mildew on p. 138, vol. 30.—J. A. C. must send his name.—G. M. H. will find full information in regard to concrete walls in the answer to J. L. C., p. 138, vol. 30. As to potato bugs, see p. 52 of this issue.—J. S. N. will find full directions for tempering springs on p. 261, vol. 29; for tempering mill picks, on p. 170, vol. 25.—C. W. R. is informed that we published a good recipe for wood filling on p. 155, vol. 30.

J. B. asks: 1. On what class of sea-going steamers are high pressure engines used? A. They are not used. 2. On what class of sea-going steamers is the condensing engine used, and what is the pressure of steam most commonly employed in such engines? What are the extremes of the pressures employed in such engines, measured above a perfect vacuum? A. On all. Steam pressure varies from 30 to 80 pounds. 3. Is steam generally worked expansively in sea-going engines, and what is the lowest terminal pressure in both the high pressure and condensing engines for sea-going purposes, measured above a perfect vacuum? A. Yes. Terminal pressure as low as 5 pounds in some cases. 4. Is the Woolf engine used to any considerable extent in sea-going engines as a high pressure engine? A. No. 5. What is the most common form or type of sea-going condensing engines? A. Vertical two-cylinder engines. 6. If, at an additional expense of $100 in the first cost of an engine of one hundred horse power and perhaps $200 in a one thousand horse power, the effective working power could be increased from 10 to 25 per cent, depending on the pressure ranging from 60 lbs. to 150 lbs. above a perfect vacuum, would it be worth the trouble? A. We do not get a clear idea of what you mean.

S. asks: Which is the strongest and will bear the most weight, a hollow pillar or a solid one, of iron, of any size? A. The solid one. The same weight of iron, however, made into a hollow (and of course larger) pillar, will be stronger than if made into a solid one.

J. S. S. says: 1. I have been running my cotton gin by steam power, using a 10 horse power engine. I have recently erected a steam saw mill near my gin house; engines are about 180 feet apart. I want to run my gin from my saw mill engine, if it is practicable. Will it be cheaper to run the gin by wire rope, or convey the steam from saw mill boiler to my small engine, 180 feet, thereby doing away with one boiler? A. We would recommend the latter plan. 2. What sized pipe should be used to convey the steam from boiler to engine? A. About 2 inches in diameter. 3. Would it be better to convey the pipe under or above ground? I need about six horse power to run the gin. A. Whichever is most convenient. 4. Will under runner rocks answer as well for grinding corn as upper runner? A. We think that they will; but there is considerable difference of opinion among millers in regard to this matter.

L. A. G. says: I have made a field camera by the directions given in *Science Record* for 1874, but find no image on the paper unless the object is held within two feet of the lens, or the paper held within three inches of the mirror. My lens is 2½ inches in width with 7 inches focus, and made to slide in and out; the box is supported about 20 inches above the table, and a dark chamber is made by covering the wire with thick dark cloth. What is the matter? A. If the object or foreground is ten feet off, then the shorter conjugate focus of your lens will be 7·35 inches. The paper or ground glass must be placed at this distance from the lens, or a lens of focal length equal to the distance from table to mirror, *plus* the distance from mirror to lens, may be substituted; or you may reverse the box so that the lens is between mirror and table.

H. R. J. says: I work at architectural drafting and wish to be a thorough architect. I have a very good English education, but cannot afford to go to college. Can you tell me what course I should pursue to attain what I wish? Is a thorough knowledge of constructive carpentry necessary? What is the best and simplest work on it? A. You could succeed best by going into the office of an architect in good practice, and thus get access to his library, where you would find, most likely, the best works on every branch of the subject. In the mean time, you will find Tredgold's "Carpentry" an excellent book to begin with.

F. C. R. asks: How are hollow plaster of Paris toys made? A. They are made in two or more parts, and then joined together.

J. E. S. asks: How can the residuum in the still after the distillation of petroleum be best purified to produce a nice paraffin oil? A. American oils contain but a small proportion of paraffin. The crude oil is first put into a still, into which steam can be admitted; the still is also heated externally by fire. 25 per cent of a fluid is obtained which, on being submitted to fractional distillation, yields hydrocarbon of specific gravity 0·62 to 0·86, while the boiling point varies from 26·7° to 200°. The lightest and most volatile of these hydrocarbons is used as an anæsthetic (known as Sherwood oil), while the heavier oils are burnt in paraffin lamps. The residue of this first distillation (about 75 per cent of the original quantity) is again distilled with steam at 150° to 300°, and the products, of variable volatility are separately collected. The last portions of the distillate contain chiefly paraffin, which is in a crude state separated from the liquid by artificial cold. The heavy oil is used for lubricating, and the paraffin is purified. This is the treatment of the Rangoon oil, from Burmah.

S. H. D. asks: Will hot water put out fire on a building that is ignited by lightning? Some people maintain that it will not. A. Most certainly, if applied properly and in sufficient quantity.

E. K., Penza, Russia, and others write for practical details of a process for burning bricks with mineral oil, mentioned on p. 53, vol 30. A. The writer of the paragraph declines to give further information.

O. L. asks: Is there any simple and cheap method for rendering paper damp proof, so that, in giving it a form by embossing, it will not get out of shape? A process involving the passing the paper though a liquid would be advantageous for the purpose. A. Yes; by saturating it with oil. If you will state more fully what you desire to know, perhaps we shall be better able to answer you.

E. P. says: I have in use a 32 horse power boiler with 62 three inch flues. The brick work strikes the boiler about 4 inches below the water line. The said arch needs repairing. Would it be advisable to construct the cover 4 inches from the shell? Would not a boiler arched over in such a manner supply drier steam than when covered in the ordinary way? Would there be more danger of explosion? A. Such an arrangement as you propose is very common. 2. Would coal tar and plaster of Paris make a good cement for roofs? Would it render it as fireproof as if the tar were boiled? A. It will probably answer quite as well as if the tar were boiled, provided you can make the mixture as thoroughly.

E. L. E. says: A friend says that the lightning seen at a distance in summer evenings is heat lightning. I say there is never any lightning unless there is thunder; but it being at a great distance, we cannot hear the thunder. He also says that the thunder comes before the lightning; but as it takes so long for the sound to reach us, we see the lightning first. I contend that the lightning comes first, and that the thunder is caused by the rushing together of the air after being rent by the electricity. He says that there is never any thunder accompanying flash lightning, that it only comes with what is called chain lightning, and I say that the thunder accompanies both kinds of lightning. Which of us is right? A. As the lightning causes the thunder, you are right in the main. Wherever there is lightning there is always thunder, although it may be so far distant as not to reach the ear; this heat lightning, so-called, is merely the reflection of very distant flashes below the horizon.

M. A. says: The peach crop in this section of our State is becoming a matter of some importance, and the great difficulty in packing for shipment is the heat. Can a packing room, 30x20 feet, be so constructed that a low temperature can be maintained without the use of ice, and is there any agent other and cheaper than ice by which the temperature of a room can be kept at 45° or 50° Fah.? A. All methods for producing a low degree of temperature (excepting that of ice) are costly and troublesome. Such a room as you speak of could certainly be constructed. There is one simple plan, however, which seems to have worked well, and that is as follows: A small room, such as you speak of, is built entirely of wood and as nearly airtight as possible, having only one small door. The room should be built with double walls, about six inches apart, and between these walls should be filled with sawdust; the room is then covered both inside and out with a double coating of very thick felting. Into a netting hung in one of the top corners of the room is placed about 100 lbs. of ice; the room can now be filled with fruit and the door or opening made tight. It is said that fruit so stored will keep for months unaltered. After once closing the door or opening, it must not be again opened until it is desired to remove the fruit.

M. A. B.—We have never seen any noiseless gunpowder.

R. O. P. asks: Which of the fillings used in fireproof safes have stood the best in large fires? Is cement and water or plaster of Paris and water considered the best? A. There has never yet been a safe constructed that was absolutely fireproof. That in which a filling of alum is used is claimed to be the nearest approach to fireproof. But plaster of Paris and hydraulic cement also are used.

A. L. B. says: I am building a small oscillating engine, the cylinder having 1 inch stroke and ½ inch bore. I would like to make a double acting engine of it, for a small screw steamer. Could you give me a simple way of making this? A. Arrange the valve so that it will admit steam at each end of the cylinder alternately, opening the opposite end of the cylinder to the exhaust at the same time.

F. S. J. asks: A few days ago I placed in a small phial a solution of water and sulphate of copper. I then added about 20 drops of sulphuric acid, which made the solution quite warm; and having some ammonia near at hand, I added it also to the mixture, by way of experiment. Immediately one half (the upper) of the solution turned dark blue, with a hard white or cream-colored substance moving at the bottom of it. I shook the bottle a moment or so when the dark blue and white substance entirely disappeared. The bottle being now full, I emptied about half of it out, and in its stead placed ammonia and spirits of turpentine, which had the same effect at first as the ammonia in the former mixture; but after shaking for some time, the mixture turned a bright green, but was not clear. A. The heat developed on the addition of the sulphuric acid was due to its entering into chemical union with the water. You added the ammonia. It is lighter than the liquid, and only mingles with the upper surface. There the ammonia is in excess. The azure liquid is the solution of the basic sulphate of copper in excess of ammonia. The solid part below the azure is the basic sulphate, where the ammonia is present not in excess. At the bottom the liquid is acid from excess of sulphuric acid. On shaking the bottle, the above-formed bodies redissolve in the sulphuric acid to form sulphate of copper and sulphate of ammonia. The turpentine had no effect; it was the ammonia. The green turbidity was due to the basic sulphate; if you had added less ammonia, it would have been a dense precipitate. If you had added more, it would have dissolved to an azure liquid. Do not waste time in making such mixtures; go through a systematic course of qualitative chemical analysis.

J. W. says: 1. I have a new cistern for rain water. The paint on the roof is dry. Is the first filling of the cistern fit for use, or should it be pumped out and filled a second time before using? Should it be ventilated, and how? A. The first filling of the cistern might be fit for some uses and not for others; if you mean for drinking, we should say not. If the leaden pipe that supplies the water from the roof is of good size and is not trapped by having its lower end in the water, this itself will give you ventilation; but if you have an overflow pipe leading to a drain, it should be trapped. 2. The tank in the roof of my house is lined with lead, and the pipe (leading some 35 feet) is lead. Is water from the lead tank, through lead pipe, good for cooking purposes? A. We should say that water standing in a lead-lined tank, and supplied through a lead pipe, was not good for cooking purposes. 3. How long should I wait before moving into a new house after the plastering and painting is finished? A. If the weather is good and the house kept open to let the air be frequently changed, it ought to be in a proper condition to be occupied in three weeks after the last coat of paint is put on.

S. asks: What is the best method for testing the percentage of chlorine in bleaching powder? Can you give me the name of some work where I can find specific instructions relative thereto? A. The most recent is the iodometrical method, and is based upon the fact that a solution of chloride of lime separates the iodine from a weak and slightly acidified iodide of potassium solution, the iodine being quantitatively estimated by means of hyposulphite of soda. The test is thus executed: 100 cubic centimeters (=1 gramme) of bleaching powder solution, obtained by dissolving 10 grammes of chloride of lime in 1 liter of water, are mixed with 25 cubic centimeters of solution of iodide of potassium acidified with dilute hydrochloric acid. The ensuing clear, deep brown colored solution is treated with hyposulphite of soda solution until quite colorless. The hyposulphite of soda solution is composed of 24·8 grammes of that salt to 1 liter of water; 1 cubic centimeter of this solution neutralizes 0·0127 grammes of iodine and 0·00355 grammes of chlorine.

W. J. N. W. asks: 1. I hear some men say that they can tell where a stream of water is, underground, and within a foot or two of its depth, by a forked switch which they hold in their hands. Is this true? A. No. 2. I see that the locust deposits its eggs in the twigs of trees. Why is it that they come up out of the earth and from what depth do they come? Do they eat anything while they stay in the ground? A. The eggs of the locust (*cicada septemdecim*) are deposited in pairs in the terminal twigs of different species of deciduous trees, especially the oak. The larvæ hatch out in about six weeks after they are laid, and drop to the ground, in which they live, feeding on roots of trees, for exactly seventeen years, the pupa state lasting but a few days. When about to transform into the winged state they ascend to the surface, making cylindrical burrows, firmly cemented and varnished so as to be waterproof. In low and wet localities the pupæ often extend these galleries from four to six inches above ground, leaving an orifice of egress even with the surface. In the upper end of the chambers the pupæ can be found awaiting their approaching time of change. They will then back down to below the level of the earth, and, issuing forth from the orifice, will attach themselves to the first object at hand, and undergo their transformations in the usual manner. They issue from their burrows in countless millions, in forests or where forests were seventeen years before. The singular noise sounding like "Pharoah" produced by the males in these camp meetings is absolutely deafening. After depositing their eggs in the twigs of trees, they soon perish, no food of any kind being taken by them in their brief above-ground existence, nor do they fly far from their burrows. They have different periods in different localities; in this vicinity they appeared in 1843 and in 1860, and will appear again in 1877.

G. F. P. says: 1. We are informed that hollow copper lightning rods are used in preference to solid ones, on account of conducting the electricity better, also that the hollow rod conducts better, as the atmosphere is damo within the rod, which is a better conductor than metal. Is this so? If so, and the rod were smashed together in bending and turning the eaves, would it not render it dangerous? Does not the current require the same amount of space to pass all the length of the rod as at the beginning? I have noticed some rods that were smashed nearly together where they were bent in turning the eaves and cornices, does this make any difference? A. A good material for constructing lightning rods is three quarter inch iron, terminating at the top in a gilt copper arrow head very sharp, and in the earth with a large extent of conducting material. The metals are by far the best conductors; damp or moist air is very inferior in comparison. 2. Do rods running only three or four feet into the ground offer much protection to the building? A. The house would probably be safer without the rod.

M. W. J. asks: Why is it that growing clover causes cows to swell? I never hear any complaint of it swelling horses or hogs. I am told that it will swell sheep. Farmers say that it is the gas that causes the cow to burst. If so, what kind of gas is it and what generates it? Why is it that the second growth of clover, that is, the growth after the cutting of the first crop, "slobbers" horses? The first growth will not, or at most very little. A. In consequence of the complicated digestive apparatus in cattle, if their stomachs are excessively distended with green clover or other succulent or saccharine food, fermentation takes place, the carbonic acid gas thus formed (sometimes in excessive quantity) distending and often rupturing the stomach and thus causing death. This result is often avoided by puncturing the distended paunch with a fine trocar with a canula or aspirator needle, thus allowing the gas to escape. Dry food, such as Indian meal, sometimes causes death in cattle if used in excessively large quantities: in their greediness, it is swallowed dry, and, when wet in the stomach, swells and becomes a hard mass which is very difficult to remedy.

N. L. T. asks: 1. Can you inform me of some cheap and efficient solution for the preservation of shingles on roofs? A. A solution of chloride of zinc. 2. Can I construct a reliable lightning rod of iron, and what should be the size of iron for such a rod? A. Yes. About ¾ of an inch in diameter. 3. Is the conducting power of a lightning rod injured by painting, and will ordinary paint prevent iron underground from rusting? A. No; red lead might be used. 4. Is it sufficient to extend the rod vertically into the ground to a depth level with a creek, about ten rods distant from the house? A. No. It would be better to extend your rod underground out into the water of the creek. 5. In my vicinity, the lightning rods generally used are made of copper and hollow, the metal being about ⅛ of an inch in thickness, and the rods about ¾ of an inch in diameter, extending into the ground six feet. Are these reliable in your opinion? A. No. They are unsafe because there is not a sufficient amount of rod conducting surface in contact with the ground. No rod is really a safe conductor unless it has an extensive amount of conducting material for its base, or terminal in contact with the earth.

J. W. S. asks: 1. Will galvanized iron undergo any change if exposed constantly to soapsuds? A. Yes, but very slowly. 2. How can I make a varnish with shellac which will not chip off after being applied some time, as it does when dissolved in alcohol alone? A. Some recommend the adding to the varnish about 1 tablespoonful of boiled linseed oil to each pint of varnish; of course the oil remains only in mechanical mixture. 3. Can I collect ozone in small quantities, say 4 or 8 ounces, by displacement of water (as oxygen is made)? If not, how can I obtain it? A. No; it cannot be obtained separate from the oxygen or air from which it is formed. If a stick of phosphorus moistened with a few drops of water be placed carefully in a bottle of air, the slow oxidation of the phosphorus is attended with the production of ozone. In about one hour this has reached its maximum, when the phosphorus should be removed, otherwise the ozone odor will disappear. This is one of the best methods of obtaining it in small quantities, although very dilute.

P. T. R. says: In your article on chameleons (April 11) you are certainly in error when you say that these curious little lizards are never seen on this continent. I have often seen, in several of the Southern States, small lizards that answer your description of the chameleon in every respect. The people residing in these localities have no other name for them but chameleon, and I believe that they are right in so calling them. A. Sir Richard Owen, F.R.S., says: "This family, which includes only the single genus *chameleo*, contains about 18 known species, all inhabitants of the old world," etc. And again: "It occurs in all the northern parts of Africa and also in India; it has become naturalized in some parts of Europe." There are innumerable varieties of lizard closely allied to the chameleon indigenous to this country; especially iguanas and geckos, which have doubtless led to your impression.

G. C. T. asks: Are you acquainted with any paint, pigment, substance, or solution which can be apolied to the weatherboarding of a frame building with the effect of rendering it wholly or partially incombustible, or at least capable of resisting the heat and flames of a burning building 25 feet distant from it without igniting? A. We do not think it is possible to render a wooden house perfectly fireproof. In regard to your other questions, it must be evident to you that it would be improper for us to recommend particular manufacturers in these columns.

C. C. asks: What is the best way to take the scale out of tubular or locomotive boilers? There are several about here that have been running in limestone or some other mineral water; they are thickly scaled inside, and therefore will not make steam well. A. There are numerous compounds in the market, which are said to be efficacious in such cases. By inserting a notice in our Business and Personal columns, you can doubtless open communication with the manufacturers.

E. M. B. says: I have a horizontal tubular boiler in which fire goes under the shell and then through the tubes. Would it save coal to put a brick floor within 9 inches of the shell's front end, and 6 inches from back end to keep the heat in the shell of boiler. A. We would not recommend the change if the boiler works well at present.

J. K. asks: How are artesian wells made, and what is the best way of fixing them, in order to water stock? A. The mere fact of inserting a pipe will not cause the water to flow. It is necessary to bore until water is reached that comes from a source higher than the place where the well is made.

H. J. I. asks: What is the rule to calculate the pressure on a hydraulic ram? A. The pressure on the ram is equal to the pressure per square inch produced by the pump, multiplied by the number of square inches in the cross section of the ram.

J. A. A. says: 1. We have a fire engine that will throw about 140 feet. The machine has no vacuum chamber. Will it help her to put one on? Will it be any advantage, and how much? The pumps are 6 inches bore by 7 inches stroke; suction is 3½ inches by 18 feet long. A. We would not recommend it, if the pump works satisfactorily at present. 2. What is the pressure to the square foot of gas that will raise water 5½ inches in a bent tube ¼ inch in diameter? A. About 28 pounds.

O. J. P. says: We generally use here lift and force piston pumps for tanks in houses, bathing purposes, etc., but instead I would like to use two plunger pumps of 2½ inches bore and 24 inches stroke, with air vessels, and connected together, with the same action. In this case, the pump will be about 200 feet from the river and 18 or 20 feet above the level of the water, the tank being 30 feet above the pumps. I fear that two plunger pumps could not be used as advantageously as a piston pump for lifting the water, but I understand that the plunger pumps would force up the water more advantageously than a piston one. Am I right? A. We think that the piston pumps will give better satisfaction in this case. Your other question is a professional one and should be referred to an engineer.

J. H. W. asks: 1. Is it possible to transmit a moderate degree of pressure through a half inch gas pipe, 15,000 to 20,000 feet long, by forcing compressed air into one end? Could the loss of power and the time required for transmission be calculated? A. Yes. You will find some facts in regard to the matter in reports of operations in the Mont Cenis Tunnel, published in *Engineering* a few years ago. 2. Is the process of lighting street lamps by electricity attended with such a degree of expense (in first cost and subsequent operation) as to preclude its employment on the score of economy? A. We think so. 3 What would be the probable approximate cost of erecting the apparatus necessary to light the 5,000 lamps of Boston, Mass., and what would probably be the annual working expense? A. We believe the attempt was made some time ago; and probably by writing to the authorities, you can obtain the information you desire.

W. P. S. asks: Can you give me the dimensions, focal distances, etc., of the lenses for a wonder camera, as described in your paper of June 6? A. The larger your objectives, the clearer will be your picture. The convexity of the glasses depends much upon the size of picture desired. 2. What light is best where gas cannot be obtained? A. A coal oil lamp has been used to advantage. 3. Would an extra lens between the light and the photograph be an advantage, and what should be its dimensions? A. Yes, a condenser, the larger the better. 4. What is the next step in the education of a mechanical engineer after a college course, and on what terms are learners taken into machine shops and other engineering establishments? A. The next step is to lay aside the idea that college education will give anything but a theoretical knowledge, and to learn to do any menial labor that a mechanic has to do with all the strength and ability he possesses. On these terms, if he is fortunate, he will be admitted into a machine shop.

J. C. K. asks: Is it injurious to the water in lead service pipes, or to the pipes, to lie in the same trench as gas pipes, the gas pipe and water pipe lying within three or four inches of each other, and passing through the same opening in a stone wall? If so, what is the effect? A. No; there is no reason why it should be injurious.

C. F. B. asks: What are the velocities of light and electricity? A. Wheatstone gives electricity (of high tension, such as atmospheric) a velocity of about 288,000 miles per second. Light has a speed of about 190,000 miles per second.

J. K. asks: Does the sun, by shining on one side of a saw every day for a length of time, injure it? A. Ordinarily, we should suppose not. We do not, however, know the circumstances of the case to which you refer.

S. M. L. asks: 1. Can I keep the air out of a tube 30 feet long, 8 feet wide, and 1½ deep? Can I do it with an air pump? What sized valve would be necessary, and what power would be required to run it? A. Yes. The size of the valve is not the matter to be considered. A large air pump would answer. 2. If the air were taken from an airtight cylinder in which was placed a flywheel running at moderate speed, would the motion of the wheel create air again in the cylinder? A. No. 3. If a tube, open at one end, were placed with the open end in a cistern of water, could the air be taken out of it so as to create a perfect vacuum? Would air enter by the water at the lower end? A. Vapor of water and air transpiring through the water would prevent obtaining a perfect vacuum. 4. Please name some good work on air pumps. A. Consult a work on natural philosophy, Ganot's "Physics," for example.

T. J. K. asks: What is the best material to put on a carpet when sweeping it? A. Try spent tea leaves.

H. W. asks: 1. Will scrap zinc do to use in a Hill or blue vitriol battery? A. If melted and cast, yes. 2. What sized cylinder do I want to make a 1-6 horse power engine at 30 lbs. pressure? A. A cylinder 2 inches diameter by 6 inches stroke, making 60 revolutions per minute, will give just over 1-6 of a nominal horse power.

C. L. F. asks: How can I determine the azimuth angle, or the variation of the magnetic from the true meridian? A. By the declination compass.

E. B. W. asks: What is the rule for finding the hight to which a stream of water will be thrown through a nozzle 3 inches diameter at varying pressures in the water main? A. We must refer you to some good treatise on hydraulics for an answer to your question, as its consideration would occupy too much space for these columns. We have discussed some of the points in our article on "Friction of Water on Pipes," p. 48, vol. 29.

H. L. W. asks: What is the best equilibrium slide valve? A. We do not recommend special articles of manufacture in these columns.

M. C. S. asks: What are the chief objections to an iron or steel rail whose under side is wrought into a series of arches or curves, designed to span the spaces between the ties? The top or tread of the rail is to be horizontal as now, but the underside curved, except where it rests upon the ties. A. We scarcely think that the change is very desirable.

C. R. asks: Will a spring made of the best spring steel be affected if placed in the steam chest of an engine? If so, is there any metal or alloy that will resist the most intense heat of steam and retain its original form? A. Springs exposed to high pressures and temperatures are apt to become weakened. We do not know of any better material than steel.

G. M. R. asks. Who compose the American Society of Civil Engineers, what is the object of the society, and what formalities are necessary to become a member of this society? What are the time and place of their meetings and are the meetings public or not? A. It numbers the principal engineers of the country among its members. By addressing the secretary (Mr. G. Leverich, 63 William street, New York city), you can obtain full information in regard to your other questions.

F. W. B. asks: 1. Would there be a demand for a double engine, having oscillating cylinders, and provided with a reversing attachment? A. There are such engines in the market. 2. Is an oscillating engine, with a given head of steam, inferior to an engine whose cylinders do not oscillate? A. Not necessarily.

A. asks: 1. How can gutta percha be fastened to ordinary sole leather? A. By using gutta percha dissolved in naphtha as a cement. 2. Will it wear as long as sole leather? A. No. 3. Will it melt with ordinary sun heat on the sidewalk? A. It will soften in summer weather.

P. P. W. asks: If the pressure is greatest on the bottom of a boiler, how does an injector work? A. We do not see the connection between the two. As to your other question: According to general usage, a corner building is on the street on which the main entrance opens.

G. W. M.—Your questions are too comprehensive to be answered in these columns. You will find the flight of birds fully explained in Pettigrew's "Animal Locomotion."

E. B. K. says: I have a small telescope constructed on the principle of the compound microscope, with achromatic object glass 1¾ inches in diameter and 13 inches focus. Eye-piece consists of 4 lenses. Can I obtain a higher power by using an achromatic object glass of 30 inches focus and 2¾ inches diameter? A. Yes.

J. S. asks: How can I cut moss agates and cornelians? A. By means of a blade of soft iron and diamond dust. Copper is sometimes used in place of the iron.

S. D. L. asks: 1. Is there any difference between a stereopticon and a magic lantern? A. No. 2. Can colored photographs be used in them? A. Yes. 3. Can photographic negatives be used? If so, how can they be colored? A. Read directions for coloring published on p. 397, vol 26.

D. G. asks: 1. What is the process of polishing paint, as it is done on carriage work, where no brush marks are to be seen? A. Carriage painting and varnishing are processes much too complicated to be described in these columns. See M. Arlot's work, frequently advertised in our pages. 2. What causes paint to crack? Is it the use of too much or too little oil? A. Too little.

S. says: If spiritualism is a humbug, how can you account for such men as Crookes, Wallace and Edmonds believing in it? A. Spiritualism is no more a humbug than is hydrophobia. Both phenomena have certain points of resemblance. Both appear to be affections of the nervous system, resulting from some sort of action upon the nerve centers. How this action is induced is not positively known; but there is evidence to show that a mental impression, a whim, or the imagination of the individual, may be a sufficient exciting cause. These diseases, and their multitudinous allies, nervous disorders of all kinds, are not respecters of persons. They attack all classes, the learned and the ignorant; but the earliest and easiest victims are generally found among individuals of weak or bad physical conditions.

T. A. C. says: Tell D. S. H., whom you answer at head of first column, p. 27, to cover the face of his pulley with leather to keep his belt from slipping. He can put it on with tacks or very small nails. Flesh sides together I think, work best.

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

R. R. R.—No. 1 is finely laminated micaceous schist, containing, as far as can be determined from such small pieces, nodules of impure steatite. No. 2, heavy spar or barite. The specific gravity of the specimen enclosed is 4·4. No. 3, limonite, containing on an average from 80 to 85 per cent oxide of iron. No. 4, magnetite.—R. L. W.—No. 1, on analysis, was found to contain a little silica and insoluble matter, the remainder being carbonate of lime. It is not a hydraulic limestone. Properly burned it would be converted into quicklime. No. 2 is fibrous gypsum.—J. W. T.—We compared the powder, for polishing purposes, with rouge, the finest French emery paper, and Bath brick. It is a medium between rouge and French emery paper, being inferior to rouge, and much superior to the emery. It is just equal to Bath brick, which it closely resembles in color. An eminent optician observes that it might be used by nickel platers.—A. M. B.—No. 1 is iron pyrites. No. 2 is hepatic pyrites, in which the sulphuret has been converted into oxide of iron.

F. E. T. says: Piles driven in salt water on the southern coast are very soon destroyed by worms. They might be protected by metal sheathing, but that is too expensive. Is there any method known, both cheap and effective, of securing wood against the attacks of these worms?—J. C. G. asks: How can I burnish brass?—J. S. N. asks: How can I straighten a rifle barrel?—E. H. B. asks: How is raw wool prepared for dyeing with indigo blue?—T. H. R. asks: How can I wash a chamois shirt without shrinking or injuring it?—H. L. K. asks: How are white rubber hand stamps made? What kind of molds are used, and what kind of rubber? How is the rubber melted?—E. K. M. asks: How are the rubber bands of different sizes sold by stationers joined together? The joint or seam is quite level, and as strong as any other part.—H. B. S. asks: What materials are used in the manufacture of firebricks, and what is the usual method of their manufacture?—H. E. K. asks: What is the best way to make putty of the colors of different woods (walnut, ash, etc.)?—L. H. asks: What will prevent pastel colors from being rubbed?—G. H. M. asks: What part of a horse power is an eight day clock spring? What is the weight of a four horse power engine?—W. C. L. says: The front wheels of a wagon are 3 feet 10 inches high, and the hind wheels 4 feet 4 inches high, or the front wheels are 4 feet and the hind wheels 4 feet 6 inches. What is the rule for setting the axle, and should the hind axle be any longer than the fore?—W. F. W. asks: 1. What is the rule for computing the horse power of an overshot water wheel, of 18 feet diameter, width of buckets 4 feet, depth 18 inches by average of 3½ inches, with a 10 inch run, making 61 buckets to the wheel? 2. What is the meaning of the word "rages," used by machinists? 3. Will crawfish work in soft slate? Do they go any deeper than to the gravel? 4. Will it injure bolting cloth to wash it?

We shall be glad to receive replies to the above for publication.

COMMUNICATIONS RECEIVED.

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

On Feathered Arrow Heads. By S. C. G., by T. L. W., and by A. H. I.

On a Balloon Device. By L. A.

On the Dress of Women. By F. M. S.

On Bursting and Explosion of Boilers. By J. M.

On the Boiler Explosion at Geddes, N. Y. By D. T.

On the International Rifle Match. By E. H. P.

On the Chances of War. By W. W. H.

On the Interior Angles of a Polygon. By C. E.

On a Small Steamer. By J. F. K.

Also enquiries and answers from the following:

J. A. C.—C. M. C.—W. C.—H. L. M.—C. E. J.—J. E. Jr.—D. B. S.—T. M. C.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of enquiries analogous to the following are sent: "Please to inform me where I can buy sheet lead, and the price? Where can I purchase a good brick machine? Whose steam engine and boiler would you recommend? Which churn is considered the best? Who makes the best mucilage? Where can I buy the best style of windmills?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

June 23, 1874,

AND EACH BEARING THAT DATE.

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APPLICATIONS FOR EXTENSIONS.

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

30,155.—ATTACHING SAW HANDLE.—I. Pelham. Sept. 9.
30,157.—BLOWER.—F. H. Roots. Sept. 9.
30,175.—POST HOLE BORER.—A. S. Ballard. Sept. 9.
30,185.—CORN SHELLER, ETC.—J. C. Richards. Sept. 9.
30,215.—HARVESTER.—T. N. Foster. Sept. 16.
30,668.—CASTING TOOLS.—S. W. Collins. Nov. 4.
30,691.—STEM PLOW PLATE.—F. F. Smith. Nov. 4.

EXTENSIONS GRANTED.

28,837.—FOG ALARM.—C. L. Daboll.
28,874.—POST HOLE DIGGER.—J. Lee.
28,928.—NAIL CUTTING MACHINE.—W. Wickersham.
28,941.—SKELETON SKIRT.—S. S. Sherwood.

DISCLAIMER.

28,837.—FOG ALARM.—C. L. Daboll.

DESIGNS PATENTED.

7,498.—CARPET.—J. Fisher, Philadelphia, Pa.
7,499.—HONEYCOMB COVERLET.—P. J. Otto, Lancaster, Pa.
7,500.—MEDAL.—T. R. Hartell *et al*., Philadelphia, Pa.
7,501.—TOY BLOWPIPE.—F. H. Lane, Boston, Mass.
7,502.—CARRIAGE CLIP.—G. F. Smith, Plantsville, Conn.
7,503.—BRACKET.—J. B. Sargent, New Haven, Conn.

TRADE MARKS REGISTERED.

1,840.—EYE CUPS.—Dr. J. Ball & Co., New York city.
1,841.—WHISKY.—G. Clark, New York city.
1,842.—TALLOW COMPOUNDS.—J. Hobbs, Boston, Mass.
1,843.—VOLTAIC SOLES, ETC.—E. J. Seibert, N. Y. city.
1,844.—WHITE LEAD IN OIL.—St. Louis Lead and Oil Co., St. Louis, Mo.
1,845.—STOVE POLISH.—Strow & Co., Philadelphia, Pa.
1,846.—TOBACCO.—H. K. Thurber & Co., New York city.
1,847.—DENTAL RUBBER.—S. S. White, Philadelphia, Pa.
1,848.—FLOUR.—Bain & Pegram, St. Louis, Mo.
1,849.—MIDDLINGS PURIFIERS.—Brennan *et al*., Paris, Ill.
1,850.—MACHINE NEEDLE.—H. B. Goodrich, Chicago, Ill.
1,851.—INJECTORS.—Rue Manufacturing Co., Phila., Pa.

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 application for Extension of Patent..... $50
On granting the Extension..... $50
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

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3,561.—H. L. Lowman, Birmingham, New Haven county Conn., U. S. Improvements on the manufacture of scythes, called "Lowman's Scythe." June 15, 1874.
3,562.—T. Steers, Jr., Ottawa, Carleton county, Ont. Improvements on currycombs, called "Steer's Currycomb." June 15, 1874.
3,563.—J. Woodhams, Dorr, Allegan county, Mich., U. S., assignee of C. B. Turner, Grand Rapids, Kent county, Mich., U. S. Improvements on steam valves, called "Turner's Improved Steam Valve." June 15, 1874.
3,564.—R. M. Wanzer, Hamilton, Ont., assignee of J. F. Chamberlain, same place. Improvements in portable furnaces, called "Chamberlain's Improved Portable Furnace." June 15, 1874.
3,565.—T. Miller, New York city, U. S. Improvement on what are termed oil cabinets, called "Miller's Oil Cabinet." June 15, 1874.
3,566.—W. J. Clokey, Belleville, Ont. Improvement on a machine for thrashing grain, called "Clokey's Thrashing Machine Safety Gear." June 15, 1874.
3,567.—D. P. Sharp, Ithaca, Tompkins county, N. C., U. S. Improvement on horse rakes, called "Sharp's Improved Horse Rake." June 15, 1874.
3,568.—W. R. Macauley, Hamilton, Wentworth county, Ont. Useful invention for bending painters' brushes to be used in the ordinary pursuance of house and carriage painting, etc., called "The Painter's Friend." June 15, 1874.
3,569.—J. M. Allen, Marion, Plymouth county, Mass., U. S. Improvement on the art or process of making paper pulp and paper, called "Allen's Process of Making Paper Pulp and Paper." June 15, 1874.
3,570.—J. McNab, Widder Station, Lambton county, Ont. Improvements on car couplings, called "McNab's Improved Automatic Car Coupling." June 15, 1874.
3,571.—H. H. Warren, Bridgewater, Ont. Improvements on a machine for trapping animals, called "Warren's Steel and Animal Trap." June 15, 1874.
3,572.—A. R. Nichols, Williamtport, Lycoming county, Pa., U. S. Improvements on machines for edging lumber, called "Nichols' Improved Edging Machine." June 15, 1874.
3,573.—W. S. Wisner, Brantford, Brant county, Ont., assignee of C. P. Brown, Manchester, Ontario county, N. R., U. S. Improvement on seed-sowing machine, called "Brown's Improved Grain Drill Distributer and Tube Shifter." June 15, 1874.
3,574.—H. Carter and D. Stewart, Aylmer, Elgin county, Ont. Improvements on odometer, called "Carter & Stewart's Odometer." June 15, 1874.
3,575.—J. Orth and W. Honsberger, Clinton, Lincoln county, Ont. Improvement on threshing machines, called "Orth & Honsberger's Chaffer." June 15, 1874.
3,576.—R. Kline and R. M. Jack, borough of Pottstown, Pa., U. S. Improvement in running gears for carriages, called "Kline & Jack's Improved Running Gears for Carriages." June 15, 1874.
3,577.—I. P. Magoon and H. Fairbanks, St. Johnsbury, Caledonia county, Vt., U. S. Improvement on feed water heaters for locomotives, called "Magoon's Locomotive Feed Water Heater." June 15, 1874.
3,578.—H. Watkeys, Syracuse, N.Y., U. S. Improvement upon throttle valves for locomotive and other steam engines, called "Watkey's Throttle Valve." June 18, 1874.
3,579.—C. Mitchell, De Kalb township, St. Lawrence county, N. Y., U. S. Improvements on animal pokes, called "Mitchell's Animal Poke." June 18, 1874.
3,580. C. V. Hase, Belleville, Ont. Improvement on a machine for propelling vessels, called "Hase's Rim Propeller Wheel." June 18, 1874.
3,581.—B. C. Richardson, Syracuse, Onondaga county, N. Y., U. S. Improvements on a spool case, called "Richardson's Spool Case and Cushions." June 18, 1874.
3,582.—F. Bramer, Little Falls, Herkimer county, N. Y., U. S. Reissue of No. 2,600, called "The Warrier Mowing Machine." June 18, 1874.
3,583.—J. Lydiatt and E. R. Kent, Hamilton, Ont. Improvements in glass molds, called "Lydiatt's Improved Glass Mold." June 18, 1874.
3,584.—E. Voisin, Bourges, France. Improvements in cupola furnaces, called "Voisin's Improvements in Cupola Furnaces." June 18, 1874.
3,585.—T. Worswick, Guelph, Ont. Improvements on force pumps, called "Worswick's Adjustable Force Pump." June 18, 1874.
3,586.—J. Brokenshire, Kingston, Ont. Improvement on capstans for the use of vessels, called "Brokenshire's Elevated Geared Purchase Capstan." June 18, 1874.
3,587.—J. Hock, Vienna, Austria. Improvements in motor engines worked by the combustion of petroleum or other liquid hydrocarbons, called "Hock's Petroleum Motor Engine." June 18, 1874.
3,588.—William Gowan, Wausau, Marathon county, Wis., U. S. Improvements on head blocks and set works for saw mills, called "Gowen's Improved Saw Mill Set Works." June 18, 1874.
3,589.—T. D. James, Syracuse, N. Y., U. S. Improvement in wash boards, called "James' Perforated Wash Board." June 26, 1874.

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Practical Hints to Inventors.

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

To Make an Application for a Patent.

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

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Preliminary Examination.

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

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

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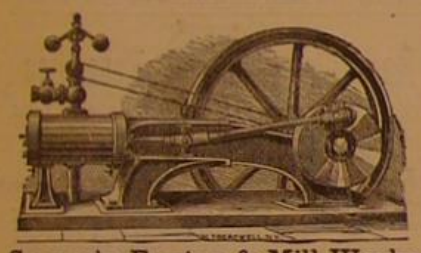
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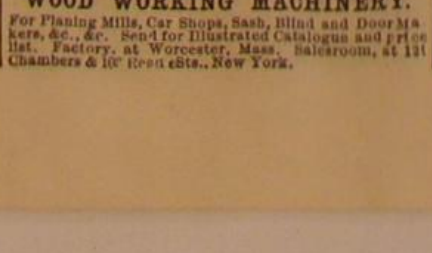
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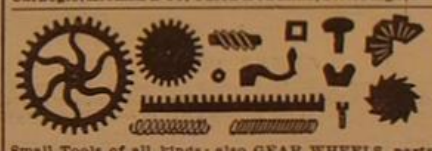
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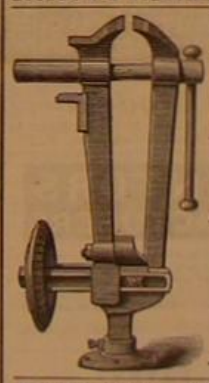
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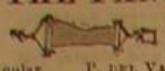
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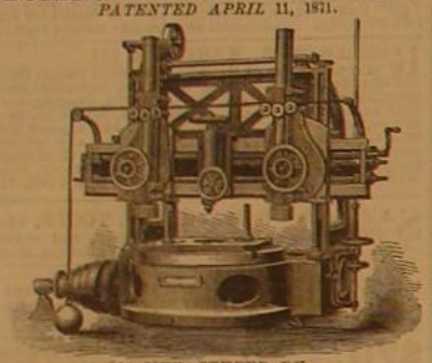
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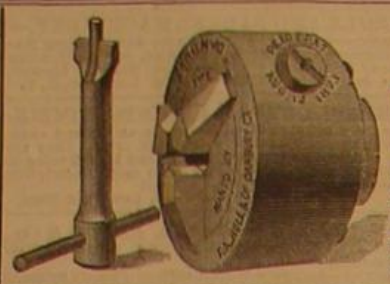
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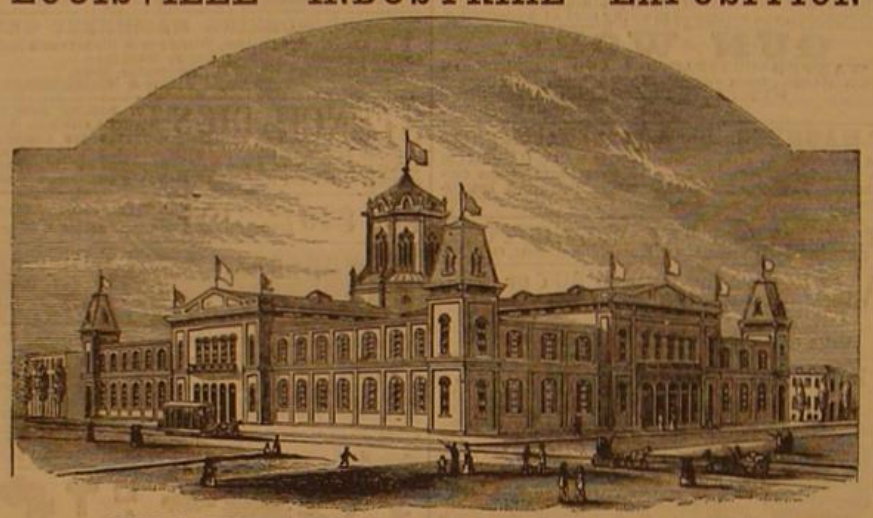
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