

SCIENTIFIC AMERICAN

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

Vol. XXXI.—No. 5.
[NEW SERIES.]

NEW YORK, AUGUST 1, 1874.

\$3 per Annum
IN ADVANCE.

IMPROVED GEAR CUTTING ATTACHMENT FOR LATHES.

Not long ago we illustrated an ingenious work holder for lathes, the device of Mr. William P. Hopkins, of Lawrence, Mass. The same inventor has also produced another attachment for the same machine, the object of which is to cut gears. The work is operated upon by a cutter turning upon the centers of the lathe, and is held and governed by the means represented in the illustrations and described below.

A is the arbor box, in which freely turns a hollow spindle, B. Through the latter passes a tapered arbor, C, on the upper and larger extremity of which the gear wheel to be cut is secured. Fastened to the hollow spindle by means of a set screw, and hence rotating with it, is the index pulley, D. Attached to the arbor box is an arm in a slot, in which travels an index point, E, connected with a suitable spring, which holds its extremity in any of the orifices on the pulley, D, to which it may be adjusted. Several rows of different numbers of these apertures around the pulley, D, provide various graduations; and from the pointer, E, traveling freely along its slot, it may be readily placed over any desired row. When one groove or space is cut in the work, the pointer is lifted from the orifice, and the pulley turned, carrying with it the arbor spindle and its attachments until the next hole is met and entered by the index point. The number of holes in each row is marked upon the face of the slide clasp, F, directly over each series of apertures. The clasp slides entirely around the circumference of the index pulley, and can be used to mark the number of holes passed under the index point, serving the purpose of the spacing point on common gear-cutting machines.

The device may be attached to the lathe tool carriage, as represented, or bolted on top of the tool post block, when the point shaft box slides down below the angle iron frame. By means of the worm and segment, shown in Fig. 2, the pivot shaft may be rotated, so setting the attachment at any angle for cutting any variety of straight or bevel gear. The long set screw, G, serves to adjust the elevation of the device, and the remaining adjustments are obtained upon the ordinary lathe carriage in manner readily understood. The hollow spindle upon which the index pulley is fastened can be removed, and a solid one substituted, on one end of which a small chuck is fixed. The latter may be used for a variety of purposes with convenience and advantage.

The index pulley has 28 different graduations, and with two pulleys any graduation under 100, and all even numbers up to 130, can be cut. A small level on top of the index pulley indicates the proper adjustment for straight or spur gears. The construction of the device, we are informed, is of the most careful description, well calculated to insure durability and efficiency.

The apparatus may be seen at this office, and further particulars may be obtained by addressing the inventor as above. Patented September 30, 1873.

The California Wood Rat.

In a recent number of the *American Journal* is an extract of a letter from Mr. A. W. Chase, U. S. Coast Survey, concerning the habits of the so-called California wood rat. It is a little larger than an ordinary Norway rat, dark brown in color, with large lustrous eyes, and a tail covered with thin hairs. I should call

it intermediate between the squirrel and rat. This creature builds its nest in the woods, sometimes on the ground, more frequently in the lower branches of trees. They accumulate

sity of this little creature that I wish to call attention. To make my story intelligible, I would first state that I am partial owner of some property on the Oregon coast, on

which a sawmill had been placed, but which, owing to various causes, has never been in operation. On this property was a dwelling house for the hands, in which, on work being discontinued, were stored a quantity of stuff, tools, packing for the engine, six or seven kegs of large spikes; in the closets, knives, forks, spoons, etc. A large cooking stove was left in one of the rooms.

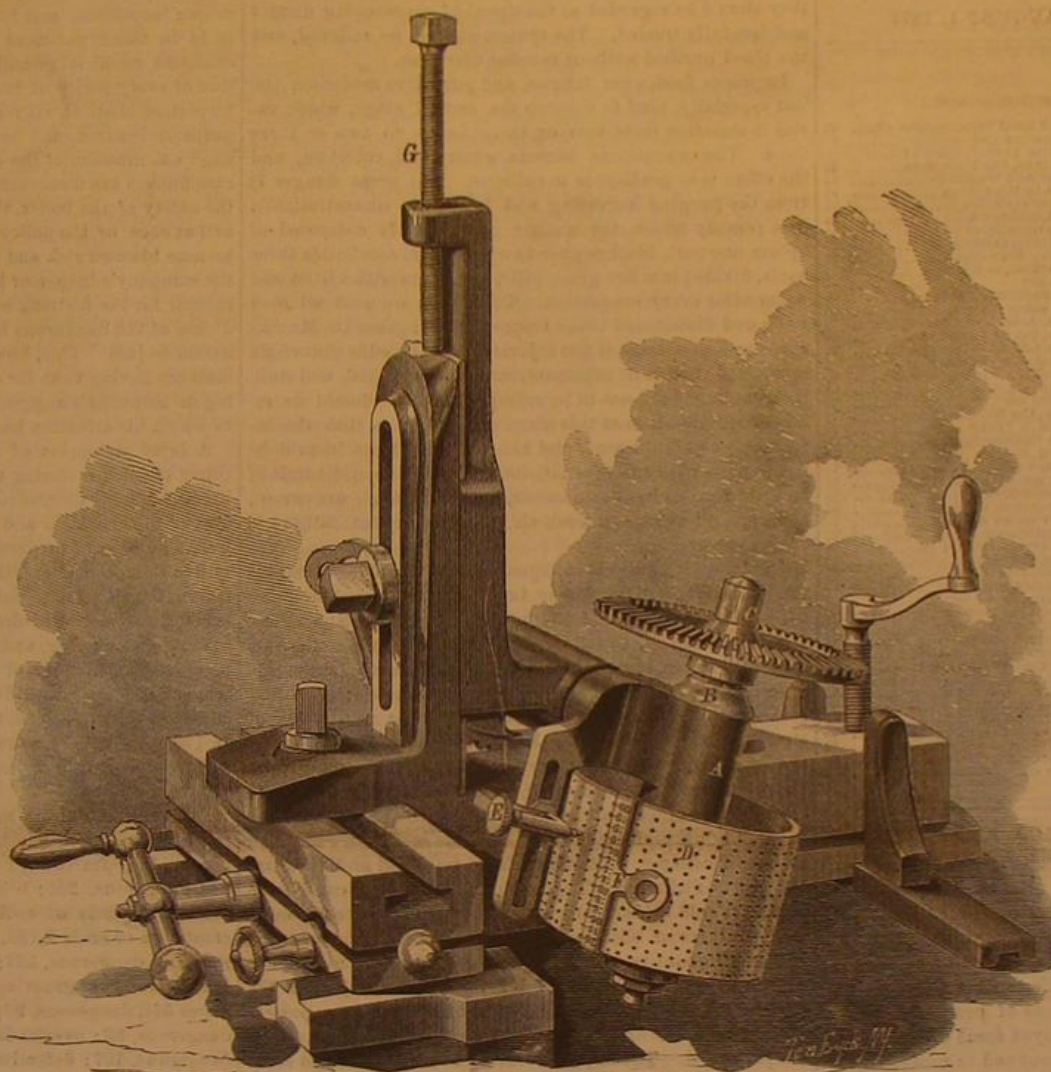
This house was left uninhabited for two years, and, being at some distance from the little settlement, it was frequently broken into by tramps who sought a shelter for the night. When I entered this house I was astonished to see an immense rat's nest on the empty stove. On examining this nest, which was about five feet in height and occupied the whole top of the stove (a large range), I found the outside to be composed entirely of spikes, all laid with symmetry so as to present the points of the nails outward. In the centre of this mass was the nest, composed of finely divided fibers of the hemp packing. Interlaced with the spikes, we found the following: About three dozen knives, forks, and spoons, all the butcher knives, three in number, a large carving knife, fork, and steel; several large plugs of tobacco; the outside casing of a silver watch was disposed of in one part of the pile, the glass of the same watch in another, and the works in still another; an old purse containing some silver, matches, and tobacco; nearly all the small tools from the tool closets, among

them several large augers. Altogether, it was a very curious mixture of different articles, all of which must have been transported some distance, as they were originally stored in different parts of the house.

The ingenuity and skill displayed in the construction of this nest and the curious taste for articles of iron, many of them heavy, for component parts, struck me with surprise. The articles of value were, I think, stolen from the men who had broken into the house for temporary lodging. I have preserved a sketch of this ironclad nest, which I think unique in natural history.

Many curious facts have since been related me, concerning the habits of this little creature. A miner told me the following: He once, during the mining excitement in Siskiyou county, became in California parlance "dead broke," and applied for and obtained employment in a mining camp, where the owners, hands and all, slept in the same cabin. Shortly after his arrival small articles commenced to disappear; if a whole plug of tobacco were left on the table, it would be gone in the morning. Finally a bag, containing one hundred or more dollars in gold dust, was taken from a small table at the head of a "bunk," in which one of the proprietors of the claim slept. Suspicion fell on the new comer, and he would perhaps have fared hardly; for, with those rough miners, punishment is short and sharp; but, just in time, a large rat's nest was discovered in the garret of the cabin, and in it was found the missing money, as well as the tobacco and other articles supposed to have been stolen.

STEAM on our canals seems to be an accomplished fact. Six boats are now plying on the Erie canal and twelve others will shortly be added, all capable of making the trip from New York to Buffalo in five days. It is believed that the grain trade of the fall will be considerably affected by the increased cheapness of transportation.



HOPKINS' GEAR CUTTING ATTACHMENT FOR LATHES.

a surprising quantity of dried twigs, which they interlace to form a dome-shaped structure, often ten or twelve feet high and six or eight feet in diameter.

Openings in the mass lead to the center, where is found the nest, consisting of the finely divided inner bark of trees, dried grass, etc. But it is to the peculiar thievish propen-

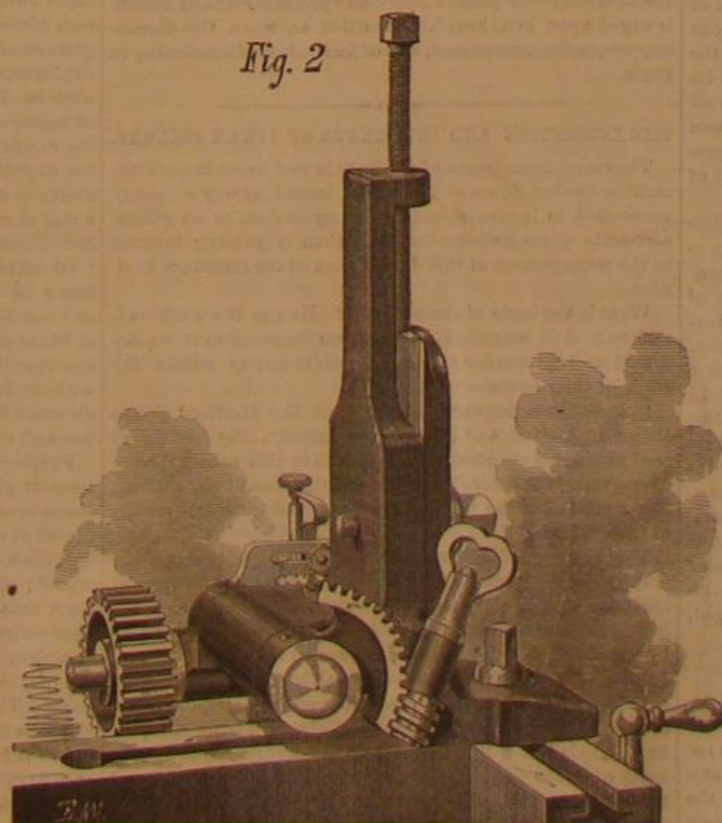


Fig. 2

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
Resale, per copy, one year, each \$2 50	25 00
Over ten copies, same rate, each	2 50

VOLUME XXXI, No. 5, [NEW SERIES.] Twenty-ninth Year.

NEW YORK, SATURDAY, AUGUST 1, 1874.

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ANOTHER GREAT FIRE IN CHICAGO, AND THE MATERIALS ACCUMULATING FOR ONE IN NEW YORK.

Chicago was visited, on the 14th ult., by a second great fire, which devastated about eighteen blocks of buildings, and entailed a loss estimated in the neighborhood of two millions of dollars. Though falling far short of the conflagration of 1871 in its disastrous effects, this visitation has been the means of rendering thousands of people homeless. Unlike its predecessor, which destroyed some of the fairest portions of the city, it was mainly confined to rookeries and dens, in the obliteration of which the community is rather the gainer; but, as is the rule in such quarters, the population was dense, and consequently the numbers deprived of shelter are greater than would be the case had other parts of the town been burned.

There is evidence of mismanagement of the fire department, to which is probably owing the non-extinguishment of the fire at an earlier period. Engines were posted behind the flames instead of in their path, and attempts at blowing up buildings were miserably unsuccessful, owing to lack of powder, a state of affairs difficult to comprehend. To one good substantial fireproof building, the safety of almost the entire city is due. The blaze lapped it all around, but its marble walls stood grandly; and then, as the fire attempted to crawl over it, the flames grew weaker and were beaten back by the firemen on the other side. One honest structure was the savior of millions of property; and the builders of the metropolis may well take the fact to heart.

New York, at this moment, fairly invites the fate of Boston, Portland, and Chicago. Buildings are being run up to heights to which water by the fire engines cannot be thrown. There are wooden structures in close proximity to some of the grandest edifices; there are blocks upon blocks of tenements filled with swarms of people, the majority of whom, from poverty, use kerosene in place of gas, and in which a great fire, once started, would work terrible ravages. In our up-town streets, houses shoot up half a dozen at a time together, a mass of the thinnest possible walls and kindling wood beams and fittings, built to sell and to realize a big interest on capital, without any regard to the simplest precautions in favor of safety. We have an admirable fire department, to the prompt exertions of which our immunity thus far is mainly due; but if circumstances combine to engender a great fire, as in both cases in Chicago, it will be through the mercy of Providence, and not through our own foresight, if we escape a terrible visitation.

CHOLERA AND ITS TREATMENT.

In view of the general uneasiness which reports of apparent cases of Asiatic cholera, as they recur, will tend to engender, a little volume before us is of timely interest, inasmuch as it not only gives valuable information regarding the origin, symptoms, and nature of the disease, but also points

out, probably, the most efficacious methods for its cure. The book, which is entitled "Observations on the Pathology and Treatment of Cholera" (G. P. Putnam's Sons, New York), has been written very recently by Dr. John Murray, Inspector General of Hospitals in England, and late of Bengal; and it aims to give the result of the author's forty years' experience during a residence in a country ordinarily considered as the hotbed of the disease.

Cholera is caused, we are told, by the presence of the poison in the system, and until this is removed health cannot be regained. The first stage of the disease, *malaise*, is frequently unnoticed by the patient, and it may be produced by many causes independent of cholera poison, such as over-excitement, fatigue, depression from misfortune, and similar physical or mental conditions. Hence, while such symptoms, under ordinary circumstances, need excite no especial apprehension, still, if the patient has been in contact with cholera cases, or in the neighborhood of an infected region, they should be regarded as the signal of approaching danger and carefully treated. The system should be relieved, and the blood purified without causing diarrhoea.

Improper food, over fatigue, and purgative medicine, the last especially, tend to develop the second stage, which varies in duration from two or three hours to two or three days. The evacuations become watery and colorless, and the effect is to predispose to collapse. The great danger is from the purging increasing and becoming uncontrollable. The remedy which the author prescribes is composed of opium one part, black pepper two parts, and asafoetida three parts, divided into five grain pills, and given with a little cold water after every evacuation. These pills are used all over India and distributed to the troops. Astringents Dr. Murray condemns as useless, if not injurious, and he adds that chalk mixture, infusion of capsicum, camphor in alcohol, and similar compounds are not to be relied upon. It should be remembered that it is at this stage of the disease that the infection is communicated, and hence disinfectants should be freely used with the evacuations. The diet should admit of no solid food unless farinaceous, such as bread, arrowroot, and sago. Exercise in fresh air is desirable, but fatigue is dangerous.

The following stage is collapse; and as, when the disease is thus far advanced, danger is imminent, treatment becomes most difficult. It would be impossible, with the space here at our command, to follow the author through the various symptoms laid down and the remedies advised. He describes the stages generally under three heads: The first is incipient collapse, where there is a great prostration of strength; but the voluntary life of the body is active, and the involuntary life only partially suspended. The treatment here recommended is in great measure expectant, to gain time to allow Nature to eliminate the poison through the individual secretory organs. In the second or confirmed degree of collapse, voluntary life is impaired and involuntary life is flickering. The treatment advocated consists in palliative cold drinks, hot saline enemata, and strong mustard poultices or blisters upon the abdomen. The addition of a small quantity of quinine to the water administered is useful, and the appearance of bile in the evacuations is the first sign of hope. In the last form of collapse, the powers of voluntary life are very low and those of involuntary life are paralyzed. The hope of recovery is very faint, and there is no remedy on which reliance can be surely placed.

Dr. Murray devotes the larger portion of his work to the consideration of collapse, and also to the discussion of the after effects of the disease during convalescence. In referring to hospitals, he says that those best suited to the disease are small buildings on open ground, well drained, and in the vicinity of trees, if possible. Huts may be used with great advantage, and should be located in the center of the infected district. In conclusion, the necessity of deciding on the best course to pursue before an epidemic actually occurs is urged upon local health authorities, as, when the disease appears, excitement ensues, and often confusion amounting to panic.

THE INSPECTION AND INSURANCE OF STEAM BOILERS.

The recent amendment of our State law of boiler inspection, making the certificate of inspection issued by any company authorized to insure steam boilers equivalent to an official certificate, gives occasion for more than a passing interest in the management of this department of the insurance business.

What is the basis of the business? How is the work carried on? And why should the parties engaged in it be accepted as trustworthy agents of public safety within the scope of their business operations?

In response to inquiries of this sort, the Hartford Steam Boiler Inspection and Insurance Company, the leading as well as pioneer corporation of the kind in this country, have courteously laid before us, for the information of our readers, full details as to the method, purpose, and practical results of their work.

That the use of steam power is fraught with danger is only too well known; the extent of the danger, however, as indicated by the number of explosions every year and the loss of life and property entailed, is but vaguely appreciated by the public at large. No official record is kept of such accidents, and only those of exceptional interest are reported in the newspapers; nevertheless the number so reported and brought to the notice of a single individual during the past five years is but a little short of six hundred, causing the death of 1,829 persons, and the wounding of upwards of 1,500 more! The amount of property destroyed cannot be told: any one knowing the destructive character of boiler

explosions will understand that it could not have been small.

Against losses of this character, ordinary insurance offers no indemnity, since the destroying element is neither fire nor water, though both have something to do with it. The need of a special system of insurance to cover these particular risks was early appreciated by steam users in England; in this country it remained unmet until 1866, when the company above named went into operation.

Unlike other forms of insurance, this does not undertake merely to indemnify the policy holder for losses of the special nature embraced in its plan of operation, but to prevent such losses by a watchful care of the property insured. Its tendency is therefore quite the reverse of ordinary insurance in that it lessens instead of increases the likelihood of "accident."

Boilers do not explode without cause, which cause, in the great majority of cases, may be detected in its incipency by proper inspection, and the risk removed by timely repairs. It is in this department of its work that the company becomes an unofficial guardian of public safety: a prime condition of every policy of insurance being that the company's inspectors shall at all reasonable times have access to the property insured, and be afforded every facility for a thorough examination of the boiler and its attachments; and in case defects are discovered at any time, in any way affecting the safety of the boiler, the assured is bound to correct the evil at once, or the policy dies. Should the owner choose to assume his own risk and refuse to make the needed repairs, the company's inspector is required to notify the official inspector for the district, who alone has power to compel the disuse of the dangerous boiler if in his judgment its condemnation be just. This, however, is a purely imaginary case, no instance having thus far occurred of a policy holder slighting an inspector's suggestions, or declining to correct defects to which his attention had been called.

A brief statement of the work done by the company's thirty inspectors during the past year, with the number and kind of defects discovered and corrected, will give a rough idea of the character and usefulness of its work.

The number of inspections made was within two of twenty-five thousand, more than a third of which were thorough internal inspections, including external examinations of tubes, flues, and fire sheets, internal and external of the bracing and staying, and the condition of all boiler attachments. The number of defects discovered was 11,988, of which 2,892 were regarded as dangerous, that is, of such a character that an accident was liable to occur at any moment. In 178 cases boilers were condemned outright, as so completely worn out or injured by carelessness as to be beyond repair.

In detail the defects may be classed as follows: Furnaces out of shape, with sheets contorted and buckled, 599, dangerous, 124; fractures, 1,003, dangerous, 459; burned plates, 682, dangerous, 291; blistered plates, 1,737, dangerous, 298; cases of deposits of sediment, 2,263, dangerous, 327; of incrustation or scale, 2,180, dangerous, 205; of external corrosion, 818, dangerous, 163; of internal corrosion, 333, dangerous, 92; internal grooving, 206, dangerous, 47; defective water gages, 561, dangerous, 96; defective blow-out apparatus, 253, dangerous, 83; overloaded or defective safety valves, 321, dangerous, 107; defective pressure gages, 1,470, dangerous, 280, the extremes of variation from a standard gage being from minus 57 to plus 50; boilers without gages, 683, dangerous, 62; deficiency of water, 113 cases, dangerous, 69; cases of loose and broken braces and stays and insufficient bracing, 465, dangerous, 230.

Who can estimate the amount of peril to life and property obviated by the discovery and timely correction of these twelve thousand defects and deficiencies?

The fidelity and skill with which the inspections were made during this and preceding years, as well as the correctness of the theory on which they were based—a theory which gives small space to the mysterious in accounting for boiler explosions—are sufficiently attested by the almost entire absence of serious accidents in connection with the thousands of boilers of all sorts and conditions that are or have been in the company's care. In two cases only has life been lost by the explosion of such boilers, the victim in one being the driver of a locomotive, in the other the engineer in charge of a stationary boiler which exploded for some cause that baffled detection.

Of course it is impossible to say that any others would certainly have exploded if left in the condition of the uninsured and less frequently inspected: still a glance at the museum of boiler defects collected by the company's inspectors would convince the firmest believer in protecting providence that, without their intervention, nothing short of perpetual miracle could have kept some of the diseased subjects from sudden and violent ends.

Further evidence of the value of the company's inspections is given by the increasing appreciation of them by steam users. To a very large extent the inspection and approval of the Hartford Steam Boiler and Insurance Company is made a condition without which a boiler will not be accepted; while many leading boiler makers have all their work thus inspected, the company's certificate going with each boiler as a guarantee of its soundness and proper construction.

So far the business affects only boiler makers and boiler users. The late legislative enactment makes the community at large a party also, in that it practically entrusts the public safety within certain limits to the care of the insurance companies. It is but right and natural that the public should ask why and wherefore.

The amendment was passed in response to a petition very

numerously signed by the leading manufacturing firms of the State, the reason offered therefor being substantially that the conditions of insurance implied a full compliance with the spirit of the law, the sole object of which was to lessen the danger of boiler explosions, by periodic inspections and the restriction of pressure within safe limits. To this extent the object of the Hartford Steam Boiler Inspection and Insurance Company is the same. The end and aim of the law being thus attained, it was urged that the insured might, under proper restrictions, be justly and safely exempt from the charges and delays incident to official inspections. The legislature wisely saw the point and the amendment was adopted.

We say wisely, since, without impugning in the least the honesty and ability of the inspectors appointed by the government, it stands to reason that the supervision of parties having a pecuniary interest in preventing explosions, and restrained by no care for the cost of making doubtful property safe and sound, will be quite as rigid and exacting as that of the government, which assumes no such liability. Equally reasonable is it to expect that the agents of an insurance company, directly responsible in the premises, will be quite as carefully selected for integrity and special fitness for the work as the appointees of that transitory and irresponsible thing we call the government; and the inspectors so chosen will also be quite as likely to be free from corruption or favoritism in fixing the limit of pressure or in overlooking defects, the inspector's personal liability for damage by explosions being the same in one case as in the other.

We have referred incidentally to a feature of the work of the Hartford Steam Boiler Inspection and Insurance Company, which, though not a necessary element of their scheme, is one which bids fair to prove of great benefit to steam users, and consequently merits a somewhat fuller notice. It is the study the officers are making of what may be termed the pathology of steam boilers. Every application for insurance is accompanied by an inspector's report describing the boiler and its attachments in detail, and giving full particulars as to the setting and construction of the boiler, its age and maker's name, the kind of fuel used, the source and quality of the water supply, in short everything affecting in any way the durability and safety of the property. These facts are entered in a record book, and supplemented by the facts supplied by the monthly inspection reports, so that the history of every boiler with its attachments can be ascertained in a moment. In this way boilers are taken as they are used, the practices which obtain in different parts of the country are compared, the effects of different kinds of fuel and water are studied, together with the various safeguards and correctives employed; the working of different gages is observed under all sorts of circumstances, in fact all the fruits of widely extended and thoroughly systematized observation are brought to bear on the question why boilers explode, and on the practical problem of preventing explosion. It is impossible that such an accumulation of knowledge in regard to the wear and tear, the weakness and dangers of boilers, should not ultimately lead to practical results of the highest utility.

PATENT OFFICE JUSTICE.

In the matter of the interference case between H. H. Bigelow and S. W. Baldwin, before the Patent Office, the Commissioner of Patents, acting as it appears illegally, refused to permit the case to go before the Examiner in Interferences, who is the special officer designated by law for the hearing of such matters, thus preventing a final decision as to the question in dispute. Mr. Bigelow thereupon applied to the Supreme Court of the District of Columbia, for a mandamus to compel the Commissioner to do his duty. Judge Carter, after a full hearing of the case and of the excuses of the Commissioner, concluded that a mandamus must issue. The Court decided that the examiner in charge of interferences in the Patent Office is exclusively authorized by law to examine all cases of interference, whether between two pending applications for a patent or a pending application for a patent and an unexpired patent, and primarily to determine the question of priority of invention involved in either class of said applications; and that the Commissioner of Patents is bound by law to direct said examiner in charge of interferences to proceed to determine the said question of priority in invention.

Applicants for patents will necessarily be subject to delays, expenses and troubles, so long as the Patent Office, with its battalion of examining officials and assistants, four hundred in all, are permitted to act as inquisitors of inventors. Questions about the novelty of inventions and rights of priority between claimants must, under the American system, be finally decided by the courts. The only unsatisfactory part of our patent laws is that which subjects inventors to so many troubles at the Patent Office, before they can reach the courts. The Bigelow case is only one of many others. Had this applicant been a poor man, as the majority of inventors are, he probably would have been unable to lose time upon the case or spend money to pay lawyers in arguing for this mandamus; and the adverse whim of a Patent Office official would have stood as a permanent bar to his suit. What is needed is, to eliminate all such objections from the patent laws, and make it the simple duty of the Patent Office to issue a patent to every applicant who chooses to ask therefor, on presentation of suitable documents in proper form, leaving all questions relating to the validity of patents to the courts of law for settlement. This is the common practice in nearly all other countries in the world, and is found to work well. But in Prussia and the United States, the inventor is obliged to submit to the costs and annoyances of official inquests before he can obtain the patent cer-

tificate. In Prussia, the patent officials manage to interpose so many preliminary objections that nearly all applications for patents are rejected, while the government retains the money paid. In this country we grant more patents, but we nevertheless inflict upon inventors an immense amount of useless trouble, before issuing the certificate. Our Patent Office officials would consider their occupations gone and themselves of no account in the world if they were not privileged to hunt up objections to excite and harass the applicants for patents.

POLITICS IN THE BEEHIVE.

The idyllic picture of divinely appointed harmony, drawn by naturalists of the old school in describing the social economy of bees, is sadly disturbed by the prying observations of modern students. Instead of being models of industry and virtue, each and all, some of them, at least, prove to be no better than the rest of us, given to political dissensions, liable to bully royalty itself, and—tell it not to Watts—preferring theft to honest labor.

Lubbock has cast a grave doubt over their vaunted wisdom, and now Fritz Müller discovers that their virtue is as little to be depended on as that of our most pious statesmen. Happily they are not our bees that misbehave so badly, and it is only for Brazilian bees that the poet's verses will have to be amended so as to read:

How doth the naughty little bee
Improve the shining hour?
He robs his neighbor every day,
And never seeks a flower,

or something to that effect.

There is one species (*trigona liondo*), as Mr. Müller writes to Charles Darwin from the province of Santa Catharina, Brazil, which never appears to collect honey or pollen from the flowers. "It robs other species of their provisions and sometimes takes possession of their nests, killing or expelling their owners. The hives in my garden have often been invaded and two of them destroyed by these robbers; and I have seen in the forest several nests, formerly inhabited by other species, occupied by them."

Mr. Müller is making extended observations on the several species of these stingless honey bees, and expects, after a few years of study, to be able to give a tolerably complete account of them. The observations he has already reported, though briefly, give cause for expecting valuable as well as interesting results at his hands. On one occasion, for instance, he "assisted" at a curious contest well worth reporting, for the light it throws on the intellectual faculties and the political or social habits of the bees. It occurred between the queen and the worker bees in one of his hives of *trigona minim* whose peculiar custom it is to construct the cells in which the young are raised around the circumference of the two or three uppermost combs; when the cells are finished and filled with food for the grubs, the queen lays an egg in each, whereupon it is immediately shut. A set of forty-seven cells had been filled, eight on a nearly completed comb, thirty-five on the following, and four around the first cell of a new comb. "When the queen had laid eggs in all the cells of the two older combs, she went several times round their circumference (as she always does, in order to ascertain whether she has not forgotten any cell), and then prepared to retreat into the lower part of the breeding room. But as she had overlooked the four cells of the new comb, the workers ran impatiently from this part to the queen, pushing her in an odd manner with their heads, as they did also other workers they met with. In consequence the queen began again to go around on the two older combs, but as she did not find any cell wanting an egg she tried to descend; but everywhere she was pushed back by the workers. This contest lasted for a rather long while, till at last the queen escaped without having completed her work. Thus the workers knew how to advise the queen that something was as yet to be done, but they knew not how to show her where it had to be done."

Possibly the queen had some glimmering notions of royal prerogative, and did not choose to be quite so forcibly advised by her subjects, who appear to have been a turbulent lot at best, since it was in this hive that Mr. Müller found two dissenting parties among the workers quarreling about the construction of the combs, and even going so far as to destroy each other's work.

THE LOCUST IN MINNESOTA.

The visitation of locusts in Minnesota has proved a serious calamity. The total damage, thus far done, consists in a loss of about one twelfth the usual crop, or about the same as if the average yield throughout the State were diminished one and a half bushels below the average per acre. The plague extends over one tenth of the cultivated area of the State, and involves about one thirteenth of the population.

The insects, we notice, are universally styled "grasshoppers," which is incorrect, although the mistake, owing to the confusion of names, is a natural one. The principal points of difference between the locust and the grasshopper consist in that the latter is usually of a green color and is more active by night than by day. Grasshoppers, moreover, do not associate together nor migrate in large numbers, while their flight is short and unsteady as compared to that of the locusts, beside being noiseless. The locusts which have appeared in Minnesota are, when full grown, of about an inch and a quarter in length, and of a dusky grayish color, the heads being reddish and the under wings, when spread, of a coppery hue. The eggs are gray, ovate, and about as large as a wheat corn, and are deposited in clusters in the ground and under the grass and stubble. When hatched, the insects feed on the nearest vegetation, and then rise in vast clouds, seeking other pastures. A Minnesota settler, who has suf-

fered severely from their ravages, in writing to the *Minneapolis Tribune* describes a throng of the locusts as resembling a huge snow cloud, often completely obliterating the sun. The lower insects fly at a height of about forty feet from the ground, and the others fill the air above as far as the eye can reach. When they settle on a field of grain, every stalk is covered, so that the entire field seems to have suddenly turned brown. They do not eat the grain but bite into the tender stock and juicy kernel, and suck out the vital sap, leaving every particle of vegetation dead, so that within a day or two the entire crop becomes dry and withered. Their appetite seems especially directed toward garden stuff and grain, but frequently the voracity is such that every living green thing is devoured before they rise.

Minnesota farmers assert that there is no remedy. Fall fires do no good and water and frost are without effect. Plowing up the ground where the eggs are deposited or burning over the grass where they are laid during the spring, it is believed, are the best known preventives. The worst enemy of the locust, however, seems to be a little red parasite, which gets under its wings and gnaws into the very vitals of the insect. Dead locusts are found covered with these worms. Various portions of Europe and the north coast of Africa have suffered greatly from the plague both recently and in the past. In France, during May and June, when the insects first appear in the fields, all the women and children turn out to hunt them. Four persons grasp the corners of a sheet, two in advance holding their ends close to the ground and the couple in rear elevating their corners, so that the sheet is held at an angle of 45°. In this position, the cloth is carried over a field several times, the insects being forced to rise, when they fall upon the sheet and thence are tumbled into bags. Some idea of the immense numbers of the locusts which may thus be destroyed may be gained from the fact that a single peasant, with a entomologist's small net, has been known to capture 100 pounds of insects in a day, equal to about 80,000 eggs destroyed.

The Arabs drive off locusts by making great bonfires, producing large quantities of smoke. In Algiers, the most effective plan is said to be spreading large nets over the insects early in the morning after they have become gorged and inert through feeding, and then collecting them in bags and bury them in lime. Leaving the dead bodies on the ground is apt to breed infection. Harrowing over the fields, where the females lay the eggs, seems, however, to be a widely followed plan of destruction, as, if the eggs be scattered, the sun soon dries them up. Birds and toads are excellent auxiliaries in disposing of the eggs after a field has thus been gone over.

FOUR HUNDRED AND FORTY-FOUR MILES, AT OVER FORTY MILES PER HOUR, AND THREE STOPS.

An evident improvement in the direction and appointments of the principal American railways is in progress, an example of which is seen in that portion of the Pennsylvania Railway between New York and Pittsburgh. The road is provided with 60 lbs. steel rails, oak ties, broken stone ballast, and the best splice joints. The bridge work is of the most substantial character, the superstructure is smooth and solid, the cars and locomotives superior in construction, all the latest appliances for safety being likewise supplied, such as Westinghouse air brakes, safety platforms, switches, block telegraph signals, etc.

The run of 444 miles from Pittsburgh to New York is made in eleven hours, with only three stops, being an average rate of over 40 miles an hour, as follows: Pittsburgh to Altoona, 117 miles, stop 5 minutes; to Harrisburg, 132 miles, stop 20 minutes; to Philadelphia, 105 miles, stop 5 minutes; thence to New York, 90 miles. The locomotives dip up water from side troughs at certain stations without stoppage. The trains are comprised of magnificent Pullman parlor cars. It would be difficult to name any stretch of railway in the world, of equal length, where passengers can be more expeditiously and luxuriously carried.

The railroad mileage of the United States now exceeds the combined mileage of all Europe, although the population of Europe, 282,000,000, is seven times greater than that of this country. Every year adds to the improvement as well as the length of American roads. How to make our railways better and safer is the constant study of the legion of engineers, inventors, and managers who are connected with them. The practical results of their labors will be naturally manifested in gradual changes for the better in all branches of railway service.

The Annual College Regatta.

The annual regatta of the principal colleges took place this year on Saratoga Lake, N. Y., July 18. The winning boat was that of Columbia College, New York, which came in two boat-lengths ahead. Time 16m. 42 sec. Distance three miles. Wesleyan was second, and Harvard third. The colleges which contended were Trinity, Princeton, Cornell, Yale, Harvard, Wesleyan, Columbia, Dartmouth, and Williams. The attendance of spectators was very large, and much enthusiasm prevailed.

PHOSPHORUS BRONZE.—Some of the brands will bear a considerably greater breaking strain than steel itself. It appears, also, to be suitable for sheathing ships, since, when immersed in sea water, it loses scarcely more than one third as much as is lost by the best sheet copper.

MINERAL OIL may be detected by its property of imparting a fluorescence to animal or vegetable oils, and by its aromatic odor on burning. The presence of resin may be ascertained by its giving a deeper color with nitric acid than that given by the pure oil.

THE MEZZANA-CORTI BRIDGE OVER THE RIVER PO.

We extract from *L'Illustrazione* the annexed engraving of an iron railway bridge, which extends across the river Po, near Mezzana-Corti, Italy. It was constructed for the Southern Railway Company of Italy, by Messrs. Gouin & Co., of Paris, and its total length is 3,310 feet, comprising ten clear spans of 196.2 feet each, supported on nine piers and two abutments in masonry. It is constructed for a double line, and the upper part of the iron girders supports a carriage way 28.8 feet in width. It is calculated to support a load of 11½ tons per 3.2 feet running, besides its own weight. The total quantity of iron employed was about 5,706 tons.

The foundations for the piers and abutments were sunk by the aid of wrought iron caissons, closed at the top and charged with compressed air. In putting in the foundations, the excavations had to be carried down some 67 feet through the gravel, and even more, below the level of low water, so that the work was necessarily prosecuted under very considerable pressure. The caissons were eventually filled with concrete, and they remain as permanent portions of the work.

The superstructure consists of lattice girders connected at their tops and bottoms by plate iron girders, the lower series of the latter supporting the double line of rails, and the upper series carrying an ordinary roadway, having footways on each side formed over the flanges of the main girders. The two main girders of each span are 24.6 feet deep between top and bottom flanges, and they are placed at a distance apart, transversely to the line of the bridge, of 27.26 feet from center to center. The lower cross girders are connected by short intermediate longitudinal girders extending between them, under the timbers on which the rails are placed. The cross girders forming the upper series have a slightly arched form on their upper sides, and they are connected by longitudinal timbers on which the planking forming the roadway is laid. The clear height from the rail level to the under sides of the upper cross girders is 17.8 feet, and the latter are well connected to the main girders by strong gusset stays. The bridge was completed in 1866.

The Syrian Sponge Divers.

The English Vice Consul at Beyrout, in a report to his government, gives some interesting particulars regarding the sponge fisheries. The industry, as prosecuted upon the Syrian coast, yields sponges to the value of \$100,000 annually, and employs about 300 boats and 1,500 men. Although they vary much in quality and size, sponges may be generally classified as: 1. The fine white bell-shaped sponge, known as the toilet sponge. 2. The large reddish variety, known as *sponge de Venise*, or bath sponges. 3. The coarse, red sponge, used for household purposes and cleaning. Two thirds of the produce of the Syrian coast are purchased by the native merchants, who send it to Europe for sale, while the remainder is purchased on the spot by French agents, who annually visit Syria for the purpose. France takes the bulk of the finest qualities, while the reddish and common sponges are sent to Germany and England.

Diving is practised from a very early age up to forty years, beyond which few are able to continue the pursuit. It does not appear, however, that the prac-

tice has any tendency to shorten life, although as the diver approaches forty he is less able to compete with his younger and more vigorous brother. The time during which a Syrian diver can remain under water depends, of course, on his age and training. Sixty seconds is reckoned good work, but

there are rare instances of men who are able to stay below eighty seconds. The diver (naked of course), with an open net around his waist for the reception of his prizes, seizes with both hands an oblong white stone, to which is attached a rope, and plunges overboard. On arriving at the bottom



IRON BRIDGE OVER THE RIVER PO, NEAR MEZZANA-CORTI, ITALY.

the stone is deposited at his feet, and, keeping hold of the rope with one hand, the diver grasps and tears off the sponges within reach, which he deposits in his net. He then, by a series of jerks to the rope, gives the signal to those above, and is drawn up.

ROLLING BRIDGE BETWEEN ST. SERVAN AND ST. MALO.

The towns of St. Servan and St. Malo, in France, are situated on either side of the river Ronce, or, more strictly, of the arm of the sea into which that river empties. The tide is here subject to great fluctuations, retreating so that the bed of the estuary may be crossed on foot, and again rising to a height of several yards. The mode of crossing the stream, until the construction of the curious bridge represented in our engraving, consisted in taking a wide *détour* to a point where an ordinary bridge spanned the river, or else in using boats. To avoid such inconvenience as we have referred to, M. Leroyer, town surveyor of St. Malo and architect to St. Servan, designed and had constructed the bridge we illustrate. It consists of a platform supported on wheels, which run on rails laid on the bottom of the estuary. The platform is supplied with accommodation for horses and vehicles at either side, and two passages are provided for passengers, the fares being one and two cents respectively. The platform stands level with the quay at each side, so that nothing is more easy than access to it; and, as our illustrations (from *L'Illustration*) show, it is worked at all states of the tide with perfect safety. One of the engravings represents the bridge traveling on its ways at low tide, and the other, crossing the river when the water is high.

The bridge appears to be exceedingly popular with the inhabitants of St. Malo and St. Servan. It is novel in design, and reflects no small credit on M. Leroyer.

THE DEGERFORS IRON WORKS, SWEDEN.

There is a marked contrast between the relations of employer and employed in Sweden, and the similar relations existing in England and the United States. In both English-speaking countries strikes and lockouts are rather the rule than the exception. Master and man are arrayed on opposite sides, each seeking to get the better of the other, and neither attempting in any very appreciable degree to lessen the existing antagonism. In Sweden, exactly the reverse is the case. The practice so earnestly advocated and followed in the past by the man most prominent in the development of the iron industry of the country, of regarding his workmen as living fellow beings, and not as mere machines from whom the utmost labor possible must at all

compulsory schooling for his children. Again, the iron masters do not concern themselves with the buildings and plant of their ironworks only. They are intimately associated with every detail of the existence of the communities of which they are the leaders; they build dwellings and schools, even hospitals or infirmaries; they own and cultivate lands, and rear crops for the maintenance of their industrial allies, or enable them to do so; they possess, directly or indirectly, their own mines for ores; they own large tracts of forest land, and burn huge quantities of charcoal. Finally, they utilize the natural resources of their country by turning to full account all the water power available.

These considerations will lend additional interest to the following description of one of the greatest Swedish iron

by a large turbine of 300 horse power; two shearing machines for plates and bars, to be worked by steam power; and a 4 ton steam hammer; with additional foundries and repairing shops, etc. Since the union of the two works, the upper and lower Degerfors, under one administration, both the waterfalls have been united, by the construction of a canal, giving a combined total fall of 25 feet, and producing a water power of 1,400 effective horse power, utilized in the operations of the works; this, however, is estimated to be only about one third of the total effective hydraulic power of the river Leth-elfven, which exceeds 5,000 horse power—a truly magnificent prime motor and basis for industrial operations.

The finished products of the works for the last year of operations, 1873, amounted to 5,000 tons; but of this total quantity about 2,000 tons were rolled for and on behalf of other ironworks, as yet unprovided with rolling mills of their own. Of the remaining 3,000 tons the bulk was converted principally into nail rods and wire rods, a small quantity being rolled into bars of various sizes, some also being used up for axles, piston rods, etc. It is confidently anticipated that, owing to the increased facilities offered as regards the transport of ore and raw materials, the proportionate make of iron will largely increase during this and subsequent years.

There are 156 skilled hands constantly employed at the iron works; these men are mostly married, and live, rent free, in convenient and substantial cottage dwellings, provided for them by the proprietors. None of the women of the families are employed at the works, but several boys are provided with constant employment; these, however, are engaged in work for a limited

period only, their attendance at school daily, for a specified time, being compulsory, until they have attained the age of sixteen years. In addition to the foregoing, about 200 daily laborers are regularly employed at Degerfors; and about the same number of hands are engaged in the pursuits of charcoal burning and the work connected therewith, and in agricultural occupations, on the proprietors' estate at Lassona.

All the male and female adults of the little community can read and write, without exception; all the children, except as above named, are kept at school until they are fifteen or sixteen years of age, when they are examined and confirmed by the vicar of the parish. Thereafter they are freed from compulsory school attendance. The school buildings are provided by the company, and maintained by them under the management of two teachers.

All the men employed at the works in any capacity are engaged by the year; but they are paid in various ways, according to the nature and conditions of the work, some of



ROLLING BRIDGE AT ST. MALO, FRANCE, AT LOW TIDE.



ROLLING BRIDGE AT ST. MALO, FRANCE, AT HIGH TIDE.

hazards be ground for the least pay, holds in the great establishments of the present. The example of Samuel Owen was a grand one. In lieu of unions, draining upon the earnings of the industrious for the support of the lazy, flourish sick and benefit clubs and coöperative societies—while we read besides of yearly engagements, dwellings and land provided free for the workman by the employer, free fuel, free medical attendance and medicines, and free and

operation, but they do not give the full measure of the future productive capacity of the works, for there are other important extensions which are now fast approaching completion. They comprise a complete set of cupolas, converters, and all the requisite plant for the manufacture of Bessemer steel; also another blast furnace and a calcining furnace; one 22 inch rolling train, for rolling boiler plates; one 22 inch rolling train for puddled bars; both these trains to be driven

them, for example, such as the rollers and all assistants employed at the rolls, blast furnace men, and those employed at the charcoal burning furnaces, are paid at specified rates per ton, by agreement; others, such as shinglers, weighing machine men, and the like, are paid by the day, and earn from 50 cents to 75 cents and \$1 per day of 10½ hours. The piece work men work in shifts or turns of eight hours, and may earn from 75 cents to \$2 per day, according to circum-

stances. The wages are paid fortnightly. In estimating their position, it must be borne in mind, as before stated, that, over and above their wages, all the hands employed at the works are provided with houses and fuel free, and have medical attendance, with medicines, also free; their children are freely educated at the schools of the works, and for themselves a sick club has been established and maintained at the works.

These facts, in reference to the Degerfors Iron Works and their administration, are sufficient by their simple enumeration to prove the value of the enlightened policy on which they have been established and are maintained: comment thereon would be superfluous.

Correspondence.

Hardening and Tempering Tools.

To the Editor of the Scientific American:

I have read with some interest the several articles in the recent issues of your journal by Mr. Joshua Rose. Practical information, such as he seeks to impart, is of great value to the artisan, and especially to the young mechanic or apprentice. He has entered upon a field which, if well cultivated, must be productive of great good. In that part of article No. 4 which relates to the above subject, he, like almost all who have written upon it, overlooks some of the most important points in the problem.

The following, taken principally from a series of lectures delivered by me to the classes in engineering, while Instructor at the Naval Academy at Annapolis in 1868, will elucidate the points I refer to, and will, I think, add to the interest with which your readers must have perused Mr. Rose's articles:

"It is safe to say that a cutting tool cannot be too hard for any purpose whatever, so long as the edge will not crumble or break up; in other words, to make any cutting tool the most efficient, it should be made as hard as it can be made to perform its work without fracture. With many forms used for cutting metal, the solid angle required for the cutting edge is so great as to give sufficient strength, without resorting to what is known as drawing the temper. In a large majority of cases, however, the latter operation must be resorted to in some degree. The difference in the degree of hardness to be obtained simply by the different temperatures at which the tool has been originally dipped has been experimentally proved to be very slight, and results only in varying the strength or tenacity of the metal. That is to say: A tool dipped at a high temperature, as at nearly a white heat, will be more brittle and possess less strength than if dipped at a low red heat, but will not be truly harder to any sensible degree. A tool, then, dipped at a high temperature will require to be drawn more—that is, reheated to a higher temperature—than one dipped at a lower heat, in order that it shall withstand the required strains without fracture of the edge; and it will be, in consequence, really softer, when ready for use, than the low dipped tool."

In some experiments conducted by the writer, a short bar of good tool steel was so heated that in its length it had every gradation of temperature, from a white heat at one end to that which could be borne by the hand at the other, and in this condition it was immersed in its entire length. It was found that, by the most careful manipulation, small cutting tools, made by grinding from small pieces broken from the highly heated end, could not be made to scratch or mark, in the slightest degree, any piece taken nearer to the cold end, except beyond the very decided line, which will always be found in such a case, beyond which no sensible hardening had taken place. If, therefore, a tool be dipped at the lowest temperature at which it will harden at all, it will be harder when ready for use than if dipped at any higher temperature, if required to be drawn in temper at all.

It is, however, in the final operation of drawing the temper that Mr. Rose makes his greatest oversight. To give simply the certain color to which a certain tool must be drawn is to give the least of what is actually required to be known or observed. It is well known that the color produced upon the polished surfaces of steel or other metals, as their temperature is elevated, is due to the formation of a film of oxide, and the variations from the light yellow to the blue, as on steel or iron, is the effect of the increasing thickness of the film. For the formation of this film two things are necessary, oxygen and elevation of temperature; while to lower the temperature of or partially soften a tool, elevation to a certain temperature, and that alone, is required. The film of oxide is taken as a convenient high grade thermometer simply; and if the very necessary precaution is taken to observe and take into account all the conditions, it serves as a very good one indeed; but to take account of the color of the film alone is to throw out terms of the problem which will render the results of no value. The element of time and the greater or less facility for access of the oxygen of the air to the polished surface are as important to be observed and taken into account as the color produced. For instance, a tool in reheating may be raised to the temperature at which a yellow color begins to form; and if simply maintained at that temperature, it will in time assume the full blue color, and its assumption of that color without further elevation of temperature is a question of time only; while really the blue would, without taking into account the time of its formation, be taken to measure a much higher temperature. A piece of polished steel, once raised to the temperature at which oxidation is in visible progress, will continue to oxidize without further heating until the film has become thick enough to assume the blue

color. Of course it takes a much longer time than when produced by the aid of continually increasing temperature. Again, the temper of tools is very often drawn over a coal or charcoal fire, in a muffle open at one or both ends, or, as Mr. Rose advises in the case of dies, by laying them upon a piece of heated iron, turning them over often to insure an equal distribution of the heat. But in either of these processes the perfect operation of our color thermometer is interfered with by the partial exclusion of the air, and consequently of the oxygen from the surface upon which the color is to appear. Over a fire of any kind the air is constantly and very much diluted with the products of combustion, and the same may be said of the muffle, while the piece lying upon the hot iron has the surface in contact with the iron in some measure excluded from the air. If the formation of the film is thus retarded, it will easily be understood that a tool so treated will be softer, when the required color is obtained, than was intended, unless this condition be taken into account. To temper an ordinary cold chisel, for instance, in the initial dipping, it may in one case be immersed a sufficient depth and length of time to require the lapse of but a few seconds for the heat to be conducted from the body of the chisel so as to bring the edge to the wished-for blue, while in another case it may have been cooled so that two or three minutes would be required. In the latter case the operative, tired of waiting for the color to appear at the edge of the chisel, will endeavor to hasten it by holding it over the clear coals; but he is surprised to find how strongly the color comes, and finally wonders, when he comes to use the chisel, how it could possibly have become so soft with such a perfect color arrived at. If he is patient and allows the color to form without the assistance of the fire, he then wonders how it can be so hard with the prescribed blue upon it, to a shade. And this is an everyday experience in shops: an unprofitable experience, wherein proper information disseminated through so widely circulated a medium as your valuable journal—read as it is now-a-days in almost every workshop in the country—will go far to save.

In drawing the temper of such a tool, the operative should be taught to be as careful as possible to dip it about far enough, and a sufficient length of time to require a moderate time only to bring the proper color: not too quick, as that would defeat his object by causing the gradation of softness from the cutting edge upward, which must necessarily be the result in this method, to be very sudden, and will leave an extremely small fraction of the chisel's length sufficiently hard for his purpose. If, however, he has misjudged in his dipping and he finds the color coming too slowly, let him be sure, in whatever means he takes to hasten it, not to interfere with the free circulation of the air around it. If the color comes slowly, but not sufficiently so as to require additional heat, he must still take into consideration the time it really occupies, and produce a deeper color if the time is unusually long; while, if very quickly brought, the color should not be allowed to arrive at so deep a point before the final cooling. An intelligent observation of all these points must be had in order that correct results may be arrived at.

JOHN T. HAWKINS.

62 Cannon street, New York city.

Raiding Ants.

To the Editor of the Scientific American:

I never, in reading the natural history of insects, came across a description of the ant which I designate as the "raiding ant" (I know no other or a better name); I do not know whether this little guerilla is known to naturalists; at any rate I have never met with an account of it anywhere. It is one of the most daring of all the ant tribe, but its honesty and humanity cannot be boasted of. It is about half an inch in length, of a dark brown color; in shape and in movement, it closely resembles the common large black ant, known in nearly all the Western States, and called the "black colony ant"; but the raiding ant differs from all others in his warlike disposition toward his neighbors. He is a merciless murderer and robber.

I have seen these ants in Northwestern Arkansas, but never in any other country. They are the most notorious marauders in all the insect world. They send out spies; and on a favorable report being received by the authorities, an expedition is set on foot, for the capture of a neighboring colony, and carrying off their store and their young as booty. On one occasion, I discovered a large force of these diminutive marauders on the march. There seemed to be many hundreds, all moving rapidly in the same direction, every one keeping in his place with the greatest exactness, and all very close together, in fact so close that the ground could scarcely be seen in the middle of the column. The column was near twenty feet in length and about ten inches wide. In front of the main body moved three or four who seemed to be leaders of the troop, never falling back to the main column, except to give orders, as it were. On either side of the column moved about twelve or fifteen others, who kept continually about one foot away from and a little in advance of the main column. I supposed that they were removing from one locality to another for the purpose of taking up their abode in a new or more advantageous position. I followed them for about two hundred yards, when they all came to a halt, at the command of one of the leaders. The halt was only for a moment. Those who had moved on either side of the column did not stop as the others did, but moved rapidly around a stone, about six inches in diameter, when they turned their heads toward the place whence they had come, and stopped. This seemed to be a signal, for the main column instantly rushed toward the stone, on one side of which was plainly to be seen the opening of an ant colony. These marauders surrounded the stone on all sides, and

rushed into the hole as fast as they could gain admittance, till all were in, except about fifty, who seemed inclined to stand aloof from taking any part in this wholesale murder and robbery; but it was not long before they proved themselves full brothers, for soon a poor, frightened fugitive came rushing from his home, and ran a short distance and took refuge under a friendly leaf. He had been seen by two of these fellows outside, who watched him to his hiding place; and then with all the fierceness of savages, they rushed upon him and literally dragged him from under the leaf and killed him almost instantly. Several others came moving from the hole, having escaped death inside, to meet it surely outside.

Very few who came from the hole escaped being killed. Soon these raiders began to emerge from the hole, each one carrying something in his mouth, generally the larvae belonging to the colony they had murdered and robbed. They instantly set out on the march for their own home, not halting until they had reached their own abode, distant about three hundred yards. They seemed kind to the members of their own tribe, carrying back their killed and wounded (four or five), but none of the dead or wounded of their enemies. After pursuing the raiders home, I returned to the stone and turned it up, and found numbers of dead and wounded, and but few left to tell the dreadful story.

I have seen several of these raiding parties in Northwestern Arkansas, but never elsewhere.

Mount Vernon, Mo.

J. S. D.

The Fireless Locomotive Accident.

To the Editor of the Scientific American:

I regret that a paper so ably conducted as the SCIENTIFIC AMERICAN should have given space to such a tissue of misstatements as those over the signature of Edwin Baker, 24 Atlantic avenue, Brooklyn, in your issue of July 4, page 5 entitled "Explosion of the Fireless Locomotive."

He asserts that, "on May 22, a large party of editors and reporters were invited to attend the trial trip," which is simply an untruth. He says that "none of the reporters present published an account in any paper." There were no reporters present, and it required a man like Mr. Baker, who could draw on his imagination *ad libitum*, to make such misstatements as he has done.

The facts were these: The small half inch glass tube attaches outside the stationary boiler to indicate the water line, cracked; and some steam escaped from the glass until the valves could be closed. This was the extent of the calamity so dreadfully described by Mr. Edwin Baker. Instead of the fireless locomotive having exploded, as alleged by him, she left within a few minutes, without a speck of injury, for Canarsie Bay, and returned after making seven miles of a satisfactory trip.

It is a fact that the fireless locomotive was not injured in the least, and that she performs her accustomed trips from East New York to Canarsie Bay. It is a pity that your valuable scientific paper should have become the medium of publishing all over the world the misstatements of Baker, thus aiding him in his well known spite against the fireless locomotive, which he has indulged in for the past eighteen months. Is it asking too much that you make the necessary correction by showing that the cracking of a glass water gage on a stationary boiler was a very different thing from the explosion of the fireless locomotive, as alleged by him?

East New York.

JOHN M. GIBSON.

Superintendent Fireless Engine Company.

New Remedy for Hay Fever.

Dr. Horace Dobell, Senior Physician to the Royal Hospital for Diseases of the Chest, London, has suggested a contrivance and a prescription, by the combined use of which immense comfort may be given to many sufferers from hay fever and sneezing.

The prescription is as follows: Chloral hydrate and camphor (of each) 16 grains, carbolic acid 20 grains, pure morphia 12 grains, oleic acid (enough to dissolve the morphia) 20 grains, castor oil (the clearest and finest) 7 drachms. Rub well together to make a lotion.

The contrivance is for the efficient application of the above remedy, and consists of a miniature bottle, contained in a little boxwood case so that it can be carried easily in the pocket. To the lid of the box is attached the cork of the bottle, and to the cork, in the same fashion as the spoon of a cayenne pepper cruet, is fixed a little club shaped rod of polished ivory, long enough to reach to the bottom of the bottle, and also to the upper extremity of the nostril. The little bottle is kept half full of the lotion above prescribed, and the little rod immersed in it. Directly the patient feels the tickle or other signal of a coming sneeze, he uncorks his bottle, withdraws the ivory club, wet with the oleaginous lotion, and pushes it up the nostril till it reaches the seat of the sneeze signal; there it should be gently pressed so as to apply the lotion to the part. After this the club is withdrawn and returned to its little bottle of fluid, where it becomes at once charged for a fresh application. As often as the sneeze threatens, the operation should be repeated. Very often one application will keep off a threatened fit of sneezing altogether, even though its first effect may be to excite a sneeze.

PROFESSOR KING and two companions recently made a balloon voyage, from Buffalo to Salem, in the southern part of New Jersey. The route was roundabout, the balloonists passing over parts of the States of New York, Pennsylvania, Delaware, Maryland, and New Jersey. Starting at 6 P. M. July 4, the final landing was made the next morning at 7. Distance 400 miles. Time 11 hours.

PRACTICAL MECHANISM.

NUMBER V.

BY JOSHUA ROSE.

CASE HARDENING IRON.

Iron may be case-hardened, that is, the surface converted into steel and hardened, as follows: First, by the common prussiate of potash process, which is as follows: Crush the potash to a powder, being careful that there are no lumps left in it, then heat the iron as hot as possible without causing it to scale; and with a piece of rod iron, spoon shaped at the end, apply the prussiate of potash to the surface of the iron, rub it with the spoon end of the rod until it fuses and runs all over the article, which must then be placed in the fire again and slightly reheated, and then plunged into water, observing the rules given for immersing steel so as not to warp the article.

Another method is to place the pieces to be hardened in an iron box, made airtight by having all its seams covered well with fire clay, filling the box in with bone dust closely packed around the articles, or (what is better) with leather and hoofs cut into pieces about an inch in size, adding thin layers of salt in the proportion of about 4 lbs. salt to 20 lbs. of leather and 15 lbs. of hoofs. In packing the articles in the box, be careful to so place them that when the hoofs, leather, etc., are burned away, and the pieces of iron in the box receive the weight of those above them, they will not be likely to bend from the pressure. When the articles are packed and the box ready to be closed with the lid, pour into it one gal. of urine to the above quantities of leather, etc.; then fasten down the lid and seal the seams outside well with clay. The box is then placed in a furnace and allowed to remain there for about 12 hours, when the articles are taken out and quickly immersed in water, care being taken to put them in the water endways to avoid warping them.

Articles to be case-hardened in the above manner should have pieces of sheet iron fitted in them in all parts where they are required to fit well and are difficult to bend when cold. Suppose, for instance, it is a quadrant for a link motion: fit into the slot where the die works a piece of sheet iron (say $\frac{1}{4}$ thick) at each end of the slot, and two other pieces at equidistant places in the slot, leaving on the pieces a projection to prevent them from falling through the slot. In packing the quadrant in the box, place it so that the sheet iron pieces will have their projections uppermost; then, in taking the quadrant out of the box, handle it carefully, and the pieces of iron will remain where they were placed and prevent the quadrant from warping in cooling or while in the box (from the pressure of the pieces of work placed above it).

It is obvious, from what has been already said, that the heavier pieces of work should be placed in the bottom of the box.

CUTTING SPEED AND FEED.

The term "cutting speed," as applied to machine tools, means the number of feet of cutting performed by the tool edge, in a given time, or (what is the same thing) the number of feet the shaving, cut by the tool in a given time, would measure if extended in a straight line. The term "feed," as applied to a machine tool, means the thickness of the cut or shaving taken by the tool.

Planing machines being constructed so that their tables run at a given and unchangeable speed, their cutting speed is fixed; and the operator has only, therefore, to consider the question of the amount of feed to be given to the tool at a cut, which may be placed at a maximum by keeping the tool as stout as possible in proportion to its work, making it as hard as its strength will allow, and fastening it so that its cutting edge will be as close to the tool post as circumstances will permit. In all cases, however, cast iron may be cut in a planer with a coarser feed than is possible with wrought iron. Milling machines should have their cutters revolve so that the cutting speed of the largest diameter of the cutter does not exceed 18 feet per minute, at which speed the cut taken may be made (without injury to the cutter) as deep as the machine will drive.

It is only when we treat of lathe work that the questions of feed and speed assume their real importance, for there is no part of the turner's art in which so great a variation of practice exists or is possible, no part of his art so intricate and deceptive, and none requiring so much judgment, perception, and watchfulness, not only because the nature of the work to be performed may render peculiar conditions of speed and feed necessary, but also because a tool may appear, to the unpracticed or even to the experienced eye, to be doing excellent duty, when it is really falling far short of the duty it is capable of performing. For all work which is so slight as to be very liable to spring from the force of the cut, for work to perform which a tool slight in body must be used, and in cases where the tool has to take out a sweep or round a corner which has a break in it, a light or fine feed must be employed; and it is therefore advisable to let the cutting speed be as fast as the tool will stand; but under all ordinary circumstances, a maximum of tool feed rather than of lathe speed will perform the greatest quantity of work in a given time. A keen tool, used with a quick speed and fine feed, will cut off a thin shaving with a rapidity very pleasing to the eye, but equally as deceptive to the judgment; for under such a high rate of cutting speed, the tool will not stand either a deep cut or a coarse feed; and the increase in the depth of cut and in the feed of the tool, obtainable by the employment of a slower lathe speed, more than compensate for the reduction of lathe speed necessary to their attainment, as the following remarks will disclose.

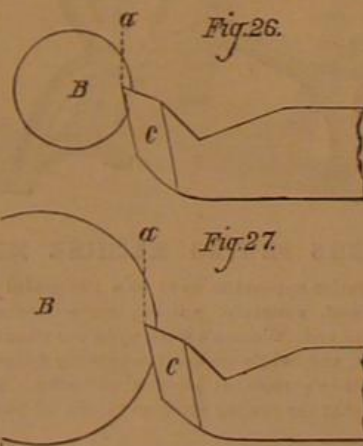
Wrought iron, of about two inches in diameter, is not uncommonly turned with a tool feed of one inch of tool travel to 40 revolutions of the lathe. With a tool feed so fine as

this, it is possible, on work of this size, to employ a cutting speed as high as 27 feet per minute, providing the depth of the cut does not exceed one eighth of an inch, reducing the diameter of the work to $1\frac{1}{8}$ inches. The length of shaft or rod turned under such circumstances will be $1\frac{1}{2}$ inches per minute, since the lathe speed (necessary to give the tool a cutting speed of 27 feet per minute) would require to be about 51 revolutions per minute; and as each revolution of the lathe moved the tool forward $\frac{1}{51}$ of an inch, the duty performed is $\frac{1}{51}$ of an inch, or $1\frac{1}{2}$ inches of shaft turned per minute, as before stated. If, however, we turn the same rod or shaft of two inch iron, with a lathe speed of 36 revolutions per minute, and a tool travel of one inch to 24 revolutions of the lathe, the amount of duty performed will be $\frac{1}{24}$ inches, or $1\frac{1}{2}$ inches of shaft turned per minute. Here, then, we have a gain of about 17 per cent in favor of the employment of the slow speed and quick feed. Nor is this all, for we have reduced the cutting speed to 19 feet, instead of 27 feet per minute, and the tool will, in consequence, stand the cut much longer and cut cleaner.

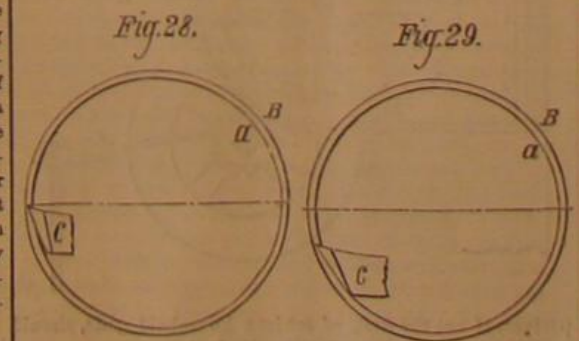
Pursuing our investigations still further, we find from actual test that, cutting at the rate of 27 feet per minute, the tool will not stand a cut deeper than one eighth of an inch; whereas under the cutting speed of 19 feet per minute, it will take a cut of one quarter of an inch in depth, thus considerably more than doubling the duty performed by the tool, in consequence of the decreased cutting speed and increased feed or tool travel.

Lathe work of about three quarters of an inch in diameter may, if there is no break in the cut, be turned at a cutting speed of as much as 36 feet per minute, the feed being one inch of tool travel to about 25 revolutions of the lathe. The revolutions per minute of the lathe, necessary to give such a rate of cutting speed, will be about 183; the duty performed will therefore be $\frac{1}{183}$, or $7\frac{1}{183}$ inches of three quarter inch iron turned per minute. A feed of one inch of tool travel to 25 revolutions of the lathe is greater than is generally employed upon work of so small a diameter as three quarter inch, but is not too great for the generality of work of such a size; for the tool will stand either a roughing or smoothing cut at that speed, unless in the exceptional case of the work being so long as to cause it to spring away from the tool, under which circumstances the feed may be reduced to one inch of tool travel to 30 or 40 revolutions of the lathe, according to the length and depth of the cut.

It will be observed that the cutting speed given, for work of three quarter inch diameter, is nearly double that given as the most advantageous for work of two inches diameter, while the feed or tool travel is nearly the same in both cases; the reason of this is that the tool can be ground much keener for the smaller sized than it could for the larger sized work, and, furthermore, because the metal, being cut off the smaller work, is not so well supported by the metal behind it as is the metal being cut off the larger work, and, in consequence, places less strain upon the tool point, as illustrated in Figs. 26 and 27.



B is a shaft, and C is the tool in both cases. The dotted line, *a*, in Fig. 26, does not, it will be observed, pass through so much of the metal of the shaft, B, as does the dotted line, *a*, of the shaft, B, in Fig. 27. The metal in contact with the point of the tool in Fig. 26, is not, therefore, so well supported by the metal behind it as is the metal in contact with the point of the tool in Fig. 27, the result being that the tool, taking a cut on the smaller shaft equal in depth to that taken by the tool on the larger one, may have a higher rate of cutting speed without sustaining any more force from the cut, the difference in the resistance of the metal to the tools being equalized by the increased speed of the smaller shaft. These conditions are reversed in the case of boring, the



metal, being cut in a small hole being better supported by the metal behind it than is the case in a larger hole or bore.

This is overcome by placing the cutting edge of the tool below the center of the work, as shown in Figs. 28 and 29, the circular lines, *a* and *B*, representing the cut, C being the tool in both cases. But in a large bore, the effect is not so seriously encountered, because of the nearer approach of the circle to the straight line, as shown in Fig. 30. The circular lines, *a* and *B*, represent the cut, and C is the tool.



On heavy work it is specially desirable to have the tool stand a long time without being taken out to grind, for the following reasons: 1. It takes longer to stop and start the lathe, and to take out and replace the tool. 2. It takes longer to readjust the tool to its cut. 3. It takes more time to put the feed motion into gear again. 4. The feed motion is very slow to travel the tool up and into its cut, and to take up its play or lost motion. 5. Lastly, the tool should take a great many more feet of cut, at one grinding, than is the case with a tool for small work.

A tool used on work 5 inches diameter (the lathe making 20 revolutions to feed the tool one inch) would perform 314 feet of cutting in traveling a foot, the lathe having, of course, performed 240 revolutions; while one used on work 10 feet in diameter (with the same ratio of speed) will have performed 314 feet of cutting when the tool has traveled half an inch, and the lathe made 10 revolutions only. In practice, however, the feed for larger work is increased in a far greater ratio than the cutting speed is diminished, as compared with small work; but in all cases the old axiom and poetical couplet holds good:

"A quick feed
and slow speed,"

as the most expeditious for cutting off a quantity of metal, and, in the case of cast iron, for finishing it also.

A positive or constant rate of cutting speed for large work cannot be given, because the hardness of the metal, the liability of the work to spring in consequence of its shape, the distance of the point of the tool from the tool post, and other causes already explained, may render a deviation necessary, but the following are the approximate speeds and feeds:

Wrought iron of about 12 inches diameter: Heavy roughing cuts, 18 feet of cut per minute; and feed, 27 revolutions of lathe per inch of tool travel. Finishing cuts, 30 feet per minute. Feed, 30 revolutions per inch of tool travel.

Cast iron of about 12 inches diameter: Heavy roughing cuts, 25 feet per minute. Feed, 22 revolutions per inch of tool travel. Finishing cuts, 25 feet per minute. Feed, 8 revolutions per inch of tool travel.

Cast iron, 10 feet diameter: Roughing cuts, 15 feet per minute. Feed, 20 revolutions per inch of tool travel. Finishing cuts, 19 feet per minute. Feed, 4 revolutions per inch of tool travel.

But these data in no wise apply to tools held far out from the tool post, nor to cutting tools used in a boring bar, concerning which latter too much depends upon the relative size of the bar to the hole to be bored, and upon the solidity of the lathe or machine driving the bar, to permit of any data being given.

Brass of small diameter may be turned at a cutting speed of 420 feet per minute, with a feed of 25 revolutions of the lathe per inch of tool travel, and work of 18 inches diameter at a cutting speed of 150 feet per minute, with a feed of 36 revolutions of the lathe to an inch of tool travel. The discrepancy in the feet of cut per minute arises from the causes explained in Figs. 26 and 27.

Telegraphic Crows.

At a recent session of the Asiatic Society, Mr. L. Schwendler showed a crow's nest, made of pieces of telegraph wire, twisted together in a most ingenious and knowing manner. He said that lately such nests had been frequently found, and that the crows often selected telegraph posts, between which and the telegraph wires they built these wire nests, causing what are known as "earth" and "contact," and interfering with communication. Crows, however, were by no means the only animals interfering, by their domestic arrangements, with overland telegraphy. Wasps build their mud nests in the porcelain insulators, causing, in rain and dew, leakage from the wire to the ground. Birds of prey frequently dropped dead fish and other offal upon the wires, causing contact. These were all frequent sources of temporary interference with telegraphic communication upon overland lines, and they, combined with many other facts not necessary to mention, seemed to show that it would be a very great advantage to use subterranean telegraphs instead of overland lines.

PASIGRAPHY.—Pasigraphy is the name of a new system of writing by numbers, which, it is asserted, may be used universally, and thus obviate the difficulty of communication between nations of different languages. Dr. Anton Bachmaler, of Munich, is the inventor. A conference of gentlemen of various nationalities was held in London, not long ago, to promote the undertaking, and the result is said to have been of an encouraging character.

THE ST. LOUIS BRIDGE has a total length of 4,463 feet, as follows: From Third street to the building line on the levee, 930 feet; thence to building line in East St. Louis, 2,107 feet; thence to commencement of the eastern approach on the dyke, 1,425 feet. This approach is 2,000 feet in length.

IMPROVED SEWING MACHINE MOTOR.

Domestic motors, unless they present the three elements of safety, simplicity, and cheapness, stand little chance of gaining popular favor. We are inclined to believe the same is true of apparatus which, apparently filling the above conditions, is nevertheless of a nature intrinsically against which prejudice exists. Thus, we doubt if any woman would charge herself with the care of a boiler and steam engine, however small its dimensions, or would undertake to manage the battery of an electro-magnetic machine; the one she has connected in her mind with explosions and similar casualties, while of the other the average female is, as a rule, totally ignorant, and hence timorous. Every woman, however, has some idea of clockwork—knows that it runs when wound up, and is not liable to sudden freaks in the way of bursting and giving disagreeable shocks; and consequently, if she finds she can drive her machine for some time by turning an exaggerated clock key a few revolutions, the chances are that she will do so rather than tire herself over the treadle, simply because, in the case of clockwork she is familiar with the power she deals with, while in the case of steam or electricity she is not.

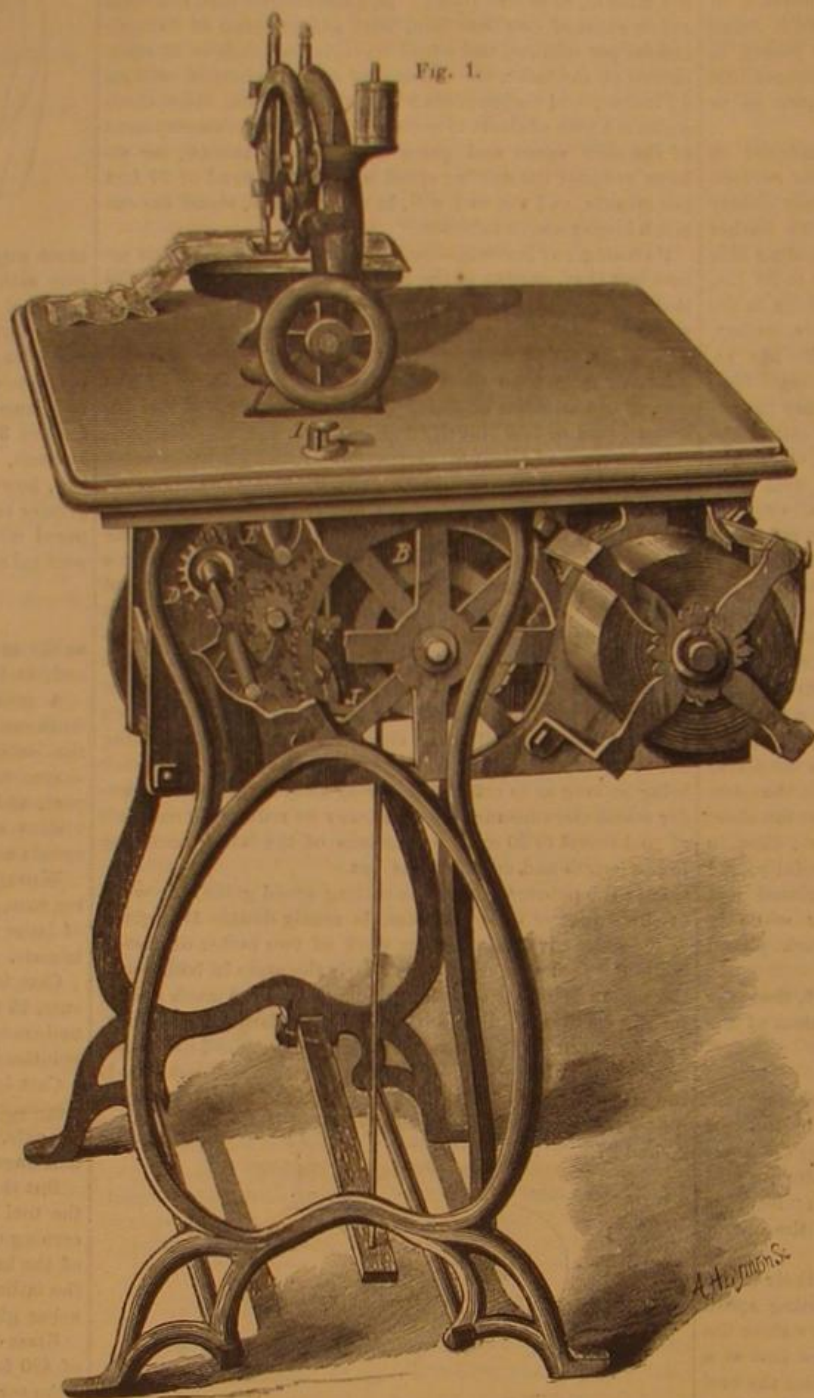
The inventor of the device illustrated in the annexed engravings has produced an arrangement of spring mechanism for actuating sewing machines, which, judging from a recent inspection of its operation, is capable of giving excellent results. Every one, it is presumed, is reasonably familiar with the general principles of such apparatus, and hence an allusion to them is not needed, nor is it deemed necessary here to enter minutely into the inter-entanglement of the various transmitting wheels. Suffice it to state that the connection between the parts is simple, and readily understood from a glance at the device itself. The points to which attention is especially directed are the mode of insuring an equal and uniform power during the entire period that the spring is unwinding, and the brake mechanism by which the motion is controlled.

To insure the best application of power throughout, the inventor has recourse to an arrangement very similar to the ordinary fusee. On the spring shaft, A, Fig. 3, is a cylinder to the periphery of which a chain is attached. The latter is also secured to the larger portion of the spirally grooved drum, B, so that the motion thereby transmitted to said drum rotates the large cog wheel, C, and thence passes to the other mechanism, and finally, to the belt pulley of the machine. The winding is done by a winch applied to the shaft, D, Fig. 1, with the pinion on which and also with the main wheel, C, an idle wheel, E, may be slipped into and out of gear (by a longitudinal motion of its shaft in its bearings) at will. By this means not only is the powerful coiled spring, represented at the right of Fig. 1, wound, but the chain tightly wrapped in the grooves of the drum, B, Fig. 3. It will be noticed that, during the first turns of the winding, which require but little power, the chain winds about the larger portion of the drum, B, between which and the diameter of the driving wheel, C, there is less difference of leverage; but toward the end, when much more power is needed to finish the work, a greater leverage is afforded through the decrease in diameter of the portion of the drum on which the chain then winds. When the spring begins to unwind, and so to drive the mechanism, the exact converse of the above takes place. The power, at first strong, is applied to the smaller portion of the driving drum, and then, as it diminishes, its point of application gradually changes so as to work with proportionally increased leverage. The drum being properly shaped, the result is to cause strong power to act upon short levers, and light power on long levers, effecting a uniform transmission of force. The same end may be reached by replacing the cylinder with another conical drum.

The brake mechanism is represented in Fig. 2. F is a flat elastic bar, to which is attached a cushion, G, which acts as a brake shoe against the fly wheel, H. To the outer end of the bar, F, is secured a rod which passes up through the table, and ends above in a button, I. By raising the latter, the cushion is removed from the fly wheel and the works allowed to operate; by lowering the button, the brake is again applied, and stoppage results. A brake at J presses upon the belt wheel shaft, and is held down upon the latter by the pressure of the foot upon the bar, K, under the table. By increasing the pressure, and consequently the friction of brake, J, the machine is caused to travel more slowly; and by relaxing the same altogether, full speed is permitted.

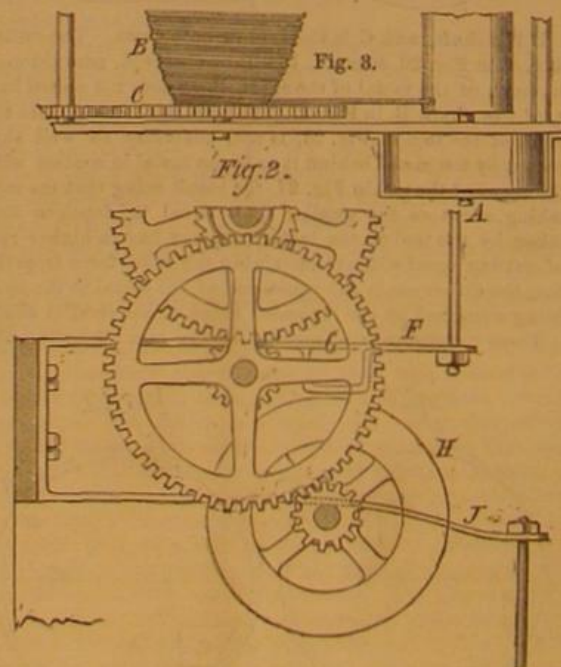
Sufficient being now said to convey an idea of the construction of the device, we may state that its general appearance is excellently shown in Fig. 1. It may be applied to any machine, requiring no other modification of the latter than the replacing of the table, if of ordinary size, by a larger one. Eight turns of the crank—which, owing to the interposition of the idle wheel, are made in direction from the operator—suffice to wind the spring and set the machine in operation at full speed, estimated at about 720 stitches per

minute for twenty minutes. This, though very much faster than is ever necessitated in actual practice, was accomplished several times in our presence, the needle in one instance piercing many thicknesses of muslin or linen. Probably once in every half hour would be all the winding required for continuous work, and this, as we have above explained, is an operation of little difficulty, done in a very few seconds, and controlled by the ratchet wheel and pawl shown in Fig. 2.



YOUNG'S SEWING MACHINE MOTOR.

The invention appears to us to be a successful application of simple and, certainly, not expensive mechanism, to a much needed end. Women's work upon the treadle is none of the lightest, and, while always temporarily fatiguing, sometimes results in permanent physical suffering. This, added to the fact that the sewing machine is one of the most im-



portant, if not the first, of modern household gods, should bespeak careful examination for the device.

Patented by Mr. William Young, July 8, 1873. For further particulars address C. T. Crawford, 43 Franklin street, Baltimore, Md.

Music by Telegraph.

Mr. Ellsha Gray, of Chicago, a gentleman well known as an inventor and manufacturer of telegraphic apparatus, has perfected an instrument by which, says the *Journal of the Telegraph*, sounds produced at one end of a wire can be conveyed to the other end by electricity, over circuits of great length. It has, says the *Journal*, already been tested upon the wires of the Western Union Telegraph Company over a circuit of 2,400 miles, with the most satisfactory results. Tunes, played upon the keyboard of the transmitting portion of the apparatus, were distinctly audible and unmistakably reproduced, note for note, at the distant end of this long circuit.

The apparatus has been named by Mr. Gray the telephon. The transmitting apparatus consists of a keyboard having a number of electro-magnets corresponding with the number of keys on the board, to which are attached vibrating tongues or reeds, tuned to a musical scale. Any one of these tongues can be separately set in motion by depressing the key corresponding to it. To this transmitting instrument the conducting wire is attached, the other end being attached to the receiving apparatus, which may be anything that is sonorous so long as it is in some degree a conductor of electricity. A violin, with a thin strip of metal stretched between the strings at a point where the bridge of the instrument is ordinarily placed, will, on receiving the sound transmitted through the conducting wire from the piano, give out a tune very similar in quality to that of an ordinary violin.

Preservation of Iron Ships.

A few weeks ago (23d of May) we summarized the instructions issued by the Admiralty relative to the preservation of boilers by the placing of unslaked lime in those boilers which could be kept empty, and, in those cases where they were liable to leakage from the sea, by filling them with a solution of lime in sea water. The result of the experimental application of the solution of lime has been so satisfactory that its use is to be extended to iron and composite ships, under the circumstances described in the following circular, No. 36 of 1874, lately issued by the Admiralty: "Experiments having shown that the destructive action of bilge water on the iron frames, etc., of iron and of composite vessels may be reduced or altogether obviated by the use of lime, my Lords Commissioners of the Admiralty are pleased to direct that in all cases where it may be found impossible to dry out completely any of the compartments, bilges, or wings, in order to coat them with composition paint, or cement, as prescribed by circulars 28 of 1872, 22 of 1873, and 31 of 1874, lime well slaked is to be placed in the water contained in such places. As unslaked lime would injure coatings of composition, paint, or cement, care is to be taken that the lime used is thoroughly slaked."—*Engineering*.

The Sczaroch.

The Russians have lately adopted a new shell which, according to recent experiments, seems to be a formidable projectile. It is well known that with the ordinary elongated bolt a ricochet fire cannot be maintained; and as this species of firing is very effective against masses of troops, the loss is a matter of considerable moment. The sczaroch, for such is the name of the new projectile, is either a percussion or timeshell and a shot, the latter of which ricochets beyond the point of explosion of the bursting charge. The shell portion is a simple iron cylinder, to one end of which is secured, by a thin sheet of lead, a spherical shot.

On leaving the gun the combined projectile acts like an ordinary elongated shell; but as soon as the explosion of the charge takes place, the cylinder of course flies in pieces, while the shot, impelled by the additional velocity and by reason of its form, ricochets for hundreds of feet ahead. In firing at batteries, the double effect of this projectile comes into excellent use, as the shell might be exploded among the guns, while the ball would strike far in the rear among the reserve troops; or while the shell might burst in the front rank of an advancing column, the ball would continue plowing its way through several succeeding ranks.

Another Dam Disaster.

The bursting of the Mill River reservoir has been very closely followed by the breaking of another dam in Massachusetts, thirty miles northwest of Springfield and on the line of the Boston and Albany Railroad. Twelve bridges, four manufactories, and several dwellings, valued at about half a million dollars, were destroyed, beside the vegetation in the path of the flood being generally devastated. Happily no lives were lost, warning being given in time.

From all accounts, the casualty was due to the imperfect construction of the reservoir, which appear to have been mere mud banks built some forty years ago. The recent heavy rains probably proved too much for the sustaining power of the soil, and hence the barriers gave way.

THE SUNDRIAGE PARK CONSERVATORY, ENGLAND.

Our illustration represents one of the most beautiful of English conservatories, that of Sundridge Park, Kent. The house is 100 feet in length by nearly 40 feet wide, and 35 feet in height, and is constructed almost entirely of iron and glass, having perpendicular sides and a curvilinear lantern-shaped roof, of pleasing proportions, supported on light iron work pillars, which also serve as supports for rare graceful climbers. The present engraving, says the *Garden*, beautiful as it is, gives but a very faint idea of the interior, which would require at least half a dozen such views to do it full justice.

The central portion of the house is laid out in beds, in which palms, ferns, cycads, camellias, and other rare exotics luxuriate with something of their native vigor. Around the sides, substantial stone benches have been erected for smaller decorative plants in pots, and beneath these the hot water pipes are placed and concealed from view by a neat and ornamental cast iron grating. The hot water apparatus is of the latest and most approved kind, while the genial temperature maintained is amply sufficient for the choice blooming orchids and stove plants, which are grown for the purpose of decoration in ranges of plant houses to the rear of the conservatory. A notable feature is a pair of lean-to curvilinear roofed houses behind the conservatory, and connected with that structure by doors opening into an alcove, very tastefully decorated with virgin cork, and planted with orchids, filmy ferns, and other choice exotics, the effect of which is considerably heightened by a large mirror which extends the whole length of the alcove behind. These very agreeable adjuncts to the conservatory are very tastefully and systematically arranged in the natural style and planted out with ferns, orchids, and choice foliage plants, all of which luxuriate in the most vigorous manner possible. The doorways are fringed with masses of virgin cork, over which lygodiums, *ficus stipitata*, fresh green selaginellas, begonias, and bright veined eranthemums ramble in rich profusion, and with a vigor only attainable by planting them out in good fresh soil with ample room to extend themselves in all directions. Conservatories, arranged in the natural style, and having the finest specimens planted out, are specially to be recommended, as they are not only effective, but much less trouble is entailed on the gardener than when pots or tubs are employed.

THE BRITISH INTERNATIONAL EXHIBITIONS.

The series of splendid International Exhibitions inaugurated by the British Government, and carried out with so much effect in London by Her Majesty's Commissioners, are to be brought to a close by the termination of the present year. These exhibitions were intended to extend over a period of several years, a new exhibition being opened each year with some special characteristic to render it prominent or attractive. But the world appears to have become surfeited with exhibitions, and even the British Government is unable to induce the people to attend or take interest in them. This may in part explain the apathy of our own people in respect to the approaching Centennial Exhibition at Philadelphia. The people are tired of such shows; they are regarded in the popular mind as tame, insipid, and nothing

but advertisements after all. This is a very incorrect notion, especially when we consider the remarkably excellent and in some respects wonderful collections of industries and objects that have been brought together at these British International Exhibitions. We have heretofore described some of the branches of the present exhibition, and now give the following from *The Engineer*:

If there is a lively place in the whole exhibition, it is the French annexe. If anything could have turned the scale in favor of the exhibition, it would have been the foreign element, especially the French. India, which is part of our own empire, is worth a good deal; but France is especially valuable for exhibition purposes. Whatever the Frenchman

Sommerard is the inspector-general. In the arcade near the French garden are shown some fine specimens of ornamental screenwork cut out of metal by the steam sawing machine at the mills of Delong & Company.

The ingenuity of the French is shown in the mechanical singing birds of M. Bontems and the marvelous watches of M. Haas. Some of these watches wind up by the mere process of opening and shutting the outer case. One watch gives the day of the week and the date, besides showing the phases of the moon, striking the hours and quarters, and marking time to the sixth of a second. Another watch strikes hours, quarters, and minutes. In the mechanical section of the exhibition the Siebe-Gorman diving apparatus was brought into working order a few weeks back, and the operations of the diver in the raised tank with its glass panels are of general interest. Close at hand Messrs. Chance Brothers & Co., of Birmingham, have erected their dioptric heliophotal revolving light—of the first order—a splendid example of mechanical engineering. As we have before stated, this is intended for the South Stack Lighthouse, Holyhead, and has only just been made.

Cut short at the end of its first Olympiad, the exhibition sees its programme shorn of its fair proportions. In 1875 we were to have woven, spun, and felted fabrics, in relation to printing and dyeing. At the same time we were to have had a display of mineralogical instruments, brass and copper manufactures, and all that relates to water supply. In 1876 there was to have been a collection of works in precious metals and their imitations, together with philosophical instruments and agricultural machinery. The plan for 1877 was poor, consisting of furniture and upholstery, "health manufactures," and machine tools. The list for 1878 looked better, including glass, tapestry, military engineering, naval architecture, and lighting by all methods. Iron was to be the leading feature in 1879, while 1880 was to be famous for chemistry and articles of clothing, supplemented by sewing machines and railway plant—a droll assortment, confounding our ideas of the druggist and the draper with the general



SUNDRIAGE PARK CONSERVATORY, KENT, ENGLAND.

touches he seems to adorn. Going into the French annexe, we are struck with the beauty of the engineering models. The very sewage apparatus has an air of elegance. The wood is polished beech, the metal is the finest brass, and everything has the finish of decorative work. There may be a lack of faithfulness and reality in all this brilliancy, but doubtless the construction is correct. These, and other models, are sent by the Municipal Council of Paris, and are further elucidated by admirable photographs and drawings suspended on the adjacent walls. Models of waterworks, bridges, and other structures, are all very good. There is likewise a steam roller and a diagonal sweeping machine. In another division of the annexe we meet with some splendid models of educational institutions, so perfect that nothing is wanting but the actual "flesh and blood." The rooms are there, all duly fitted up, and everything laid open to view by the substitution of glass for woodwork and masonry. Upstairs in the art gallery of the exhibition we meet with architectural drawings lent by the Commission which has charge of historical monuments in France, of which M. du

livelihood of a railway station. Many persons still think that there is something in this annual International Exhibition scheme which ought to be taken up and carried out. We are not, we confess, of the number. We trust that the present failure may be looked upon as final, and that, if we have not seen the last of International Exhibitions elsewhere, they may at least be regarded as defunct at South Kensington.

Railway up the Volcano of Vesuvius.

The plans of the line which is to ascend Mount Vesuvius are now complete. The route will be 16.1 miles in length. The grades are 20 and 35 per hundred, and the road terminates at a few feet from the crater. There will be one station, protected by a sort of break lava, which will divert the flow, in case of eruption, away from the building and rails. The road is so laid out as to be naturally sheltered at every point, except for a distance of about 60 feet.

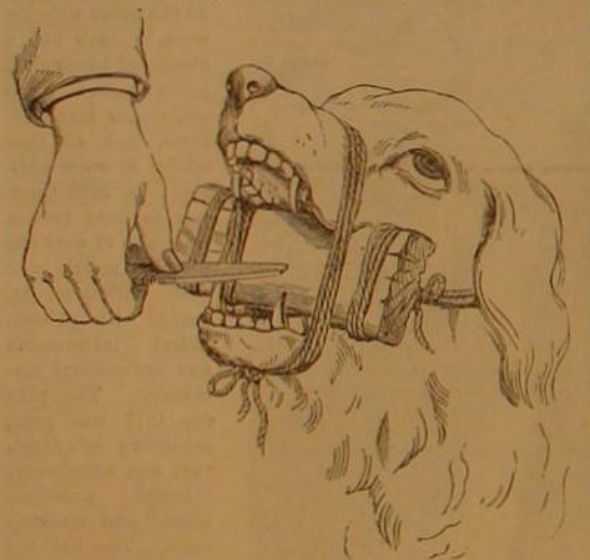
Turn *Revue Industrielle* states that apples may be preserved in perfect condition by packing them in dry plaster.

HYDROPHOBIA—PRACTICAL SUGGESTIONS FOR ITS PREVENTION AND CURE.

At a recent meeting of the New York Neurological Society, which was largely attended by prominent physicians and surgeons of this city, Dr. Hammond made an address in which many interesting facts and experiences pertaining to the dreadful malady of hydrophobia were presented. He also produced diagrams of highly magnified sections of the brain, spinal cord, and pneumogastric and other nerves, of McCormick, the expressman, taken soon after his death here from this disease. All of the parts exhibited showed a deficiency of cell structure, and it was evident that a striking change from the normal condition had taken place. The gray matter had passed into a state of fatty degeneration, mainly in the form of oil globules. This discovery was considered important, as indicating the particular members of the system that were affected and the changes therein, congestion of some of the parts being especially shown as a primary condition. The knowledge gained might assist the physician in future treatment of the disease.

Among preventives, Dr. Hammond thinks that the cutting out of the wounded parts is the best, and that it will be effectual if done at any time prior to the development of the symptoms of the disease, although the sooner it is done after the bite the better. He had performed this operation of excision some thirty or forty times, upon persons supposed to have been bitten by mad dogs, and in no case has hydrophobia ensued.

"In regard to the treatment," Dr. Hammond observes, "there is not much to say; but I have one or two ideas about it which I would like to mention to the Society. I am inclined to think that the most effectual method of treatment would be the persistent application of the primary galvanic current. I would put one pole to the patient's head and the other to his foot, and make the current flow continuously all the time while the disease lasted. In one case reported by Mr. Schivadi, he by that means maintained the life of the patient for seven days, a very long time for the disease to last, and then the patient died without any hydrophobic symptoms, seeming to die purely from exhaustion. Recollect that means has not been used successfully in but two cases. Schivadi used it in some former case, but there was such a neglect about the application of it that it was not effectually carried out, and so that patient died with hydrophobia fully developed. There are dozens of ways in which galvanism can be applied; but which one will be more effectual than others or what the effect will be, we cannot definitely say until we have



FILING THE TEETH OF THE DOG.

more experience upon the subject. There is some ground, likewise, for thinking that, in the application of the primary galvanic current in that manner, we have one of the most if not the most effectual means of treating disease known to us. And then, in addition, I would apply ice to the spinal cord and to the whole length of the spine, and keep the patient immersed in it, you may say, the whole time. I have used ice quite extensively in the treatment of tetanus four times in this city. In one case in particular, in which I was in consultation with Dr. Lewis Smith, the ice was kept at the spinal cord during the whole course of the disease, and the patient got well. Another case, induced by a wound, likewise in this city, in the person of an eminent musician, I treated in the same way—with ice—and he recovered. And I am inclined to think that in ice we have another very effectual means of treating hydrophobia, which I would feel disposed to rely upon; but I should say galvanism more than anything else. As regards the administration of internal remedies, I have nothing to say. Those cases in which they are reported as being successfully used, rely upon it are not authentic cases of hydrophobia."

Dr. Hammond then presented resolutions, which were adopted by the Society, against the muzzling of dogs, in favor of killing all vagrant dogs, and also the following:

Resolved: That in the opinion of this Society the most effectual means of preventing the origination and spread of hydrophobia is by the imposition of a tax upon all dogs kept for use or pleasure; requiring the canine teeth or fangs and the incisor teeth to be blunted, as proposed and effected by Bourrel, and the destruction, under proper regulations and by duly authorized persons, of all dogs not licensed, or which may be found with the teeth unblunted.

In the absence of any legal enactment, the New York Neurological Society recommends to all owners of dogs to have the teeth of the animals blunted in the following man-

ner, as detailed by Fleming in his "Treatise on Rabies and Hydrophobia": "The operation is a simple one. For a large dog, two assistants are necessary; for a small animal, only one. The creature is seated on a table, a gag is fixed in the mouth between the molar teeth by a band passed behind the neck; another band or piece of wide tape fastened around the muzzle at the back of the gag prevents any movement of the jaws. To blunt the incisor teeth a file is used, and to expedite the operation the longer canine teeth or fangs are shortened by sharp nippers and then smoothly rounded by the file. The gag, of course, must be proportioned in thickness and length to the size of the animal."

Dr. Hammond then placed a dog in view of the audience on which the operation of blunting the teeth had been performed. The Doctor said: "You will see how impossible it is for him to bite so as to break the skin even—it is utterly out of the question. This is the manner in which it is done: Place this stick between the molar teeth of the dog, and keep the stick in position by a cord attached to both ends of it. Then while the stick is in his mouth, and a cord placed so as to prevent his opening his mouth any wider, this operation could be done within eight minutes. When the operation of filing is performed he cannot bite, and he is not injured in the slightest degree for any purposes. He can do just as well as ever. He does not use his canine teeth to tear his food, and there is no reason why the operation should not be performed upon him, and it makes him altogether a more useful portion of society. We have performed various operations on animals to make them subservient to our uses, and there is no reason why this operation should not be made obligatory upon all owners of dogs."

THERE are 5,000 miles of telegraph line in Mexico, according to the latest official returns. Of the total, the government owns about half, and the balance is in course of construction or is controlled by States and private companies.

A CORRESPONDENT, Mr. D. B. Snow, of South Lancaster, Mass., reports the appearance of a perfect lunar rainbow at that place on the evening of June 29. Naturally the colors were not so vivid as those of a solar rainbow, but the arc was complete.

THE ST. LOUIS UNDERGROUND RAILWAY TUNNEL is 4,800 feet in length, and extends from the great bridge to Poplar street.

A LARGE portion of the rails on the Great Western Railway, England, were lately reduced from the broad to the narrow gauge, of 4 feet 8½ inches. Two thousand men did it in eighteen hours.

M. F. DE CANDOLLES has been elected Associate Member of the French Academy of Sciences in place of Professor Agassiz. M. Candolles is a Swiss naturalist of considerable reputation.

THERE is to be an International Geographical Congress held in Paris in the spring of 1875. A committee is now at work, arranging details and classifying the various subjects to be considered.

THE Chicago Railway Review appears in a new dress, enlarged in size, and full of interesting railway information. It is one of the best periodicals in the country.

HOW SHALL I INTRODUCE MY INVENTION?

This inquiry comes to us from all over the land. Our answer is: Adopt such means as every good business man uses in selling his merchandise or in establishing any business. Make your invention known, and if it possesses any merit, somebody will want it. Advertise what you have for sale in such papers as circulate among the largest class of persons likely to be interested in the article. Send illustrated circulars describing the merits of the machine or implement to manufacturers and dealers in the special article, all over the country. The names and addresses of persons in different trades may be obtained from State directories or commercial registers. If the invention is meritorious, and if with its utility it possesses novelty and is attractive to the eye, so much the more likely it is to find a purchaser. Inventors, patentees, and constructors of new and useful machines, implements, and contrivances of novelty can have their inventions illustrated and described in the columns of the SCIENTIFIC AMERICAN. Civil and mechanical engineering enterprises, such as bridges, docks, foundries, rolling mills, architecture, and new industrial enterprises of all kinds possessing interest can find a place in these columns. The publishers are prepared to execute illustrations, in the best style of the engraving art, for this paper only. They may be copied from good photographs or well executed drawings, and artists will be sent to any part of the country to make the necessary sketches. The furnishing of photographs drawings, or models is the least expensive, and we recommend that course as preferable. The examination of either enables us to determine if it is a subject we would like to publish, and to state the cost of engraving in advance of its execution, so that parties may decline the conditions without incurring much expense. The advantage to manufacturers, patentees, and contractors of having their machines, inventions, or engineering works illustrated in a paper of such large circulation as the SCIENTIFIC AMERICAN is obvious. Every issue now exceeds 42,000 and will soon reach 50,000, and the extent of its circulation is limited by no boundary. There is not a country or a large city on the face of the globe where the paper does not circulate. We have the best authority for stating that some of the largest orders for machinery and patented articles from abroad have come to our manufacturers through the medium of the SCIENTIFIC AMERICAN, the parties ordering having seen the article illustrated or advertised in these columns. Address

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DECISIONS OF THE COURTS.

United States Circuit Court—Southern District of New York.

PATENT WATCHMAN'S TIME DETECTOR.—JACOB E. BUECK vs. WILLIAM WOODRUFF, Circuit Judge.

I have re-examined the decision heretofore made by me in Bueck vs. Valentine (9 Blatchf., 478), so far as it bears upon the contest in this suit. In that case, the patents and patented devices, including the patent for the infringement of which this suit is brought, are fully described. The additional evidence here introduced does not alter my conviction that the invention now in question, and secured to the complainant by his patent of June 3, 1865, was not anticipated by any of the devices to which the evidence relates; nor by John Bueck, upon whose invention that of the complainant was an improvement.

Is the defendant's detector an infringement? I think it is. The only difference between it and the complainant's detector is that instead of forcing points upward to perforate, the defendant's force the paper downward upon and to receive an impression from stationary projections from the surface below. Both indent the dial upward; one makes a perforation, the other an upward indentation. I do not think an inventor can be robbed of the fruits of his invention by such a variation, when the whole structure of his machine is in other respects the same.

Without deeming it necessary to discuss the subject more minutely or fully, my conclusion is that the complainant's patent is valid, and that the defendant infringes it.

Let a decree be entered for the complainant awarding an injunction, directing an account, etc.

[J. Van Santvoord, for complainant.
Keller & Blake, for defendants.]

PATENT SUBMARINE DRILLING APPARATUS.—CAMMEYER AND SAMUEL LEWIS vs. NEWTON et al.

[In equity.—Before Blatchford, Judge.—Decided June 10, 1874.]

Blatchford, Judge: This suit is brought on letters patent granted July 28, 1868, to William H. Cammeyer, as assignee of Samuel Lewis, as inventor, for an "Improved Portable and Adjustable Still Water Dam." The specification states that the invention is an "improved portable and adjustable dam for the purpose of producing still water in which to operate for the blasting and removal of obstructions in rivers and other water courses, etc."

The answer of General Newton denies the infringement alleged, and avers that, during the year 1869, he invented an apparatus for use as a caisson, coffer dam, and diving bell, in excavating and taking out rock in the harbor of New York; that it was constructed by and at the expense of the United States, and has since been used exclusively by the United States in the prosecution of the work undertaken by the United States, of improving the harbor of New York; that General Newton, being an officer of the United States and a lieutenant colonel of engineers in the army of the United States, has been heretofore assigned to the duty of directing the said improvement of the harbor of New York, and, in pursuance of his aforesaid duty, and acting for the United States, has used the aforesaid apparatus; that the other defendants, during all the time they, or either of them, have had any connection with the use of the said apparatus, have been employed and paid by the United States, and have acted in connection therewith solely as employees and agents of the United States; that neither he nor any of the defendants have derived any profit or emolument from the construction or use of said apparatus; that in the year 1867, in Boston harbor, Massachusetts, one George W. Townsend put in operation a method of drilling and blasting rock under water in a rapid tide way, using therefor a drilling platform, supported by anchors and adjustable legs, combined with a boat and a system of windlasses, anchors, and chains, together with suitable machinery, by means of which a system of drills might be operated, substantially like the apparatus claimed by the plaintiff; that the apparatus and dam claimed to have been invented by Lewis was not in fact the invention of Lewis, but the same had been invented and described by the defendant Newton prior to its invention by Lewis; that such invention and a description thereof were printed and published in a letter from the Secretary of War of the United States to the House of Representatives in the Congress of the United States, dated Washington, February 11, 1867, containing a report made by the defendant Newton, which gave a full and complete description of said machine so invented by the defendant Newton, together with the mode of constructing and using the same, which said letter and report were, on the 14th of February, 1867, ordered by said House of Representatives to be printed, and were printed and published at Washington, and are now on file in the Executive Department, No. 9, House of Representatives, second session Thirty-ninth Congress; that the defendant Lewis unjustly and surreptitiously obtained a patent for the said apparatus, which was in fact invented by said Newton, who was using reasonable diligence in adapting and perfecting the same.

Lewis testifies that, having read General Newton's reports from time to time, particularly the one of 1867, setting forth the difficulties of accomplishing anything in submarine drilling in strong currents, he turned his attention to inventing a machine for that purpose. The patent sued on was taken out July 28, 1868. It discards the idea of a rigid platform supported from the rock to hold the drill tubes, but adopts the idea of a dam in sections suspended permanently from a float, and attaches the drill tubes to the dam. It is in direct antagonism to the ideas developed by General Newton. He proposed to work from the rock in drilling, so as to work as on dry land. Lewis proposed to work from a float in drilling. Newton proposed to use a dam merely to protect divers in removing blasted pieces of rock, and for this purpose a dam in flexible sections, deep enough to lie on the bottom, could well be suspended permanently from a float. Lewis proposed to suspend a sectional dam from a float, and sink the drill tubes to the dam, and subject the drilling to the contingencies of the movements of the float.

The allegations of the bill, so far as they assert that General Newton proceeded in constructing his apparatus in intentional imitation of Lewis, are not sustained either as to the intention or imitation. General Newton appears to have considered Lewis' plan, and to have deliberately rejected it, and to have proceeded on one directly opposite. The latter has proved successful. General Newton, in all he has done, that is complained of in this suit, has acted as an officer of the government, in its service, and for its interests, judiciously, carefully, and without failure. He has not used Lewis' invention. He has done nothing for his own profit. There is nothing developed in the evidence to warrant the suggestions contained in one of the arguments submitted on the part of one of the plaintiffs that General Newton put forth a snare to entrap the unwary by inviting Lewis to invent an apparatus; that he announced to Lewis his intention of taking and using any patented invention which it might suit his purpose to use in the work; that he did not intend to waste any sentimentality on nice points in relation to the rights of patentees, so long as his own purposes were served, or to allow any scruples to interfere with his taking other people's property for the accomplishment of his own ends; that the infringement complained of was a matter of deliberate intention from the beginning; that General Newton has been robbing a poor man; and that the court has never had occasion to deal with a more unscrupulous, wanton, and cruel infringement. Some ideas are found in Lewis' patent, which, if worked out in such a manner as to produce a successful practical result, are valuable—a current breaker inclosing the working drills, and drill guides near the rock affixed to the current breaker. But these ideas are so hampered in construction as to make the drill guides dependent on the boat. General Newton took up, as any inventor has a right to do, the complete invention of Lewis, and, on examining it, found that it proceeded on an entirely wrong principle, if designed to accomplish the result of having a dam to act at the same time as a current breaker and a fixed support for drill guides near the rock, and he organized it on a new principle. He took up the apparatus which Lewis left it, and discarded Lewis' arrangement. These views are sustained by the experts for the defendants, General Tower and Professor Peck, and by the other evidence in the case.

A decree will be entered, dismissing the bill with costs.
[George Gifford and Thomas P. Howe, for the plaintiffs.
Charles M. Keller and Henry E. Davies, for the defendants.]

Recent American and Foreign Patents.

Medical Compound for the Cure of Coughs, Colds, etc.
Henry M. Hoyt, Knight's Landing, Cal.—This invention consists in a compound made of ingredients whose properties are peculiarly adapted to reach the seat of disease in throat and lung complaints. In cases of colds that had settled on the lungs, this compound has given relief in a few days, loosening the matter and, in cases of consumption, the tubercles from the lungs. It is stimulating and healing, enabling matter to be thrown off without severe fits of coughing or unusual exertion. Moreover, it is entirely without opium or other stupefying ingredients, which merely deaden the sensations and temporarily relieve the patient.

Improved Railway Car.
John Coyne, Baltimore, Md.—This invention relates to modes of constructing the frames of railway cars that are to be rubber-covered on the inside and outside, and consists in sheets of metal joined together and re-inforced at the bottom.

Improved Velocipede.
Moriz Nowak, Jeffersonville, N. Y.—This invention relates to improvements in velocipedes which are propelled by the action of the occupants, and it consists of a carriage body or frame placed on wheels, and driven by means of a pivoted foot board or treadle, which communicates motion by a fly wheel, belts, and pulleys to the hind axle, while the front wheels serve for steering the vehicle. Suitable devices for retarding and arresting the motion of the vehicle are applied in connection with the same.

Improved Revolving Horse Hay Rake.
Clarence E. Peckham, Columbia Cross Roads, Pa.—Levers are connected by a cross bar, and to a platform is attached a loop to receive the operator's foot, so that he can raise the said platform by lifting with one foot while he presses against the cross bar with the other. By this construction, by raising the platform above a horizontal position, bars will be pressed down upon the rear ends of the pins, so as to raise the points of the teeth; and by pressing the platform below a horizontal position, the bars will be pressed down upon the forward ends of the pins, and the bars will be raised from the rear ends of said pins, causing the forward ends of the rake teeth to catch upon the ground, revolving the rake and discharging the collected hay.

Improved Tumbler for Permutation Locks.

Henry W. Covert, New York city, assignor to Marvin's Safe Company, same place.—The general operation of this lock is similar to the combination locks now in use, that is, having a spindle, dial, and driving wheel, with one or more revolving combination wheels. The changeable pin has a stem and two jaws, with an open slot between the jaws, which receives the rim of the wheel. The stem fits into and fills the lower portion of the slot in the wheel, and the jaws project on each side of the wheel, so that when one of these pins is placed in any one of the slots of the combination wheels, the first wheel will be revolved by a stationary pin in the driving wheel, which pin will strike one of the jaws. The opposite jaw of this pin in the first wheel will strike the pin in the next wheel, and revolve that, and so on for any number of wheels. This pin may be changed to any of the slots, and the combination is altered by such change. By making these pins with jaws projecting on each side of the combination wheels, those wheels may be reversed, and by making the pins changeable the number of combinations is greatly increased. The same is effected by changing the pin from one slot to another, and by reversing the wheel.

Improved Drum.

Thomas Rawson, Williamsburgh, N. Y.—A two pronged hook hooks over the edge of a hoop, and to the shank is formed a hole to receive a screw, which is swiveled to said hook, and its end is squared off to receive a key for turning it. The screw passes through a screw hole in the body of a bracket, the outer part of which projects upward at right angles to extend along and rest against the screw. The inner end of the bracket passes in through the shell of the drum, and is slightly bent to take hold of the edge of the lining, so as to be firmly supported. By this construction, by turning the screw in one or the other direction, the drum may be strained to any desired extent, or slackened, as may be desired.

Improved Cultivator and Marker.

Amos Barker, Nebraska City, Neb.—The tongue is attached to the middle part of a curved bar, the end parts of which are horizontal, and carry coupling blocks. The latter are secured in place by the ends of a curved brace. Small wheels revolve upon the journals of the axle, which are bent twice at right angles, and the ends of which pass up through the forward parts of the connecting blocks, and are squared off to receive the lever blocks, the forward parts of which receive hooks formed upon the forward ends of rods. The rods have hooks upon their rear ends, which enter holes formed in the plow beams, so that the movement of the plow beams may control the wheels. By suitable construction, by detaching the plow beams and attaching two devices, four rows may be marked at a time.

Improved Plow.

Michael Barry, Valparaiso, Ind.—The plow beam is extended to the rearward, and is curved upward to form the landside handle. Upon the beam is the standard, the lower end of which is attached to the head. The forward end of the head fits into a socket formed upon the base of the share, which share is kept in place without any other fastening. The moldboard is curved, and the point is beveled off and fits into a groove beneath the cheek of the share, which holds it in place, prevents the said point from wear, and allows it to scour readily. The heel of the plow is bolted to the standard, and its rear part inclines upward, and is bolted to the handle. The rear part of the heel has a lug formed upon it, which is bolted to the rear end of the head. The moldboard is secured in place by braces. One brace is curved outward, and to its middle part is bolted the moldboard. The other brace is bent at a suitable angle, and its outer part is bolted to the moldboard, and its inner part to the moldboard handle. The forward end of the handle is bolted to the standard and head by the same bolt that secures said parts to each other.

Improved Ore Separator.

Herman Schafer, Chicago, Ill.—This invention relates to an improved apparatus for use with blast and other furnaces in condensing, from the fumes of certain metals, as gold, silver, and lead, the fine particles which they otherwise carry off. The fumes, etc., entering through pipes, vaporize water, so that a tank is filled with steam or vapor, which condenses the fine particles of metal, and causes them to drop into the lower part of the tank. The fumes, etc., that enter through the pipes must pass beneath the lower edge of partitions before they can enter the escape pipe; and as they are entering the said escape pipe, they are exposed to the spray from a sprinkler, by which any particles that may have passed beneath the partitions are removed and caused to drop into the lower part of the tank. In some convenient part of the latter is formed a door, through which the solid particles from the bottom may be raked out.

Improved Hay Loader.

George W. Kidwell, Elwood, Ind.—A suitable carriage is made to receive the lower end of a post, to the upper part of which a lever is pivoted. The rear part of the latter is branched, and to the rear ends of its branches is hinged a shaft, to which are attached the curved rake teeth. A base is secured to the rake head and hooked to the post to sustain the draft when collecting the hay. By suitable arrangement, by turning a crank and winding a rope upon a shaft, the forward end of the lever will be drawn down raising its rear end and the loaded fork attached to it. When the loaded fork has been raised to the proper height, the post is turned to bring the loaded fork over the wagon at the side of the machine, upon which the hay is dropped. The loaded fork may be held in any position into which it may be raised while the post is being turned to bring it over the wagon. There are also devices for turning the rake to discharge the hay and for pushing the latter off the teeth.

Improved Alarm Attachment for Measuring Cans.

Edward A. Temple, Charlton, Iowa.—This is an improved alarm attachment for the automatic measuring can described in letters patent issued to C. M. Bridges, September 19, 1871, to give notice when the desired amount of liquid has been drawn from the can. A float in the can is connected with a ratchet disk by suitable mechanism. To a rock shaft is attached the end of a bell hammer, so that, each time a pawl drops into a notch of the ratchet disk, the hammer may strike a bell and give notice that one measure has flowed from the float tube of the can.

Improved Carrycomb.

Benjamin F. Williams, Federalburg, Md.—This is a durable and convenient comb for cleaning horses, having a comb for the mane combined therewith, and it consists of a frame of malleable cast iron, to which are attached wire teeth. These teeth are formed by bending, in serpentine form, pieces of wire which are attached to the sides of the frame by means of holes in the latter, and turning over the ends. Four of these corrugated wires may thus be attached to the frame, each forming five teeth. The mane comb is formed of one or more pieces of wire attached to the sides of the frame in the same or similar manner to the other wires. The wire for this comb is doubled at intervals, each tooth being formed of two wires, which are perpendicular to the top of the frame, and on the opposite side from the other teeth. These teeth are long, so as to penetrate the mane.

Improved Hemmer.

James M. Terry, Williamsburgh, N. Y., and Enos Waterbury, Stamford Conn.—There is a supporting plate, a tongue over which the cloth is folded, an adjustable guide for regulating the width of the hem, a curved guide for turning the edge of the cloth down, and a flanged wheel for folding it under the tongue. This wheel turns with the cloth, and the fold of the hem runs in the groove of the roller. The roller and curved guide are mounted on a swing plate which can be swung away to the left for convenience in introducing the cloth. It has a catch stud for holding it back and a spring for holding it in the working position and to regulate the roller and turning plate to the irregularities of the cloth. As the supporting plate extends under the presser foot, it is provided with a stud rising a little higher than the plate, and on this the presser foot rests. The supporting plate is connected to the removable slide plate by a spring, which allows it to rise and fall with the feed, and also to rise from the table when passing over seams.

Means for Connecting Soldering Irons to Gas Pipes.

Thomas H. Gannon, New York city.—This invention is so contrived that simply placing the soldering tool upon a pipe with its lower end resting upon a collar will open the valve, and allow the gas to escape and be ignited, heating the tool in a very short time. As the tool is removed, the escape of the gas is stopped by the upward movement of the pipe, caused by the action of a spring.

Improved Milk Cooler.

Kosuth E. Bunnell and Albert H. Brown, Guilford, N. Y.—This is an improved milk cooler by which the milk is rapidly cooled, being surrounded at the bottom and sides by cold water, and readily drawn off without leakage by a watertight pipe joint passing from the bottom of the milk pan through the bottom of the water tank to the outside. The milk pan and cooling tank are fastened by clamps, attached to the top rim of the same, for preventing the lifting off of the pan from the tank by the water.

Improved Scraper.

Peter H. Carey, New York city.—To operate the machine the scraper is lowered by a hand crank and gearing, enough for it to scrape up a load by depressing the front end and raising the rear. Then it is raised sufficiently high to be transported to the place for discharging; the frame is disconnected from the tongue, the back end board is unfastened, and both the frame and box are tilted down behind, which allows the load to escape.

Improved Turpentine Tool.

Walter Watson, Fayetteville, N. C.—This is a convenient tool for gathering turpentine from trees, having two blades, one for a scraping or down motion and one for pushing or upward motion.

Improved Cultivator.

John McGee, David W. McGee, and William J. McGee, Farley, Iowa.—There are outside and inside plow beams. To the forward ends of the outside plow beams are attached iron straps having eyes to receive a long staple attached to the front cross bar of the frame. To the inner side of the outside beams are attached braces which incline inward, project forward, and have eyes to receive the staple, so as to hold the outer plows vertical. To the forward end of the inner beams are pivoted iron straps having eyes to receive the inner vertical arms of the staples. Upon the rear end of the straps are formed curved straps, the upper ends of which are pivoted to inner arms of the staples. To the rear ends of the beams are attached the standards, the draft strain upon which is sustained by the brace rods.

Improved Roller Skate.

John H. Fenton, Indianapolis, Ind.—A bracket with two rollers is placed at the toe, and also at the heel of the skate, the two pairs being duplicates of each other, and fastened to the sole in the same manner. The bracket consists of a plate having four pendant arms, through which the spindle passes on which the rollers revolve. The plate is provided with two pivots, one on each side and opposite to each other. A spring of rubber is placed between the plate and the sole. The brackets are placed transversely across the sole, and the boxes on the pivots are so formed that the bearing or weight of the person skating is received by the springs, the elasticity of which springs gives a flexibility which allows the foot to turn in or out to guide the skates, while the pivots confine the bracket and rollers to their places.

Improved Hood for Smelting Furnace Chimneys.

John R. Egar, Corinne, Utah Ter.—The object of this invention is to provide a simple and improved means for saving the mineral which now escapes from the furnaces for smelting silver and other valuable ores; and it consists in a hood to be placed on the furnace chimney, which arrests the whole products of combustion. The smoke and gases will escape and ascend, while the dust, some twenty or thirty per cent of which is mineral, drops down and is caught in a space, from whence it is discharged through a series of tubes, and conducted into a reservoir of water for separation.

Improved Folding and Rocking Crib.

Oliver Nailer, North Lawrence, Kan.—In this crib the side pieces are pivoted together, and the rockers fold up alongside when the crib is not in use. The device consists chiefly in pivoting the uprights together at the top, and arranging end pieces to hold them apart when the crib is in use. Folded in this manner, the crib takes up but little room, and may be transported or stored away when not in use.

Improved Governor Valve for Steam Engines.

Elijah K. Eversol, Springfield, Mo., assignor of one half his right to Cyrus M. Eversol, same place.—The steam chest is provided with a horizontal partition having flat valve seats. The valves are made with flat projecting heads which close over the valve seats at both sides of the partition and are connected by a guide part. The valve stems are pivoted to a lever, which is attached to a regulating spring, and the steam supply is adjusted by means of the same together with sliding weights. The weighted spring lever is further connected with the governor of the engine, so that the balanced valves indicate instantly the changes of speed, shutting off entirely the steam supply as soon as the governor belt breaks or flies off, or the limit of speed is reached by the governor.

Improved Sewing Machine.

John Steinbach and James Ready, Brooklyn, E. D. N. Y.—The feed plate is connected to the free end of a long lever, which is pivoted to a stud projecting downward from the cloth plate. Motion is communicated to said lever and feed plate, for throwing it forward, by a lever which is pivoted to a stud projecting downward from the cloth plate, and connected, at the other end, to an eccentric rod worked by the main shaft. The return motion of the feed plate is effected by a spring. The lever acts on the long lever through a block, which is arranged between them, and connected to a bar which has a binding screw, which extends up through the slot of the plate of the machine, near the back end, for shifting said block along between the levers, to vary the stitch; and it may be fastened at any point.

Improved Type Setting Machine.

John A. Reynolds, Danville, Pa.—This invention relates to that class of machines which are used for setting type, and is a new and improved arrangement for doing the same which enables an operator to set type by a simple manipulation of keys as rapidly and much in the same manner that a performer on a musical instrument reads his notes and renders the music upon the keyboard, the printer's copy corresponding to the musician's notes, and the keys of the machine to the keyboard of the instrument. It consists in an arrangement of type (including letters, figures, spaces, and reference and punctuation marks) in vertical cases, which vary in number and height, according to the number, variety, and demand for said different classes of type. Said cases have lateral openings at their lower extremities, corresponding in size to the different sized type. Through these holes the types are pushed out upon a table by fingers of a corresponding size, said fingers being actuated by a cam groove in an endless hinged sectional metallic belt revolving around pulleys. To said belt is attached an arm which glides along the surface of the table, carrying the type with it to a slot in said table, down which it falls with its lettered end up, passing down a curved chute into a recess, whence it is forced laterally by a slide into the composing stick. The line which has thus been set up is then moved forward into column in the composing stick by the automatic operation of levers, cams, and pins. The operation of this machine is thus reduced to five mechanical motions: 1st. Taking the type from the cases 2d. Carrying it along the table. 3d. Dropping it down the chute. 4. Pushing it laterally into line. 5. Sliding the line into column.

Improved Machine for Splitting and Dressing Hoops.

David Murray and John Lamont, Annawan, Ill.—The splitting knife is set with its edge parallel with the line on which the two splitting rolls meet, and said rolls are provided with several grooves of different sizes. One roll is geared with a driving shaft. The other roll is held in bearings and provided with springs to allow it to shift to the inequalities of the poles to be split. While the hoop is confined by the feed roll in advance of the shaving knife, it presses down on the guide so as to throw the shaving knives out of action; but when it escapes, so as not to press down on the guide, the frame is drawn down at the other end so as to cause the shaving knives to taper the end sufficiently to form the lap. Springs are employed, in connection with the feed rolls, to cause them to gripe the hoop sufficiently to force it along. The shaving knife is provided with adjusting screws to regulate the knife for shaving off the requisite amount.

Improved Tobacco Packing Press.

Marcellus J. Farmer, Lynchburg, Va.—This invention consists in a novel means for compressing tobacco or other articles into bags and then relieving it of the mold, and in a peculiar means for operating the compress and mold holder.

Improved Carriage Spring.

J. H. Gould, Rutland, N. Y.—This invention is a spring adapted to all classes of vehicles, and possessing superior qualities of elasticity, durability, etc. It consists of a series of spring plates or leaves, tapered from centers to ends and of equal thickness longitudinally. They are placed at such relative distance apart as not to touch when compressed, and are either applied to recessed and bolted central blocks, or run through from socket to socket with intermediate separating pieces. Some of the springs are made detachable, and the ends of all are supported on separated pins in the sockets and lubricated in suitable manner.

Improved Rein Terret.

John J. Wightwick, Brooklyn, N. Y.—This terret is made of a single piece of metal, having one or more rein orifices or openings, according to the number of horses in the team. In the bottom is a swivel pin which passes through a bed piece. The latter is screwed or riveted to the head strap of the bridle. The terret may, therefore, turn in either direction, and prevent the lines from tangling, besides supporting their weight and rendering it much less laborious to drive four or more horses or pairs of horses.

Improved Ferrule and Hook for Whiffletrees.

William Starling, La Prairie, Ill.—Upon the forward side of the ferrule is formed a slotted lug to receive the eye of the hook, which is secured to said lug by a pin. The part of the lug in front of the pin hole, and upon its inner side, may be made thin. When used in plowing, the iron pin may be replaced with a wooden one, so that, should the plow strike an obstacle the said pin may break, and thus prevent the plow from being broken.

Improved Sausage Meat Cutter.

Jacob Knapp, Columbiana, Ohio.—In the lower part of the case are formed inclined slots, in which are secured notched or slotted plates. The two forward plates extend from the opposite ends of the case nearly to its outer ends, so as to overlap each other and leave spaces at their alternate ends for the passage of the meat. The rear plate extends entirely across the case, and its upper end terminates a little above the discharge orifice. The toothed plates thus form a zigzag inclined plane, along which the meat passes from the hopper to the discharge orifice, being all the time operated upon by the knives fastened to the rotary head. The knives being of triangular form have straight cutting edges, so that they can be readily sharpened. They can also be readily reversed when dull, so as to present new cutting edges, and thus avoid delay and loss of time from having to wait so often while the knives are being sharpened. They can also be cut from plates of sheet steel, to avoid waste of material.

Improved Treadle.

Joseph Lee, West Chester, Pa.—This is a centrally pivoted rock lever, operated alternately by two treadles, pivoted at the center, and the lever at its ends in the flanges of the treadles. Either heel or toe may be employed to alternately operate the crank rod.

Improved Derrick for Pumping and Boring Oil Wells.

John Schellkopf, Tidoute, Pa.—The object of this invention is to construct, for boring and pumping oil wells, an improved rig, which is made up of lighter timber, dispensing with the use of the heavy timber required at present for the band wheel blocks, Samson's post, and walking beam, and admitting that the rig may be taken apart, put up, and transported from place to place, with greater facility and a saving of timber, time, and labor.

Improved Gas Purifier.

Marie Eugene Paul Audouin and Eugene Philippe Pélouze, of Paris, France.—The object of this invention is to eliminate, by a new and improved process, the liquefiable matter held in suspension by gases and vapors. The mode of action of this apparatus is as follows: The gas coming from the generator through the pipe enters the top of a case, and passing downward through perforations strikes against an opposing plate, moves laterally to the next set of perforations, passes through them and strikes the next plate, and so on through an entire series of plates. The holes being so numerous and small bring the volume of gas into a finely divided series of jets, which, by striking repeatedly against the opposing plates, sooner or later precipitate all of the impurities in suspension by condensation and liquefaction, it being partly effected by cold, and partly by the mechanical motion of the particles in suspension on their passage through the apparatus. The liquefied portions drip down, and are forced through the apertures into the tar well below. The gas next passes up into a receiver through the perforations, with opposing plates in an inverted cup-shaped purifier, and out into the large holder, completely purified. For further particulars regarding this invention, see page 292, Vol. XXI. of the SCIENTIFIC AMERICAN.

Improved Windmill.

George A. Myers, Schoolcraft, Mich.—The vanes are connected in groups of four to short cross bars. The outer cross bar is pivoted to a wheel arm, and the inner bar is yoked to said arm, so that the section can swing around out of the wind when the force of the wind rises above the limit which it is to bear. This is governed by a weighted lever, whose office it is to hold the vanes in the wind. Each section is connected by a double-cranked rod, with a sliding hub or collar on the crank shaft. The latter is mounted on the top of a hollow casting, which rests at the shoulder on the top of a cast metal socket piece, and has a tubular extension fitting in said socket piece, and secured against being lifted out by the wind, so as to allow the casting to turn freely. The casting has a cap fitting on it above the crank shaft, to exclude snow and rain from the tubular part of the casting.

Improved Egg Beater.

William O. Crocker, Turner's Falls, Mass.—This egg beater consists of a stock, which has an arbor pin thereon, carrying a driving wheel which engages with a pinion. The pinion revolves on a spindle, and a rotary beater is attached thereto. The stationary frame is rigidly attached to the spindle, and is prevented from turning. The egg beater rests on bows on the bottom of the vessel. The spindle, the stationary frame, and the rotary beater are readily removed from the stock for cleaning or for other purposes. The frame surrounds the rotary beater, and serves to cut the egg as the beater revolves within it, and greatly to facilitate the operation of beating eggs.

Improved Foundry Molding Machine.

Gavin R. McGregor and Edgar Penney, Newburgh, N. Y.—In this machine, end-forked lifters extend up through slots in the table and support side studs of the flask. The lifters are attached to a sliding cross head, to which power is applied to lift the flask when the same is to be turned.

Improved Harness Saddle.

Edward Edwards, Hawkinsville, Ga.—The check hook and terrets are attached to plates, which are each bent or formed with a recess, which admits the back strap, and is fastened to the top of the saddle by means of rivets through their ends. This arrangement allows the back strap to render or slide on the top of the saddle, as it is kept securely in position by the loop plates and by leather loops on the side of the saddle. The back strap is made round. By this construction, the bearing of the thills is equalized on the saddle, as either one of the thills can rise or fall. They are also self-adjusting independently of each other.

Improved Mechanical Movement.

Emanuel Swartzwelder, Chaneyville, Pa.—This invention relates to a mechanical movement, by which a continuous rotary motion of the shaft is produced from the rocking motion of a lever pivoted loosely to the shaft. The invention consists of a rocking lever frame, which intermeshes, by intermediate gear wheels and alternately acting, toothed friction rings, with a central double cog wheel, keyed to the shaft, so that by the strokes of the levers the continuous rotation of the shaft is produced.

Improved Sound Insulating Attachment for Pianos, etc.
William H. Miller, Baltimore, Md.—This invention relates to that class of attachments for musical instruments which are used for insulating the sound vibrations, and rendering the same more clear and full by causing them to react instead of allowing them to be conducted away and deadened upon the floor. It consists in a core of glass or other similar substance for arresting sound vibrations, placed in a nicely fitting cavity in the bottom of the piano leg, fastened therein by buttons, and having in its center a socket to receive the revolving plate of a suitable castor.

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A. C. L. will find a good recipe for cement for leather on p. 119, vol. 25. —H. will find directions for making skeleton leaves on p. 123, vol. 29. The question as to the tank full of water is a schoolboy's problem, and the other is incomprehensible. —D. G. N. can cleanse iron for soldering by using sulphuric acid much diluted with water. We never heard of using an acid to prevent the splitting of wood. —W. S. E. will find directions for a good silver wash on p. 187, vol. 30. —F. B. M. will find directions for cleaning coins on p. 217, vol. 29. —J. F. G. is informed that Kötting and Morton are two different persons. —W. M. S. will find a recipe for violet ink on p. 58, vol. 30, and for oil boot polish on p. 73, vol. 26. —F. C. R. can enamel his steel apron supporters by the process described on p. 107, vol. 30.

G. W. McB. asks: 1. Does the magnetic meridian move from east to west and from west to east at regular periods? For what length of time does it move in one direction? What is the movement per year? At what dates have the changes taken place as far as known? A. The needle moves irregularly. The oscillations to the east and west of the true meridian require several centuries for their completion. For instance, at Paris in 1663 the variation was 9°, and it moved west till 1814, when it reached 22° 30' W.

L. H. D. asks: Can you give me some simple method of preparing sensitized paper for exposure in the camera? A. Take chloride of ammonium 200 grains, water 5 fluid ozs., albumen 15 fluid ozs.; beat the whole to a perfect froth. As the froth forms, transfer it to a dish and let it subside. When partially subsided, transfer to a tall, narrow jar and let it settle for some hours. Pour off the clear solution for use. To apply it, pour a portion into a flat dish to the depth of 1/2 inch. Cut paper to proper size, hold it by the two corners, bend in a curved form (convexity downwards), so as to touch in middle first; and gradually lower the corners. Let it rest on the bath 1 1/2 minutes, then take it off and pin it up by the corners. To make the paper sensitive, work by the light of a candle. Take nitrate of silver 90 grains, distilled water 1 oz. Take a sufficient quantity, pour into a porcelain dish. Lay sheet on in same way as before; allow 3 minutes contact for this paper and 4 to 5 minutes for thick. Raise the paper with tweezers tipped with sealing wax, hang up to dry, and protect from the light.

I. S. D. asks: How can beeswax be dissolved in ether? A. It is soluble in the usual way, but sparingly, that is, a large body of ether is required to dissolve a comparatively small quantity of the wax.

C. O. K. asks: 1. Is grape sugar an important article of trade in the United States, and for what use is it chiefly employed? A. Grape sugar is largely manufactured in the United States. It is largely employed in wine making and in the brewing of beer. That its use is extensive may be gathered from the fact that to 8 cwts. of malt, 1 cwt. of sugar is employed. It is also used instead of honey in confectionery, for coloring liquors and vinegar brown, and in making rum and cognac, beer and wines. 2. Is there a treatise on grape sugar manufacture published? A. We know of no such work. 3. Are there any patents on the process? A. Yes.

C. H. F. asks: 1. In extracting essential oil from flowers, how much salt by weight should be used to a pound of flowers? A. We know of no method of extraction in which salt is used, nor do we see how common salt can possibly extract an essential oil. 2. Is there any better way to obtain the perfume of flowers? A. The essential oils in flowers, being present in very small quantities, are best obtained by digesting the fresh flowers with pure olive oil, or with cotton wool soaked in sweet olive oil, the fresh flowers being placed in alternate layers with the cotton saturated in oil; in some cases pure lard is used. The flowers should be renewed till the oil is saturated with the odor. The cotton is pressed to extrude the oil. The essential oil may be recovered from the sweet oil by agitation with strong and highly rectified alcohol.

W. H. M. L. asks: 1. What will make the cream rise on milk, to get all the cream there is in the milk? A. There is no better way than the old-fashioned one of getting the cream from milk by letting it stand. In winter you might set the pans in warm water. 2. Is there an instrument made to detect water in milk? A. The water in milk may be detected by an instrument called a lactometer. It can also be detected by taking a glass tube and dividing it into 100 equal parts, then filling it and let stand 24 hours. The cream, if milk is pure, will rise and occupy 11 to 13 divisions of the tube. 3. How do they tell the speed of vessels at sea? A. The speed of vessels at sea is determined by an apparatus called a log. It is a small piece of wood of a peculiar shape, weighted and attached to a line which is divided into equal spaces called knots. When the logs are thrown into the water, the latter keeps it from being drawn forward, and the speed of the ship is found by the number of knots run out in a certain time.

F. W. R. asks: What is the best method of making a heavy cloth waterproof? A. Dissolve soft soap in hot water and add a solution of sulphate of iron. An insoluble iron soap falls to the bottom; separate it from the liquid, wash and dry it, and mix with linseed oil. The addition of dissolved India rubber to the oil improves the paint.

E. B. says: It may not be generally known that wrought iron, by repeated heating and cooling, follows a different law from cast iron, in that, as the latter expands, the former contracts. My attention was first called to this by the foreman of a foundry, who found that rings, set around the hub of a pattern as an anchor to lift the sand, soon became too small and had to be sent to the blacksmith for enlargement. Since then I have had occasion to use this knowledge in practice, and have reduced the size of a ring about one thirty-second of an inch by heating and cooling four times. The ring was one fourth by one inch, with one inch internal diameter. The process does not seem to injure the iron, as the rings were drawn about one inch in ten and were made of the common round rod in use for such purposes. A. That wrought iron shrinks by being heated and quenched is a well known fact, which has been employed for years to shorten the length of rods, etc., requiring to be very exact. But if the heating and cooling are equal all over, the first application only is effectual. That cast iron expands by repeated heating and cooling is not known, and is, to say the least, doubtful. If heated once and quenched, it hardens and expands (as does wrought iron and steel from hardening). If heated and cooled in one place at one time, and in another place at another time, your gradual expansion is explained; if otherwise, the phenomenon, if true, is new.

J. M. C. asks: What will be the pressure on the staves at bottom, middle, and top of a tub 2 1/2 feet in diameter and 9 feet high, holding a liquid weighing 12 lbs. to the gallon? A. The pressure on the staves at bottom will be 5 1/2 lbs. per square inch, at the middle 2 1/2 lbs. per square inch, and at top nothing.

J. E. B. says: I enclose you one of two eggs laid last week by the same hen. I think it is empty or nearly so. A. The egg weighed about one eighth of one of the same size. Upon breaking it open the yolk was found at one end, perfectly dry and hard. Your supposition that the egg is a fresh one is incorrect, it having been laid months before and become dry by heat. The shell of the egg when first formed is soft, and adheres closely to the solid contents; consequently the egg could not have been laid in the condition that you found it in. The egg was almost empty, no white of the egg being present, which shows conclusively that it was an old one.

T. C. P. asks: Is there a quick method of tanning small bits of rawhide? A. There is a method of quick tanning by the use of alcohol.

W. S. J. asks: How can I soften common machine steel so that I can cut it off easily with the parting tool? I want to make rollers 3/4 inch in diameter 9-16 inch thick. I have made it blood red, and let it cool off in lime and charcoal; and the steel is so hard it takes on an average 5 minutes to make each roller. A. There is no process to soften steel which will give you any practical benefit over the lime and charcoal process. Your trouble probably lies in the parting tool, which should be made of the best steel, about 1/2 inch thick, and given plenty of clearance at the point; it should be hardened right out, and placed to cut at the center. One minute is sufficient time to make such a roller, if it is made of any ordinary steel. Try using oil with the parting tool; it may assist it.

G. F. J. says: In your issue of July 11, J. W. asks if a true cylinder can be bored by a boring bar not having a sliding head (the cylinder being fed up by the lathe carriage) if the bar is not true or parallel with the ways of the lathe? He contends that the bore will be straight, but will not be round. You answer that the bore will be true, whether the bar is true with the shears 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. I think that, with a little consideration, you will be convinced that your answer is wrong, and J. W. is right. Your answer is correct where the cutter head feeds longitudinally upon the bar, but not for the case where the cylinder feeds up to the cutter. In the latter case, if the bar were not parallel with the ways (transversely, for instance), the bore would be straight with the ways, because the circle described by the cutter does not change in its relative position to the ways, consequently the cylinder would not be thinner on opposite sides at opposite ends as you stated. But the bar not being parallel, the circle of the cutter would not be upon the same plane as the diameter of the cylinder, but at an angle with it, consequently the transverse diameter of a cylinder, bored with a cutter revolving in such a direction, would be less than the perpendicular diameter. The relative position of the circle of cutter to diameter of cylinder might be shown by placing a ring inside a true cylinder of the same size, and then twisting one side of the ring toward one end of the cylinder, and the other side toward the other end. With a cutter running at a considerable angle, the bore might be made quite elliptical. A. The plane in which the cutter of the boring bar revolves is the plane of the diameter of the bore, and your ring, placed in the same plane, will show the cylinder to be round, as stated in our answer to J. W. on this page.

J. W. says: You state that the cylinder will be bored true but not parallel with the outside. If this be the case, will the ends of the cylinder be faced off truly with the central line of the bore, or with the outside of cylinder, supposing it to be done with the same tool? A. The end face of the cylinder will be true with the center line of the bore, that is, at a true right angle with the center line.

F. D. asks: What are the dimensions and details of Gramme's electric machine? A. It is impossible to answer this question, as there are none of these machines as yet in this country, the one ordered for the Stevens Institute having not yet arrived. When it does, we shall be glad to furnish the information desired.

A. B. E. L. asks: How can butter be kept fresh? A. The usual method employed is that of keeping the butter in a cool place in a receptacle, airtight or nearly so. A highly accomplished housekeeper says: Put the butter into a stone jar, cover it thickly with salt. Put a linen cloth over the top, and then fit on tightly a stone cover. Of course, keep in a cool place.

J. J. K. asks: 1. How can I get the greatest power in a steel horseshoe magnet, and what kind of wire should the electro-magnet be wound with? A. By touching it with your electro-magnet as near the base or curve as possible, and gradually drawing it out towards the poles; repeat the operation several times, taking care not to reverse the poles. 2. I have a battery of 12 pairs of Grove cups and an electro-magnet made out of 1/2 inch iron, wound with about 300 yards of silk-covered copper wire of No. 20 gage; all the power I can impart to a magnet of steel (3 inches long, 1 1/2 inches broad, 1/2 inch thick) is to lift itself; it should lift more, but I am stuck; all I can do, it remains the same. A. Your electro-magnet, if properly constructed, ought to answer the purpose. The trouble may be due to poor quality of steel of which your horseshoe is made. 3. Was the English man of war sunk at Hell Gate, New York harbor, about the year 1747, ever visited by a diver, and can it be got at?—[Will some reader, versed in local history, answer this?—Ene.]

L. B. asks: What is a cone pendulum, such as is said to be used for regulating the great telescope at Washington? A. A contrivance resembling one arm of a steam engine governor. It is driven by a turbine and revolves once in two seconds. A 6 inch flywheel is attached to the clockwork, and a brake is applied, by electricity, whenever the tendency is to revolve too fast.

F. A. S. asks: What is the correct proportion of the French meter to the United States foot? A. The meter = 39.370792 feet.

C. W. K. asks: 1. How can I make wax into sheets for making wax flowers, and how can I give it the different colors? A. See p. 50, vol. 30. 2. Does the sun radiate light? A. Yes.

R. A. B. asks: 1. How is blood albumen prepared? A. See p. 41, vol. 24. 2. When is it best to drink blood, as soon as drawn from the ox, or after it has been stirred and the clot removed, as done for manufacturing purposes? A. It is customary to use the blood directly after it is drawn, though the remedy is not prescribed by physicians of standing.

G. B. D. asks: 1. How near does the best electromagnet motor approach the best steam motor in point of economy? A. Steam is many times the cheapest. 2. Is it true that Dr. Page constructed a carriage and propelled it through the streets of Washington by means of electricity? A. Yes. 3. In answer to H. L. C., p. 346, vol. 30, you say the coil should not exceed an inch and a half in diameter; are your readers to understand from this that electromagnets cannot be successfully made larger than 1 1/2 inches, everything being in proportion? A. The question was for a very small motor. 4. How much more per horse power would it cost at the present day to use electricity? A. It has been variously estimated from five to ten times in favor of steam.

R. L. says: I am constructing an astronomical achromatic telescope, but wish to make a terrestrial telescope instead. The achromatic object glass is 2 1/2 inches diameter, and 30 inches focus, and the Huyghenian eyepiece is of a half an inch focus. What should be the dimensions of the other two lenses to make this into a terrestrial telescope, and where should they be situated? A. Place, about 2 inches in front of your eyepiece, two plano-convex lenses half an inch in diameter, one inch focus and two thirds of an inch apart, the convex sides facing each other, as in the Ramsden or positive eyepiece. 2. Could I use this astronomical for a terrestrial telescope? A. Yes. 3. Would there be any objection to it other than that of the objects being inverted? A. No.

G. T. W. asks: I. Can you tell me whether sugar dissolved into sirup can have its power of crystallization destroyed, so as to remain uncrystallizable again? How may it be done in a simple way? A. If a solution of sugar be long boiled, it irrevocably loses its property of crystallizing. This prejudicial alteration is effected still more rapidly by the addition to the sugar of 1-20 of its weight of oxalic, citric, malic, or any of the stronger acids. 2. How is printer's gold size made? A. Take 3/4 lb. linseed oil, 2 ozs. gum anini; powder the gum and add gradually to the heated oil. Strain, and mix with vermilion till it is opaque. 3. What is fuchsin? Is it such a substance that it is practicable to apply it to the preservation of meat in a hot climate? A. Fuchsin is the hydrochlorate of anilin, and is used in dyeing. It very frequently contains arsenic. It is not suitable. 4. Is boric acid in small quantities added to food injurious in any way to health? A. Probably it is.

W. M. K. says: 1. There is a difference between a degree of longitude and latitude at the poles; but how much is that difference in miles, and what is the difference at 10° from the poles? A. Longitude is the distance east or west of a given meridian. All meridian lines pass through the poles, consequently there is no such thing as longitude at the poles. Latitude is the distance north or south of the equator; and as the plane of the equator is at right angles to the axis of the earth, the poles are a quadrant's distance (90°) from the equator. A degree of latitude is invariable. A degree of longitude is 1/30 of the earth's circumference at the equator, and constantly decreases as we go towards the poles. At 10° from the poles the diameter of a curve whose plane is perpendicular to the earth's axis is $2(8970 \times \sin 10^\circ) = 31416 = 4381$ miles, or circumference of the circle. $4381 \times \pi = 1204$ miles, or the length of a degree longitude. 2. What is the best proof that the earth revolves on its axis? A. There are several ways of proving that the earth revolves on its axis. Perhaps the simplest way is to fix a telescope in position on a clear night and watch the stars cross the field of view. Or else place yourself behind a pole or other fixed object and notice the stars as they seem to pass behind the object and reappear on the other side. 3. At what place is the Mississippi river the broadest? A. At the mouth. 4. Why are the polar circles and the tropics drawn upon the globe? A. The tropics are two parallels of latitude, one on the north and the other on the south of the equator, over every point of which, respectively, the sun in its daily course passes vertically on the 21st of June and 21st of December in every year. Their latitudes are about 23° 28', respectively north and south. The arctic and two small circles or parallels of latitude 23° 28' from the poles. They indicate the limit or boundary of that region about each pole where the sun is above the horizon during the entire day (24 hours) once in a year. 5. Can there be thunder and lightning without a cloud in the sky? A. There may be thunder and lightning from clouds which are not seen. In that case we see simply the reflection of the lightning upon the sky. 6. What is the proper temperature of a school-room or dwelling to promote health and comfort? A. From 55° to 70° is a good temperature for a schoolroom. 7. Is there any substance that will remove stains of whitelead paint out of carpet or clothing without injuring the fabric? A. Benzine or turpentine will remove white paint stains.

W. N. W. says: 1. I am desirous of heating to redness a piece of platinum wire, 1/2 of an inch and 1/16 of an inch in diameter, by the electric current. I am familiar with the heating effect of the battery current, but do not wish to use this plan. Can I heat the wire by a frictional machine operated by hand? A. Not without considerable expense and large apparatus; besides, they are never free from danger. 2. As I wish to be able to heat the wire in a few moments at any time, I think a magneto-electric machine would be the thing. Economy of space is very important. What are the required dimensions for such a machine? Which method of developing the current will occupy the least space? A. You might use a magneto-electric machine, but we think a small battery would answer your purpose better, such as a Smee, with carbon plates about 10x12 inches. 3. What is the very smallest surface of zinc that will heat the wire? A. About 300 or 600 square inches. 4. How small a magnet and armature revolved by hand will answer the purpose? A. About two feet, and an armature containing about fifty yards of wire; of course the temperature of the wire would depend upon the number of revolutions per minute made by the armature.

R. W. C. asks: 1. What size are toy balloons? A. About 6 inches in diameter. 2. How many pounds will one that contains one cubic foot of hydrogen raise from the ground? A. About 495 grains, supposing the India rubber to have no appreciable weight. 3. How often must they be replenished, if at all? A. There is no rule. It depends upon the rate at which diffusion takes place through the India rubber film. 4. Which is the cheapest way of preparing pure hydrogen, and what is the proportionate yield? A. From zinc and dilute oil of vitriol. Sixty-five pounds of zinc should yield two pounds of hydrogen.

O. O. O. asks: How can I make ordinary exploding powder to hiss or burn slowly? A. Mix powdered charcoal with it.

C. T. asks: How can I clarify beer? A. Take isinglass, finely shredded, 1 lb., pour beer, cider, or vinegar 3 or 4 pints; macerate together till the isinglass swells, and add more of the sour liquid until a gallon has been used. Strain and further dilute. A pound of good isinglass should make 12 gallons. Finings, and 1½ pints finings is enough to clear a barrel of beer.

W. N. J. says: A certain philosopher states that "the moon has either no atmosphere at all, or one exceedingly rare, and not extending more than a mile from its surface. Hence it must be destitute of water, for any liquid on its surface would long since have been dissipated by the heat of the lunar days, there being no atmospheric pressure to check evaporation. If there were any water on the surface of the moon, clouds would certainly be observed at times dimming its face." I ask for information through the SCIENTIFIC AMERICAN, supposing water in the shape of lakes to exist on the surface of the moon, how could evaporation take place, and clouds float, to dim the moon's surface, if there were not an atmosphere having a certain pressure through which vapor could rise and form clouds? A. The elastic force of a vapor which saturates a space containing air or gas is the same as in a vacuum. 2. Does evaporation check by atmospheric pressure, or does this pressure assist evaporation? If the moon has no atmosphere, and water exists to a considerable amount, it would certainly not be dissipated, but heaped up mountain high by the expansion of particles during a day of three hundred hours of intense solar heat, and then subside again during the following long night, and of course escape detection by the closest observers. A. The rapidity of evaporation is inversely as the pressure upon the surface of the evaporating liquid, that is, pressure diminishes evaporation.

P. R.—B's cheap telescope, described in No. 1, vol. 30 of the SCIENTIFIC AMERICAN, is an interesting experiment. You had better buy an achromatic objective, if you can afford it; but, not, save your eye-sight and money.

F. asks: 1. Of what diameter ought a double acting force pump to be for a 2 inch supply pipe? A. Four inches. 2. Should the discharge pipe be of the same diameter as the supply pipe? A. Yes. 3. Must the air chamber of a pump stand upright if the pump be placed at an angle? A. Yes.

E. P. F. asks: 1. If a globe made of sheet metal, 10 feet in diameter, weighs when full of air 1,000 lbs., how much less would it weigh after exhausting the air so to form a perfect vacuum? A. About 40 lbs. 2. What outside pressure would it have to sustain after the air was exhausted? A. 14.7 lbs. per square inch of surface, or about 650,000 lbs. in all.

L. D. says: 1. The balls we have been using in a ball mill are of cast iron, and weigh on an average 24 lbs. each, diameter being 3½ inches. What should be the weight of a solid ball of cast iron of that size? A. About 34 lbs. 2. Is there any difference in the weights of steel and cast iron balls of the same dimensions? A. The steel ball would be about 2 lbs. heavier. 3. Is a life of Robert Fulton published in the United States? A. There are several works on this subject. See our advertising columns for booksellers' addresses.

S. R. asks: How can I cut window glass to an oval shape? I have a glass cutter, but find it will not cut without several failures, breaking plenty of glass. A. Use a good diamond.

D. asks: What will be the volume of steam at atmospheric pressure, evolved in the conversion of any given volume of water, and what the volume of oxygen and hydrogen at same pressure, evolved in the decomposition of the same quantity of water? A. Supposing that a cubic foot of distilled water at 212° Fahr. is converted into steam, and also decomposed into its constituent gases at the same temperature: The volume of the steam formed from this water will be 1,572 cubic feet; the volume of oxygen, 813 cubic feet; the volume of hydrogen, 1,571 feet.

J. E. asks: I saw in your journal a description of a wonder camera; and I have been endeavoring to make one, using an opera glass objective of about 7 inches focus and 1½ inches diameter for a lens, and an argand gas burner. It will throw upon the screen an ordinary card photograph of about 5 feet high pretty fairly, but the image is not distinct enough. What kind of lens and of what size and focus should I use to obtain the best results with an argand gas burner? Will such a burner give light enough, with a proper lens, to make a clear, distinct picture on the screen 5 feet in height? A. Lantern objectives and condensing lenses are described in back numbers of the SCIENTIFIC AMERICAN. Place a number of burners in a straight line, one behind the other, as flame is nearly transparent.

S. N. M. asks: What astronomers have observed any solar eruptions, having an upward velocity of 600 miles a second? When were such observations made? I suppose that 166 miles a second (Professor C. A. Young's statement) is the greatest observed velocity. A. The observations of Professor C. A. Young, September 1, 1871, indicate more than this velocity. At each eruption we see an eruption of hydrogen. Masses of other metals may precede or accompany it in a semi-liquid or gaseous condition. They are not seen in the spectroscopic while we look at one of the hydrogen lines with a wide slit.

A. F. C. says: I have a 3 inch achromatic telescope of 48 inches focus; and with the Huygenian eyepiece I get a power of about 120. How high a power will it stand, and how must I construct the eyepiece? A. Probably 200. Then 48 inches ÷ 200 = 0.24 inch = equivalent focus of eyepiece. Focus of field lens will be twice this, or 0.48 inch. Focus of eye lens will be one third of focus of field lens, or 0.16 inch, and the two plano-convex lenses will be 0.48 - 0.16 = 0.32 inch apart.

I. G. W. asks: 1. I have an achromatic object glass 2 inches in diameter and 36 inches focus. Of what focus and what distance apart should the eye lenses be to obtain the strongest power compatible with distinct vision for a celestial eyepiece? A. Field lens, of three fifths of an inch focus. Eye lens, one fifth of an inch focus. Distance apart, two fifths of an inch. Equivalent focus, three tenths of an inch. Power, 120. 2. What additional lenses, and what distance apart would it be necessary to add to make a terrestrial eyepiece? A. Two Huygenian eyepieces make a good terrestrial one. The lowest power is placed about twice the sum of the equivalent foci of the two eyepieces in front of the other. 3. Is your answer to N. B. in your issue of May 9, you mention the two eye lenses as being respectively ¾ and ¼ inch focus, and the ¼ in its own focal distance within the focus of the other, and further say they will be ¾ inch apart. Is this an error, or should the measurement be from the glass instead of the focus? A. In our reply to N. B. May 9, we should have written "eye lens, ¼ inch focus," as is evident from the context.

A. P. W. asks: 1. Can the vapors of coal oil be condensed by cold water? A. The vapors of coal oil can be condensed by passing them through a tube surrounded by cold water. 2. What kinds of gases are used in gas engines? A. Common illuminating gas mixed with air has been used in gas engines. The mixture is ignited by an electric spark. Some of the hydrogen formed by the ignition united with oxygen of the air, forming water; this produces heat, which expands the gases and drives a piston.

W. M. B. says: I want to paint a disk, 2 feet in diameter, with the seven prismatic colors, in such a manner as to make the surface appear white when I revolve it fast. What proportion of each color must I use? How shall I divide the disk in a proper manner? A. Divide the circumference of your disk into 6 equal parts. Then draw radial lines from the center to each of the 6 points. In the center of the disk, paint a round black spot about 3 or 4 inches in diameter; also paint a narrow black rim on the edge of the disk. In each of the six spaces formed by the radial line, paint the seven prismatic colors; you will thus have six spectra. In a spectrum, the orange occupies the least extent; if, therefore, you make this the unit, the extent occupied by the colors will have the following relation: Violet 4:16, indigo 2:40, blue 2:50, green 2:87, yellow 1:99, orange 1:90, red 3:35.

D. I. F. asks: 1. What is best to kill the effects of nitric acid on the teeth, so as not to hurt the enamel? I have been using said acid on my tongue. A. When the enamel is gone, the dentine is rapidly affected by the secretions of the mouth, especially when the system is not in a healthy condition. Soda is too powerful in its alkaline reaction. Repeated gentle rubbing with a soft brush and a harmless dentifrice like precipitated chalk would be better. 2. How can I detect elder which is not made from apples? A. If you suspect that it is made from oil of vitriol, the latter may be detected, with proper precautions, by chloride of barium.

B. M. K. Jr. says: 1. I constructed a telescope according to the plan given on p. 7, vol. 30, of the SCIENTIFIC AMERICAN. For the object glass I have a meniscus of elliptical form, 1½ by 1½ inches in diameter and 3¼ feet in focus. The eye glass is a plano-convex lens of 1½ inches in diameter and 1 inch in focus. So far I have failed to produce a perfect object. There is a great deal of prismatic color, and the rays of light seem to produce different foci. What do you think is the matter? A. An elliptical lens cannot be properly figured; besides, your objective is not achromatic. 2. As the hole in the tube is circular, does it make any difference of what form the object lens is? A. A diaphragm which cuts off any part of the aperture of an object glass reduces the amount of light passing through it. 3. Can you tell me how to polish a lens that has become scratched? A. To polish a lens, turn a wooden disk with a broad handle to the proper curvature; paint the disk with a mixture of pitch and resin just dried by the thumb nail when cool. Cut grooves across the pitch, dividing it into one inch squares with diagonal grooves across the squares. Warm, and press quickly on the lens with a piece of paper between them. Wash off adhering paper if necessary. Then coat with moist rouge and rub the lens with hypocycloidal polishing strokes while walking round it. Five minutes rubbing will suffice to destroy the figure of any object glass. Herr Steinhell showed us a scratch on a two inch lens which he said would take the workman half an hour to polish out. 4. Will the so-called furniture polish spoil the varnish on a pianoforte? A. No.

C. K. asks: 1. Of what could I make a box, to keep matches on a sheet iron mantle from catching fire? A. Of some poor conductor, such as china, porcelain, glass, plaster of Paris, etc. 2. What is the specific gravity of a piece of elmwood weighing 2 ounces, with a piece of lead attached to it weighing 4 ounces, and how can I find the specific gravity? A. The specific gravity of your piece of elmwood can be found by the following equation: Specific gravity = $\frac{2}{6 + (x + 36)}$, where x equals the sum of the weights of the wood and lead in water. 3. Why is it that some lenses show objects upside down? A. Because their action on light is to bring its rays to a focal point where they cross each other, and for this reason the image appears inverted. 4. How can I make a good battery? A. See p. 375, vol. 30.

S. T. asks: How can I bore a journal box to fit a V-shaped journal, and have it quite true, so that it will be exactly the same angle in each half of the box, and one angle true with the other? Are there any special machines for such purposes? Having only a compound rest lathe, the box must be chucked twice, and cannot be set quite true. A. There are no special tools for such a purpose, but your lathe will answer the purpose by the following method: Set the head of the compound rest to the required angle and bore out the front end of the journal box. Then cross the belt of the lathe so that it will run backwards. Use a tool bent round to the right and bore the back half of the box from the right hand side of the box (that is, the opposite side from which the front end was bored), by which method of procedure the box will only require one chucking and is certain to be quite true. Another method is to turn the tool upside down without crossing the lathe belt, and turn the back end of the box from the right hand side as before, but this renders the tool more liable to spring and jar; the first method is therefore preferable, but the rest requires in either case no alteration of its angle to perform the duty on both angles.

H. P. says: I have a cedar tank for rain water for washing purposes, and the water is foul, smelling principally of cedar, mixed with stale or stagnant smells. What shall I do to renovate it? A. We have seen the following recommended: Sprinkle a tablespoonful of powdered alum in a hogshead of water stirring the water at the same time, then let the water stand for a few hours. If, upon trial, this should not be satisfactory, let us know what results you do obtain, and a method suited to the requirements of this case will be recommended.

J. A. asks: Can you tell me of any preparation (except blanching and rose water) that can be used for whitening a clown's face, and which will not be injurious? A. We do not know of any that will answer as well.

C. P. says: I am a manufacturer of paper goods and use many different knives. Can you favor me with a recipe for a mixture that I can apply to the interior of the knives that will cause the paper to leave them freely, and yet not soil the paper? A. We have applied to a number of paper houses but find that they use nothing for this purpose. You had better apply to some practical chemist.

J. N. H. asks: 1. Can you give a recipe for making white ink to write on colored paper with a steel pen? A. One part muriatic acid and twenty parts starch water. Very dilute oxalic acid may also be used. 2. How are rubber hand stamps made? A. A number of manufacturers have been visited, and they all decline to explain their processes.

O. C. K. asks: Can you give me a recipe for a wash, to be applied externally to the skin, to keep mosquitoes away? A. Make an extract of pennyroyal, by boiling in a limited quantity of water for a short time, and when cool add a small quantity of glycerin. We do not know of anything that will remove tattoo marks without injuring the skin.

W. F. asks: How can I make the adhesive fly paper? A. A mixture of molasses and linseed oil will answer.

R. K. asks: Can you give me a good shape of furnace for heating locomotive springs to reset and temper them? A. Make a brick furnace somewhat longer than the spring plates, with the blast entering at the bottom, and the chimney having communication with each end of the furnace. Make coke (for use in the furnace) by banking up coal on a blacksmith's fire and burning the gas out of it, which coke will give you a clear fire in your furnace. The top of the furnace may be made to remove, so as to set thereon a tank of oil for tempering the plates.

J. S. H. asks: 1. What is a cheap, simple, and speedy method of utilizing bones on the farm as manure? A. The following plan has been suggested for utilizing bones: Place them in a large kettle filled with ashes, with about one peck of lime to a barrel of bones. Cover with water and boil. After twenty-four hours, nearly all the bones will be soft enough to be pulverized by hand. The rest may have to be boiled ten or twelve hours longer. When pulverized they will be in the form of paste, and suitable to mix with other manure. 2. What is a good process for converting molasses into vinegar? A. Vinegar may be made by mixing 16 parts of pure water, 1 part of sirup of molasses, and 1 part of baker's yeast at a temperature of about 80° Fahr., and keeping the compound in a warm atmosphere from ten to thirty days. A little old vinegar added on the second or third day will aid the process.

C. J. M. asks: What will make and keep rain water sweet in a clean wooden cistern? I put one bushel of charcoal in each cistern, but it does not sweeten the water. If charcoal is good, how much and how often should it be renewed? A. If your cistern is clean, and the water also when it goes into the cistern, the impurity is due to the vegetable matter taken up from the wood of the cistern. If you use charcoal to purify it, the best way will be to filter the water through it. Alum is a more effectual agent for purifying the water. A drachm of powdered alum to a gallon of water is sufficient. After twenty-four hours the water will be cleansed. All wooden vessels to hold water should be charred inside.

A correspondent says, in reply to W. C. L., who asked in our issue of June 12, how to procure a vacuum in a common bottle: "I would suggest the enclosed plan, a modification of which I have used. Let a represent a cylinder, b a piston, c a hollow piston rod, d a sliding rod for holding stopper, e a stopper, f a bottle, g a stirrup for withdrawing piston, A a discharge cock, i a cap which screws on to the cylinder. The mode of operation is as follows: Remove the cap, i, and fill the cylinder with water, replace the cap (which should be packed with rubber) and, while in this position, withdraw the piston until water appears all around it on the opposite side; also open the cock, A, and allow all air to escape. The apparatus should then be reversed, and placed upon a bracket for convenience in operation, and the space over the piston should be filled to overflowing. The bottle may then be filled and the stopper dropped in and pressed tight enough to keep its place when reversed. The stopper should be ground, as also the bottle, to fit their places. The bottle is then inserted in the cylinder, expelling the surplus water as it enters; and when firmly set, the stopper may be withdrawn by the sliding rod, d, which has a recess at the end to fit it. Now the piston may be withdrawn as quickly as convenient, the cock, A, being opened until the water has all left the bottle, when the stopper may be inserted by the rod, d, and the bottle removed. Solids may be introduced during this operation, and fluids at any time. The success will depend upon the scientific and mechanical accuracy of the operator, as the air must be expelled from the water, and care in manipulating must otherwise keep it out."

H. writes to corroborate I. F. B.'s statement concerning the water in the Humboldt and other valleys of Nevada being of a uniform level at various points in the valley, and that, if the streams were straightened and the level lowered by drainage, the frosts and damp and chilly nights would disappear, and farming be much more successful. "I have often observed the same fact in every portion of Nevada and in some parts of California, while here in Montana, we find that the water is never found lower than our streams, rising and falling with them, and in no month of the year can we be sure that we will not have frost. My experience, however, would lead me to differ from him very materially as to the cause and use of different means for the protection of vegetable life. I claim that the air is too dry. It allows the heat from the land to radiate into space with very little or no resistance. I think that I. F. B. will be aware of this, that we are more liable to have severe frosts after a hot, dry day than after a cold and damp one, and more liable in a clear, still night than a cloudy or windy one. I have suffered intensely from heat two hours before sundown in some of those Nevada valleys, while two hours after it I was suffering just as much from cold. The air was very dry, allowing the heat of the sun to pass through it without resistance, and making the earth very hot; and when the sun was set off, it would return with equal rapidity over the same free road. I think this is in accordance with Professor Tyndall's thorough and carefully conducted experiments on the subject (See Lecture IX, p. 375, of his work, "Heat as a Mode of Motion"), and I think that he gives us the true theory of frosts in the same work, p. 418. I would say it is

the custom here when we anticipate a frost to irrigate or run the water quickly over the surface if possible. I have frequently saved my garden from frost when everything was cut down more or less around it, and that under circumstances that cannot all be accounted for in any other way than that the vapor rising forms a mantle or covering, preventing rapid radiation and thus saving the plants. There are many of your western readers that are deeply interested in this question. Agriculture in the mountains is fast becoming an important industry, and our great bases are early and late frosts. Perhaps some other readers could throw additional light upon the subject."

S. P. says, in answer to S. C. H., who wishes to mount a drawing on a paper background, and then varnish the surface: Paste the drawing on the background. Flour paste is as good as any; and when it is dry, size the surface with a solution of gum arabic or white glue. When that is dry, use any varnish you please. For a delicate picture or drawing, dammar varnish is the best; but it must be applied rapidly to secure an even surface.

M. R. H. asks: How can I render hard, and unaffected by heat, beechwood lasts which are daily subjected to 12 hours dry heat at a temperature of 290° Fahr.? Common wooden lasts, undergoing this treatment, in a few months become dry and almost charred the edges break off and they are unfit for use.—C. L. asks: What is the best way to can green corn and green peas?—H. J. asks: Is animal life visible, by the use of the microscope, in the water from hot springs as well as in cold water?—A. E. R. asks: 1. How can I cover the glazing on potter's ware with silver or mercury, so as to make it a reflector of light? 2. Of what is the ash which remains after lead has been heated above melting point for about twelve hours, composed?—H. D. M. asks: How can I apply paraffin to make canvas waterproof? What shall I put in the paraffin to make it of a dark color?—S. C. H. asks: How can I prepare mocking birds' food?—J. A. J. asks: How can I make an aquarium?—W. E. L. asks: How can I line iron water tanks, to prevent rust in the water?—G. O. C. asks: How can I remove the blue color from polished steel?—H. D. M. asks: How can I clean petroleum barrels, so as to make them fit for holding ether, etc.?

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 F. E. M.
On Aerial Navigation. By G. W. M.

Also enquiries and answers from the following:

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

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 mullage? 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 30, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Adding machine, C. C. and J. B. Moore	152,670
Agricultural implement ferrule, W. H. Bowman	152,654
Air compressor, W. S. Deeds	152,668
Air in rooms, cooling, R. W. Sanborn	152,519
Alkalies, putting up caustic, Herman & Holman	152,634
Auger, earth, W. Sautin	152,522
Bale tie, cotton, J. M. Goldsmith	152,450
Baling plastering hair, W. R. King	152,503
Barrel head, O. Judge	152,605
Bedstead fastening, W. H. Elliott	152,621
Blige water gage, J. D. Leach	152,601
Blinder, temporary, H. A. Behn, Jr.	152,530
Blinder, temporary, J. Bennett	152,433
Boiler grate, steam, J. Sanders	152,622
Boot heels, burnishing, E. H. Downing	152,472
Boot seam, rubber, E. B. Stimpson	152,704
Boot soles, burnishing, Weeman & Dunnell	152,544
Bridge, iron truss, E. Humberle	152,689
Buckle, H. W. Sanborn	152,545
Buckle, G. W. Bradford	152,455
Buckwheel, cleaning, D. Pease	152,679
Burg for casks, R. Pentlage (r)	5,907
Burner, gas, T. F. McHann	152,568
Burner, lamp, S. W. Fowler (r)	3,849
Cages, mat for bird, L. A. Singer	152,526

7,500.—MONUMENTS.—A. E. Perrin, Central Falls, R. I.
 7,510.—PAPER CLIP.—D. F. Smith *et al.*, Haverhill, Mass.
 7,511 to 7,513.—FOUNTAINS AND VASCS.—W. Tweeddale
et al., Brooklyn, N. Y.
 7,514 and 7,515.—STOVES.—J. Benner, Philadelphia, Pa.
 7,516 and 7,517.—LABELS.—J. D. Frary, New Britains, Conn.
 7,518.—THERMOMETER BACK.—G. Gano, Cincinnati, Ohio.
 7,519.—RANGE.—J. Martino, Philadelphia, Pa.
 7,520 to 7,522.—OIL CLOTHS.—C. T. Meyer *et al.*, Bergen, N. J.
 7,523.—HEAD LIGHTS.—J. Radley, Brooklyn, N. Y.
 7,524.—BAND COMB.—W. Mullico, Chesterfield, Pa.

TRADE MARKS REGISTERED.

1,837 to 1,854.—GLUE, ETC.—Baeder & Co., Philadelphia, Pa.
 1,855.—WEARING APPAREL.—Caswell & Co., Hartford, Ct.
 1,856.—TOBACCO.—Frislimuth & Co., Philadelphia, Pa.
 1,857.—LUBRICATING OIL.—A. B. Hlaman, Detroit, Mich.
 1,858.—HORSE BRUSHES.—C. W. Maguire Brush Co.,
 Brooklyn, N. Y.
 1,859.—IRON ORES.—York Co. Iron Co., Pa.
 1,860.—WROUGHT IRON & STEEL.—York Co. Iron Co., Pa.
 1,861.—REFINED LARD.—W. J. Wilcox & Co., N. Y. city.

SCHEDULE OF PATENT FEES.

On each caveat.....	\$15
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

JULY 10 TO 8, 1874.

3,590.—J. Corbett, Hartford, Hartford county, Conn.
 U. S. Improvements in registering ticket punches,
 called "Corbett's Improved Registering Ticket Punch."
 July 6, 1874.
 3,591.—A. Jeffery, Guelph, Wellington county, Ont.
 Improvement in looking glass holder, called "Jeffery's
 Improved Looking Glass Holder." July 6, 1874.
 3,592.—P. Trudeau, Ottawa, Carleton county, Ont.
 Améliorations aux établis de menuisiers, dit "Etablis
 Trudeau." (Improvements in Joiner's Bench.)
 July 6, 1874.
 3,593.—R. B. Underhill, Corinth, Alcorn county, Miss.
 U. S. Improvements in apparatus for extracting cof-
 fee, called "Underhill's Improved Coffee Extractor."
 July 6, 1874.
 3,594.—J. Young, Goderich township, Huron county,
 Ont. Improvements in couplers for coupling the rods
 or shafts of threshing machines and other machines,
 called "Young's Safety Coupling." July 6, 1874.
 3,595.—J. E. Sanders, New Bedford, Bristol county,
 Mass., U. S. Improvement in flower pots, called
 "Sanders' Improved Flower Pot." July 6, 1874.
 3,596.—J. Davis, St. Paul, Ramsey county, Minn., U. S.
 Improvements in pipe stems, called "Davis' Pipe
 Stem." July 5, 1874.
 3,597.—M. Bryant, Northport, Suffolk county, N. Y., U. S.
 Improvement in windlasses for presses, called "Bry-
 ant's Improved Windlass Press." July 6, 1874.
 3,598.—L. B. Bishop, Horton, Nova Scotia. Improve-
 ment on a machine for spinning wool and cotton,
 called "Bishop's Improved Spinning Wheel." July 6,
 1874.
 3,599.—J. H. Stetner, Albany, N. Y., U. S. Improve-
 ments on fire extinguishers, called "Stetner's Repeat-
 ing Fire Extinguisher." July 6, 1874.
 3,600.—F. R. Smith, Bennington, Bennington county, Vt.
 U. S. Improvements in bed springs, called "F. R.
 Smith's Bed Spring." July 6, 1874.
 3,601.—J. Brooks and A. Bourassa, Coaticook, Stanstead
 county, P. Q. Washing machine, called "Brooks &
 Bourassa Lightning Washing Machine." July 6, 1874.
 3,602.—W. Clark, Brampton, Ont. Useful clothes line,
 rope, and other fastener, called "Clark's Clothes Line,
 Rope, and other Fastener." July 6, 1874.
 3,603.—J. H. Wentworth, Boston, Suffolk county, Mass.
 U. S. Improvement in stoves, called "Wentworth's
 Improvements in Stoves." July 6, 1874.
 3,604.—Mrs. H. R. Tracy, New York city, U. S. Improve-
 ments in sewing machine cabinets, etc., called "Mrs.
 H. R. Tracy's Sewing Machine Cabinet." July 6, 1874.
 3,605.—D. Ashbury and E. A. Osborne, Charlotte,
 Mecklenburg county, N. C., U. S. Improvements
 apparatus or process for bleaching, washing, making
 extract, and for other analogous purposes, called
 "Ashbury & Osborne's Apparatus and Process for
 Bleaching, Washing, Making Extract, etc." July 6,
 1874.
 3,606.—H. M. Skitsner, Rockford, Winnebago county, Ill.,
 U. S., and L. W. Doty, Marengo, McHenry county, Ill.,
 U. S. Improvements on sulky or riding plows, called
 "The Skinner Riding Plow." July 6, 1874.
 3,607.—M. May and F. May, Springfield, Clark county,
 O., U. S. Improvements on clothes wringing machines,
 and benches therefor, called "May's Wringing and
 Wash Bench." July 6, 1874.
 3,608.—C. Wheeler, Jr., Auburn, Cayuga county, N. Y.,
 U. S. Improvements on combined or interchangeable
 reaping and mowing machines, called "Wheeler's Com-
 bined Reaping and Mowing Machines." July 6, 1874.
 3,609.—W. N. Whiteley, Springfield, Clark county, O.,
 U. S. Improvements on machines for reaping and
 mowing, called "The Champion Harvester." July 6,
 1874.
 3,610.—J. W. Cuthbertson, Brantford, Brant county, Ont.
 Improvements on the mops used for scrubbing floors,
 etc., called "Cuthbertson's Self Wringing Mop." July
 8, 1874.
 3,611.—A. Burbank and H. E. Shaffer, Rochester, Monroe
 county, N. Y. Improvements on lamps, called "Bur-
 bank's Kerosene and Air Light." July 8, 1874.
 3,612.—J. Hughes, Bloomington, McLean county, Ill.,
 U. S. Improvements in machines for repairing boiler
 flues, called "Hughes' Machine for Repairing Boiler
 Flues." July 8, 1874.

Advertisements.

Back Page - - - - -	\$1.00 a line.
Inside Page - - - - -	75 cents a line.

Engravings may head advertisements at the same rate per
 line, by measurement, as the letter press. Advertisements
 must be received at publication office as early as Friday
 morning to appear in next issue.

ADJOURNED SALE.—The Sale of the

Manufacturing property at Belvidere, New Jersey,
 which was advertised for June 12th, stands adjourned
 August 5th. For particulars, see advertisement on
 page 5th.

WILL EXCHANGE—2d hand Machinist Tools for 12 or 14 in. Shaper, Horizontal Boring Mill, or Radial Drill. **THE STILES & PARKER PRESS CO., Middletown, Conn.**

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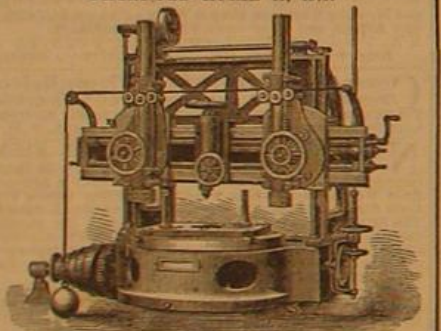
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Rotary Sharers for Milling, Horizontal Boring, Gear, Slot, Key Seat Cutting, &c. &c. Iron Planers, Self-feeding Hand Drills, Expansion Boring Bars for Lathes, Drill Presses, and Boring Mills. Twist Drill Grinding Machines, for all sized Drills—Grinds both cutting edges and clearance mathematically true. Send for Photograph, &c., to C. VAN HAAGEN & CO., 2311 Calhoun St., Philadelphia, Pa.

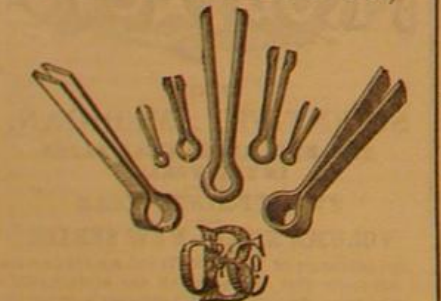
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SCHAEFFER & BUDENBERG, Magdeburg, Germany
Steam Gauges, etc. W. HEUFEMANN, 4 Cedar St., N. Y.

DAMPER AND LEVER
REGULATORS **BEST** GAGE COCKS.
MURRILL & KEIZER, 44 Holliday St. Balt.

THIRD LOUISVILLE INDUSTRIAL EXPOSITION.



OPENS SEPTEMBER 1st, 1874—CLOSES OCTOBER 17th.

Arrangements have been perfected to make the Exposition of 1874 the GRANDEST DISPLAY OF ART, INVENTION, MACHINERY AND PRODUCTS EVER SEEN IN THE UNITED STATES.

Space, Power and Shading free to Exhibitors. For full information, address E. A. MAGINNESS, Sec'y, Louisville, Ky.

SEE EMERSON'S INSERTED TOOTHED SAWS. AS ARE SAME PRICE OF SOLID TOOTHED SAWS. AS WE WARRANT THEM SUPERIOR TO ALL OTHER SAWS. AS SEND TO EMERSON FORD & CO. BEAVER FALLS PA. FOR A CIRCULAR OF OUR SAWS. AS

Working Models
And Experimental Machinery, Metal, or Wood, made to order by
J. F. WEHNER, 6 Center st., N. Y.

TO INVENTORS AND MANUFACTURERS

The Managers of the 42d Exhibition of the American Institute, of the City of New York, beg to announce, that the Exhibition Buildings on 23 and 24 Avenues and 43d and 44th Streets, will be open for the reception of heavy Machinery August 17th and for other articles, August 21st, 1874. The Exhibition will be formally opened September 2d.

For particulars, address "General Superintendent, American Institute, New York."

HOUSTON'S PATENT TURBINE WATER WHEEL.

Simplest, Strongest, Cheapest, Best.

In the test at Holyoke, in 1872, the Houston gave the highest percentage ever shown in a reliable test and the highest average results ever obtained. In practical use it is every where demonstrating its superiority over all others. Emerson's full report furnished on application. Send for Circular.

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IRON WORKS,
Belmont, Wisconsin.

PATENT EXPANSION BORING BARS—Vertical or Horizontal Boring Mills.
C. VAN HAAGEN & CO., Philadelphia, Pa.

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STEEL CASTINGS.
Solid and Homogeneous, guaranteed to stand a Tensile Strain of 25 Tons per Square Inch. An invaluable substitute for Expensive WROUGHT IRON FORGINGS or for Iron Castings, where great strength is required. OFFICE—CON. EVELINA AND LEVANT STREETS, PHILADELPHIA. Send for Circular, Price List, &c.

HOISTING Machinery,

Crane Bros. Mfg. Co.,
CHICAGO.

PATENTS Bought, sold, and introduced.
F. T. H. RAMSDEN, Mechanical Engineer, Bryan Block, Chicago, Ill.

EDISON'S INDUCTORIUM—A powerful electrical induction coil for giving shocks. Useful for medical purposes and amusement. Price only \$100. DOLLARS. Sent, C.O.D., by express. Send for circular. EDISON & MURRAY,
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Protect Your Buildings

WITH GENUINE

FIRE AND WATER PROOF PAINT.

Notar is used in this composition, one coat of which is equal to six of ordinary paint, and **STOPS EVERY LEAK.** Filling up all holes in shingle, felt, tin or iron roofs; never cracks nor scales off; and is only 80 cents a gallon, ready for use, with a liberal discount to the trade. Two gallons will cover 100 sq. ft. of shingles, or over 400 sq. ft. of tin roof.

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Emery Wheels **TANITE** Emery Grinders
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"THE EMERY GRINDER,"
A Mechanical Journal of general interest, issued monthly, at the nominal price of 50c. per annum.
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From the best London Manufacturers. For sale by JAMES BRAND, 55 CHURCH ST., N. Y.
A Practical Treatise on Cement furnished for 25 cents.

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EDISON'S INDUCTORIUM—A powerful electrical induction coil for giving shocks. Useful for medical purposes and amusement. Price only \$100. DOLLARS. Sent, C.O.D., by express. Send for circular. EDISON & MURRAY,
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DOUBLE ACTING BUCKET-PLUNGER
Steam Pumps
ALWAYS RELIABLE.
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The simplest, most durable and effective STRAIN PUMP now in use. Will pump gritty or muddy water without wear or injury to its parts. It cannot get out of order.

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Stationary and Portable, to 60 H. P., kept in Stock; also, Circular Saw Mills and Power Hammer.
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More than four times as many of James Leffel's Improved Double Turbine Water Wheels in operation than any other kind. 24 sizes made, ranging from 24 to 96 inches diameter, under heads from 1 to 240 feet. Successful for every purpose. Large new pamphlet, the finest ever published, containing 120 pages and over 30 fine illustrations, sent free to parties interested in water power.
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SCIENTIFIC AMERICAN

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

Vol. XXXI.—No. 6.
(NEW SERIES.)

NEW YORK, AUGUST 8, 1874.

\$3 per Annum
IN ADVANCE.

NEW GRANARY AT BRISTOL, ENGLAND.

We present herewith an engraving of a building (lately erected at Bristol, England), which is a favorable specimen of highly ornate architecture applied to commercial purposes. The ground being defective for so heavy a structure, a layer, 6 feet thick, of ground brown lime concrete was spread over the whole site, and upon this platform the external walls were erected, to the great height of 100 feet. The building is 95 feet long, 45 feet wide, and contains ten stories. The lowest story is used as one large bonded cellar, a portion of the top story for an engine room, and all the rest of the building for storing grain, and it will contain 96,000 bushels.

There are only nine internal supports for the granary floors, and this leaves the large floor space unusually free of pillars. The external walls are faced with the hard Cattybrook bricks, and advantage has been taken, of the necessity of obtaining a large surface for the introduction of air into the granary, for ornamenting the lower portion of the window openings with open patterns in brickwork. The great difficulty experienced in designing the usual external lifts and external doors on each floor, for the introduction and delivery of grain, has been avoided by arranging the lifts in niches at the angles of the building, and by delivering the sacks of grain into carts upon movable skids, sliding out of the round holes under the first floor string course. The cost of the building was \$30,000.

Facts about Storms.

From the United States weather maps for 1872-3, Professor E. Loomis has made an extensive series of deductions, deriving many interesting facts, from which we take the following:

The average direction of the storm paths for two years was N. 82° east, or 8° to the north of east, and the average velocity was 25.6 miles per hour; but there is a noticeable variation, both in the direction and velocity, depending upon the season of the year. The course of storms is most southerly in summer, and it is a little less northerly in winter than it is in spring or autumn. July is the month in which the course is most southerly, and October is the month in which it is most northerly, the mean difference between these two months amounting to 23°. The velocity of progress is greatest in winter and least in summer.

The diversity in respect to the velocity of progress of particular storms is still greater. In some cases a storm center has remained sensibly stationary for 24 hours, and occasionally still longer, while in four cases a storm center has advanced over 1,200 miles in 24 hours, and in one case, May 15, 1872, the average velocity for 24 hours amounted to 57.5 miles per hour. Thus the velocity of progress ranges from zero to 57.5 miles per hour.

The storm path may have every possible direction, and the velocity of progress may vary from 15 miles per hour

toward the west to 60 miles per hour toward the east.

The fall of rain appears to have a decided influence in modifying the course of a storm path.

Every considerable depression of the barometer is accompanied by a fall of rain, and the area of rain fall usually extends further on the eastern side of a storm center than it does on the western side. The average extent of the rain area on the east side of the storm's center is 500 miles.

The fall of rain, that is, the precipitation of the vapor of the atmosphere, is generally accompanied by a fall of the

barometer. According to the theory advocated by the late Mr. Espy, when the vapor of the atmosphere is condensed, its latent heat is liberated, which raises the temperature of the surrounding air, causing it to expand and flow off laterally in all directions in the upper regions of the atmosphere, thus causing a diminished pressure over the region of precipitation, and an increased pressure on all sides beyond the area of the rain.

The progress of the storm eastward is not due wholly to a drifting, resulting from the influence of an upper current of the atmosphere from the west, but the storm works its own way eastward in consequence of the greater precipitation on the eastern side of the storm. Thus the barometer is continually falling on the east side of the storm and rising on the west side, in consequence of the flowing in of colder air upon that side. The stronger the wind on the west side of the storm, the less is the velocity of the storm's progress.

Some persons might have anticipated that an increase in the velocity of the wind in the western quadrant of a storm would have the effect of driving the storm eastward more rapidly; that is, of increasing its velocity. But upon each side of a storm's center the wind blows obliquely inward, and hence we must infer that in the central region of the storm there is an upward motion of the air; and this is the cause of the precipitation of vapor, that is, the cause of the rain fall. An increase in the velocity of the wind in the western quadrant is accompanied by an increase in the velocity of the upward motion in this quadrant, that is, an increase of precipitation. This increased precipitation of vapor tends to depress the barometer on the western side of the storm, that is, tends to retard the eastward motion of the



NEW GRANARY AT BRISTOL, ENGLAND.

storm's center; and this cause may operate with sufficient force to carry the storm's center westward, as actually happened in several instances in the years 1872 and 1873. On the other hand, an increase in the velocity of the wind in the eastern quadrant tends to produce a greater precipitation on the eastern side of the storm's center; that is, tends to push the storm's center eastward, or increase the velocity of its progress.

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
One copy, three months.....	50 00
CLUB RATES (Ten copies, one year, each \$2 50.....)	25 00
(Over ten copies, same rate, each.....)	2 50

VOLUME XXXI, No. 6. [NEW SERIES.] Twenty-ninth Year.

NEW YORK, SATURDAY, AUGUST 8, 1874.

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THE SIMULTANEOUS PERCEPTION OF SOUNDS.

The celebrated German physicist Helmholtz has, in his *Physiological Theory of Music*, made some modifications in various points of the hypothesis by which he accounts for the functions of our organs of hearing.

It will be remembered that, in the process of hearing, the sound waves of the air are collected by the outer ear which is peculiarly adapted by its form to concentrate them. The waves then pass along a canal to the tympanum or drum, which they vibrate. This vibration is communicated by a chain of bones to the membrane covering the *foramen ovale*, by which it is passed to the fluid contents of the inner ear and thus reaches the nervous surface which transmits to the brain the sensation of sound. It is not difficult to understand how the liquid in the inner cavities may be thrown into vibrations of which the durations are the same as those in the outer air, while the amplitudes are proportional, if acted upon by sound waves coming from a single source. But when we consider that the vibrations of so small a quantity of air as that contained in the auditory canal, transmitted to the still smaller surface of the inner ear, suffice to convey a perfect perception of the most complicated exterior phenomena, then the mystery begins. During the passing by of a military band, for example, we hear not only sounds emitted by the instruments, but the rolling of carriages, the voices of the crowds, the rustling of the leaves of trees, and innumerable other noises, all clearly distinguishable.

The eye, it is true, can regard an extended view or a multiplicity of subjects, but its perception is successive; it glances quickly from point to point and thus embraces all, but the ear recognizes a number of sounds simultaneously.

To understand the theory by which Professor Helmholtz explains the phenomenon, it is necessary to consider the oscillations of a pendulum. It is well known that a suspended body, even if of considerable weight, may be set in motion, by slight successive impulses, provided the latter be properly timed. These impulses must be repeated at equal intervals, and, in the case of a pendulum, act in the same di-

rection as the movement of the body, determined by gravity, which is the motor force. Otherwise their effect will be to stop the motion rather than to accelerate it. Hence the interval of time which separates two consecutive impulses must be equal to the duration of an oscillation of the pendulum or to a multiple of such duration. Suppose a number of pendulums of different lengths be arranged in regular succession in the same vertical plane, as shown in the accompanying diagram. With a rigid horizontal rod, imagine

the experimenter to strike all these pendulums in some particular rhythm. It is evident that such pendulums of which the times of vibration are equal to the interval between two successive blows, or to a submultiple of such interval, will oscillate. To all others the cadence of the rod will be in opposition, and they will hence stop and remain at rest. The same result takes place if sonorous cords, each having its own duration of oscillation, be substituted for the pendulums. Suppose that in the internal ear a great number of nervous fibers exist, the movements of which correspond to a determinate impression for each one. If the liquid vibrates during a certain period all the fibers having a corresponding time of oscillation will be set in motion; and a combination of impressions will result, peculiar to a given vibration, and different for any other. Such in brief is the theory by which Helmholtz explains the perception of simultaneous sounds, harmonies, the production of beats, and in fact all the phenomena due to audition. The probability of the truth of this view is strengthened by the fact that the internal ear does contain a great number of organs which appear to be suitably disposed in order to serve as vibrating fibers. In the first edition of his work, Helmholtz believed that the nerve prolongations, known as the organs of Corti, fulfilled the purpose, but in subsequent editions he has renounced this idea, since Hasse has proved that the Corti fibers do not exist in amphibious animals. Among the membranes, however, in the interior of the inner ear, is one known as the basilar, which is ruptured with difficulty in a direction longitudinal to its fibers, while it yields readily to force applied in a perpendicular direction to the same. Helmholtz now considers the fibers of this membrane to act as a series of juxtaposed cords, and the variation in the length of the fibers (since Hensen has proved that the breadth of the membrane increases from one extremity to the other in proportion of one to twelve) tends to confirm the hypothesis.

M. G. Guérolt, the French translator of Helmholtz' work, suggests that the Corti fibers may serve the purpose of dampers, but adduces no experiments or other proof in support of the idea. An exhaustive comparative examination of the auditory mechanism in various animals, by means of the microscope, would doubtless show which organs are everywhere necessary to audition. Besides, as there appears to be a relation between the auditory faculties and the pitch of the voice of animals, the detailed comparison of the ears of those having deep voices with the similar organs of others having voices of a high pitch would probably elicit curious and valuable results.

THE AQUARIUM.

One of the first principles, in constructing a tank for an aquarium, is to give the water the greatest possible exposure to the air. The simple rectangular form is the best. This is generally constructed of iron and glass; the iron should be japanned, and the glass be French plate, to insure brilliancy and strength. The breadth and height of the tank should be about one half of the length. Cheap tanks can be made of wood and glass, the frame and bottom being of wood, and the sides of glass. In order to make the joints watertight, care must be taken to get a proper aquarium putty or cement. The following is a good recipe: Put an eggcupful of oil and 4 ozs. tar to 1 lb. resin; melt over a gentle fire. Test it to see if it has the proper consistency when cooled; if it has not, heat longer or add more resin and tar. Pour the cement into the angles in a heated state, but not boiling hot, as it would crack the glass. The cement will be firm in a few minutes. Then tip the aquarium in a different position, and treat a second angle likewise, and so on. The cement does not poison the water. It is not advisable to make the aquarium of great depth; about eight inches of water is sufficient. In regard to the light, great care must be taken. Too much often causes blindness, and is a common source of disease. The light fish receive in rivers comes from above; and an aquarium should be constructed so as to form no exception to this rule. All cross lights should be carefully avoided, at least if the light is very strong. Never place the aquarium in front of a window so that the light passes through it; for, when viewing an aquarium, the source of light should come from behind us. Not enough light is as injurious as too much, and causes decay of the vegetation. Having constructed a watertight aquarium, the bottom is strewn over with clean sand to the depth of 1 to 3 inches, on this a little gravel is spread; then a few stones or rockwork. Heavy large rocks should be avoided; they displace a large amount of water and increase the danger of breaking the glass sides. Pumicestone, well washed, is the best kind, being light and with a rough surface suitable for the rooting of plants, etc.; and if fancy forms are desired (bridge work, etc.), the pumicestone can be cut quite easily to the desired shapes. The plants are rooted in the sand and the vessel left at rest for a week for the plants to vegetate. The following plants will be found useful: *Utricularia inflata*, *Utricularia vulgaris*, *Myriophyllum spicatum*, *Anacharis Canadensis*, and *Hottonia inflata*.

In obtaining plants, procure all the roots and see that they are well rooted. If fungus should form, add snails (*Planorbis trivolvis*); they will completely destroy it. After the plants are well started, add the shells and amphibious animals. The following shells will be found desirable: *Planorbis trivolvis*, *Physa heterostrophus*, *Unio complanatus*. Many shells are not needed. Snails act the part of scavengers; and where the different elements of an aquarium are rightly balanced, two or more snails will be found sufficient.

If amphibious animals are introduced, the rock work must extend above the surface of the water, or a float of some kind must be substituted. It is impossible for them to live under water all the time, and they would die without some such arrangement.

The turtles claim first rank. The *emys punctata*, or spotted water turtle, and the *chrysemys picta*, or painted water turtle, will be found to be the best for the aquarium, and should be procured when very young, as they are very destructive when old. The tritons (*triton tigrinus*, *triton niger*), the red salamander, the cray fish (*astacus bartoni*), are all suitable, and present a very odd and yet a very natural look to the aquarium.

In selecting the fishes, there is no boundary to the number to be obtained, but experience has proved that comparatively a few only thrive in confinement. Among these, and the first, is the gold fish. He can live for months without introduced food, and is, without comparison, the most hardy, standing remarkable changes in the temperature; and he is the most gaudy and attractive. A large number of the fishes prey upon each other, and will only do for the aquarium when in the young state. Among these may be mentioned *pomotis vulgaris*, or sun fish, *caox reticulatus*, or common pickerel, and *perca florescens*, or yellow perch. The *leuciscus pygmaeus*, or rock fish, is a great addition, and is found very plentifully in our streams. The *pimelodus atrarius*, or common black catfish, is another worthy of a place. So also is the *hydrargia diaphana*, or transparent minnow. But few fish can live in an aquarium; and the needless crowding together, so often seen, is very hurtful to health, and causes strong fish in a short time to become weak and poor. The great difficulty in keeping an aquarium is to secure enough oxygen for the fish. To a slight degree, it is the duty of the plants to supply this; but if too much vegetation be present, decomposition takes place and ruin follows. It has been demonstrated that only a small amount is necessary to absorb the carbonic acid given off by the fish and amphibians; consequently, if the water be daily aerated with a syringe, it will absorb an abundant supply of oxygen for the animal life, and the trouble arising from the decay of much vegetable matter will be lessened or altogether avoided.

THE PRACTICAL MAN.

He sat beside us in a street car. He looked over our shoulder at the new copy of the SCIENTIFIC AMERICAN, which, fresh from the press, was receiving our final scrutiny, and requested the loan of the paper for a moment when we had finished. He glanced at the first page, skimmed over the middle, and peeped into the inside.

"I suppose that paper interests a great many people," he remarked.

We modestly signified our assent, and murmured something about forty odd thousand.

"Wall, it doesn't me," he interrupted sharply. "It doesn't take no books or papers to learn me my business, you know. Never learned nuthin from books in my life. Didn't have but a quarter's schoolin, and then I went into the shop. Served my time with old Pete Reynolds, of Boston. You know'd him, mebbe; dead now. Was his foreman; now I'm boss of my own works in the city. I'm a practical man, I am. All yer hollergerys and hoserphys may do well enough to write about; but they ain't no sort'er use in the shop. They just git inter mens' heads, and set'em a thinkin about other things than their work, and then they git inventin', and that's the last of 'em. Why, I had a likely young feller, who used ter buy that paper, and read on it, dinner hour. Sometimes he'd stick it up on his lathe, until I stopped that, mighty sudden. Wall, one day I caught him scribblin' with a piece of chalk on a bit of board; then I know'd the invention fit had got hold of him, and that he was a gon'er. A few weeks after he comes to the office, and says be: 'Boss, I've got a little arrangement here that'll make the old lathe do better work,' and he out with one of them reg'lar printed paytents, and showed me a new attachment for making gearins, and sich. 'Wall,' says I, to humor him, like, 'sonny,' says I, 'you can go make yer masheen and set it up on the lathe, if yer wanten.' But the ungrateful villin began to say something about royalty and shop rights, and I told the book-keeper to pay him right off and let him clear out. Blow me if he didn't go over to Smith's, across the street, and rig his affair there; and the first thing I know'd, Smith was turnin' out work at half my prices. Then I had to go find that feller, and pay him his blamed royalty, and a heap it was too."

"Now, there was a good hand just spiled by a readin'; if he'd a let that ere paper of your'n alone, he might ha' been a good, stiddy man, gittin his three dollars a day comfortable and reg'lar. Now they say he's makin stamps by thousands, but he's spiled. Wont be worth nuthin ever fer work agin. Where'd I have been if I'd pegged away at books and nooze-papers—eh?"

Our practical friend did not wait for an answer; for while we were cogitating a suitable response, he suddenly made a bolt out of the car and rushed down a side street toward a dilapidated looking edifice, which, we conjectured, was none other than the "works."

"We want no theorist, we require a practical man." "Where can I find a practical man to take hold of my invention and push it?" How frequently we have heard these remarks! And how often, when we have turned to the speaker and asked for a definition of the term practical man, has a puzzled expression and a lame attempt at explanation, usually ending with "Oh, I know what I mean," been the sole reply!

Our street car friend is one type of the practical man. He is of the "self-styled" variety, the most numerous, probably, existing. He is the least useful as an individual, the least progressive as a brain worker, and the least enlightened as a member of the human race, of any class of civilized mankind. He is a compendium of thumb rules, an epitome of set ideas encircled by the iron barriers of his own mind, which allow of neither the substitution nor admission of better views, nor the expansion of those within. At mere handicraft, he may be skilled; but ask him for a reason, and he is dumb. He it is who leads the van of the shriekers against free and liberal education, who clings to that sophism which argues that the "world is the best teacher," who turns his son directly from the nursery into the shop; who renounces the inventor and all his works, until compelled, by absolute force of circumstances, to yield to progress; and finally, who, having no knowledge other than his manual skill and set of thumb rules, scorns it in others.

"But we want no longhaired philosophers to run our shops," possibly thinks the reader. True, nor need we have them. "Science," says Lord Brougham in his fine definition of the term, "is knowledge reduced to system." The true scientist is he who not only possesses this systematic knowledge, but, if he be so situated as to require its immediate aid, knows how to put it in practice. He is neither the sage who meditates erudite abstractions, nor the *soi-disant* "practical man" who devotes himself to mere system. He is eminently the man of practice, but of intelligent practice, who is a master of principles, of reasons: to whom the mere application of a truth is nothing as compared with the truth itself; the latter immutable, the former an idea to be changed as occasion may require or judgment suggest. Such is the person we mean when we seek the "practical man," not the blatant individual who thrusts himself forward under that title.

Our acquaintance of the street car carried off our paper. He honestly mailed it back to us the other day. We smiled as we saw the thumb marks on all the pages, and opposite an engraving there was a pencil note of: "I know a better plan than this." Perhaps after all a latent idea in his brain has been aroused; or has he taken the invention fit? Should he see this, he will probably scout the idea that our humble efforts have awakened him, for "it doesn't take no papers to learn me my business, you know."

LANGUAGE OF INSECTS AND ANIMALS.

Our notice was lately attracted to the labors of a colony of small black ants, which has taken up its abode in a chink in the wall outside our office window. A solitary ant, evidently on a private foraging expedition, suddenly encountered a scrap of bread, which had fallen on the sill several feet from his home. Instead of nipping off a fragment and carrying it away, the insect apparently made a careful examination of the entire piece and then turned and ran at full speed back to the hole. In an instant hundreds of ants emerged and marched directly to the bread, which they attacked, and very speedily, morsel by morsel, transported it to their dwelling.

Another good instance is that of a terrier dog belonging to a friend, from whom we obtained the facts. The animal somehow, it seems, excited the ire of a larger dog, and accordingly received an unmerciful shaking. Shortly afterward the terrier was seen in close consultation with a huge Newfoundland. The result was that both trotted off together, and found the terrier's assailant, which then and there received a furious thrashing from the Newfoundland, while the terrier stood by and wagged his tail in high glee.

The last case which came under our own observation was that of a brood of very young chickens which, losing their parent, refused to go with another hen but manifested an extraordinary affection for a pair of turkeys almost as juvenile as themselves. The turkeys have assumed all the parental functions, scratching worms for their charges, and gathering them under their wings, while the chickens appear to comprehend the significance of the turkeys' "peep" equally as well as they did the clucking of their natural mother.

In the case of the ants, it is clear that the single insect must have imparted the news of his discovery to an entire community of his fellows; in that of the dogs, the terrier must have made the Newfoundland understand the circumstances of his misfortune and so secured sympathy and assistance; lastly, between the chickens and turkeys, apart from the singularity of the relation, it is curious to remark that the language of one fowl was understood by others of different species.

DEAD CITIES.

To Americans especially the ancient world is little more than an abstraction. Save the relics of the mound builders which dot the prairies of the West, and the occasional discovery of old Indian remains buried here and there in New England, we have little to bring us face to face with evidences of human existence in ages gone by. We study our histories and become familiar with them as we are with the tale of the romancer: we can discuss the Punic wars with as much freedom, perhaps more, than the closing campaigns of the Rebellion; but the new world, except in its sparsely filled

museums, shows us nothing tangible, nothing which we can directly connect as part and parcel of the times and men of historic yore.

But let the old world be visited, and the antiquarian may find the very handiwork of nations which have utterly disappeared. Whether he wander through civilized Europe, half civilized Asia, or barbarous Africa, everywhere are relics of the past, all forming, to the lover of archaeology, a feast, never so rich as at the present day. He may ramble through Spain, and muse over the quaint architecture of Moors, recalling the heroic prowess of the Cid; he may climb that hill jutting into the harbor of Cartagena, and stand in a building reared by the army of Hannibal. He may trace out the Roman camps in Northern England, or the earlier relics of the Druids and Norsemen, or he may roam for hours through the streets of Pompeii, reading the history of everyday life seventeen centuries ago in the marks of the wheels on the pavements, the signs on the stores, or the very bread lying, black and dry, in the ovens. He may watch the laborers as they slowly dig out the loose ashes in a buried room, and will see them stop their work when the floor is almost reached. Then, as we did ourselves one warm summer morning not many years ago, he will see the men carefully grope through the residuum. A shout denotes a discovery, and then very carefully a bar is pushed down into the place where the object is supposed to be. Into the hole thus made, the liquid plaster is poured. A few moments of anxious, curious delay and the spot is again attacked, the ashes thrown quickly upward, and the plaster, now set and hard, withdrawn. Perchance the mold of some household object is produced; sometimes it is a human figure, such as we saw unearthed, which, with its arms doubled over its head, had crouched into a corner for shelter, but only to die there, suffocated in the deadly shower.

Then there are the Syracusan ruins, little visited by the tourist, but overflowing with interest. He may wander past the very walls, cross perhaps the threshold over which Archimedes stepped while pondering the problem, of which when solved, he shouted *Eureka!* (I have it), and rushed naked, through the streets. On some seat of the amphitheater, which he enters, the great inventor may have reclined while devising his burning glass, his levers, and the engines of war with which he routed a besieging enemy. On descending the huge caves hewn from the solid rock, he may marvel at the knowledge of acoustics which dictated to the tyrant Dionysius the building of that labyrinthine passage which so closely counterfeits the duct in the human ear. Clambering up the rough hewn steps, the little closet is before him where the cruel king used to sit and hear the slightest whisper of his captives in the vaults below. The tearing of a scrap of paper sounds there like the rushing of a vast wind, and a pistol report is deafening. Hard by is the circus made famous by the story of the slave Androcles, whom the lion refused to attack because his antagonist had before removed a thorn from a wounded paw. There also is one of the earliest of Christian churches, erst a heathen temple, in the crypt of which are still to be seen the gridiron, the pincers, and the other instruments of torment by which perished the early martyrs of the Church.

The subject is a fascinating one, and, as we write, it looms up before us to such magnitude that the traditional "acres of paper and oceans of ink" would barely suffice to do it justice. But the confines of newspaper space are inexorable. Therefore, with this brief glimpse of the romance of archaeology, we refer the reader to the latest news from the subterranean world, which he will find in the record, of the excavations and explorations now or lately in progress, printed on another page.

SCIENTIFIC AND PRACTICAL INFORMATION.

STRASBOURG GOOSE CULTURE.

Pâte de foie gras, or Strasbourg pie, is an oleaginous luxury, very expensive in this country, and about as indigestible as it is costly. As its name indicates, it is a pie filled with the livers of geese, which are rendered, by peculiar treatment, diseased, and hence abnormally enlarged. To produce the necessary development, the fowls are closely confined by tying, for a period of seven weeks, in dark cellars, during which time they are fed with a paste of maize, chestnuts, and buckwheat. This is stuffed down the throat once in two hours, and the effect is at last to produce an enormous enlargement of the liver, when the fowls are killed, and the livers used as above mentioned.

PULVERIZING THE CHLORATES.

Chlorate of potash and other chlorates are extensively employed in the manufacture of fireworks. The inconvenience, of moistening with alcohol before pulverizing them, and pulverizing wet, may be overcome by employing the following method of Gawalowski: The salt is dissolved in hot water until a perfectly saturated solution; is obtained, when a pane of glass is dipped into the solution; and on taking it out, it is found covered with a layer of fine crystals of the salt. They are scraped off with a paper card on to a sheet of paper, and form a kind of meal. This method is entirely free from danger to the workmen, and a large quantity of the salt is readily prepared in a relatively short time and with very little inconvenience.

ACTION OF SULPHUR PREPARATIONS IN CHRONIC LEAD POISONING.

By the advice of Dr. Liebreich, M. Siew has attempted to chemically combine the lead distributed through the organism, so as to render it harmless. To satisfy himself of the possibility of doing this, he injected subcutaneously some

chromate of lead; and after introducing suitable sulphur compounds, he tested for sulphide of lead at those points. If alkaline sulphides were administered, the red color of the injected tissue remained unchanged; but if a rabbit partook of glycosulphuric acid, which is easily soluble in water, and forms with lead a very insoluble salt which passes off unchanged from the system, then the injected part showed a black spot. Siew considers this to be sulphide of lead, from the reduction of the glycosulphate of lead. That this salt is really reduced by the organism is proved by feeding animals a long time on glycosulphate of lead, when the walls of the stomach are found to be black. He does not state his conclusions.

LIME DEPOSITS IN WATER PIPES.

MM. Fabre and Roche point out that wherever there is a joint in water pipes, made to connect tin conduits or copper faucets, at such points carbonate of lime is most abundantly deposited. If a piece of silver be placed inside in contact with the lead pipe, it becomes covered with the carbonate in a very short time. The investigators find that all metals, electro-negative with relation to lead, are thus affected. A voltaic couple is in fact formed, and a veritable chemical precipitation caused.

TESTING URINE FOR ALBUMEN AND SUGAR.

The following tests by Siebold are so simple that an inexperienced person can employ them for testing urine: In testing for albumen, ammonia is added to the urine until it is slightly alkaline; it is then filtered, made slightly acid with dilute acetic acid, and a portion of the mixture boiled. This portion is compared with the cold portion, when any turbidity is easily detected. In testing for sugar, he employs a modification of Roberts' process, whereby an inexperienced analyst can detect $\frac{1}{10}$ per cent of sugar, while a more experienced person can easily recognize half that quantity. About one and a half or two fluid drachms of Fehling's solution is heated to boiling, and five to ten drops of the urine added. If much sugar be present, a yellow or brick red precipitate is formed. If this does not happen, add 50 or 80 minims more of urine, and set aside to cool. If the liquid is not milky when cold, less than $\frac{1}{10}$ per cent sugar is present.

ANOTHER NILE EXPLORING EXPEDITION.

An expedition is being organized in Egypt for the purpose of examining the geological and physical constitution of the valley of the Nile, and of the land bordering on the Red Sea. The most important question to be determined is the possibility of establishing a branch of the river in the ancient bed of a stream occupying the base, or the valley called by the Arabs the Valley of the Dry River. If this work can be accomplished, a large amount of now waste land will be rendered suitable for agriculture.

NON-INFLAMMABLE SHIPS.

The British Admiralty have lately caused some experiments to be conducted at Plymouth, England, upon wood saturated with a solution of tungstate of soda. These, we understand, have given successful results, sufficient to warrant the construction of two small vessels, one made of ordinary timber and the other of the same material treated with the chemical. Both, when completed, will be filled with combustibles and fired simultaneously, thus submitting the efficacy of the protective substance to a final and crucial test.

PRIMEVAL MUSICIANS.

Another curious relic of primeval man has been discovered, which shows that our very remote ancestors, in addition to being cognizant of the arts of sculpture, drawing, and engraving, were also, in their rude way, musicians. M. Piette has recently found, in a cavern in Dordogne, France, mingled with scraps of pottery, bones of animals, and flint implements, a flute. The instrument is made of bone, and has but two holes, so that it could produce but four sounds. It bears a close resemblance to the similar instruments used by the savages of Oceania.

DANGER IN BAD FLOUR.

From an investigation, recently conducted in Petersburg, Michigan, into the cause of the epidemic of cerebro-spinal meningitis, with which the locality has been afflicted during the past spring, there appears ground for ascribing the prevalence of the disease to some poisons in the food of the people. Experiments conducted many years ago showed that grain affected with smut was capable of producing violent illness. Ergot of wheat is more active even than ergot of rye. The examining physician, in the present case, reports that the crop of the first mentioned grain, raised in the vicinity last year, contained much more smut than usual. It is, therefore, possible that the disease is due to consumption of bad flour.

ARSENICAL WALL PAPER.

Some new cases are reported, by the Michigan State Board of Health, of severe illness caused by living in rooms papered with green hangings. Two instances are mentioned of families becoming sick; and on the paper being examined, 1.16 grains of arsenic to a square foot of surface were found.

ORNAMENTING METAL SURFACES.

A NEW process for ornamenting metal surfaces, by K. Goddard, of Richmond, N. Y., consists in plating, electroplating, or otherwise covering a plate, bar, or ingot of soft metal with a thin film of harder metal, and then rolling out or pressing the ingot into a sheet; whereby the coating is broken into irregular forms, and a marbled appearance produced on the surface of the sheet.

Sensitizing Gelatin Paper.

This is accomplished in a solution of one part bi chromate of potash in twenty parts of water. The purer the bichromate salt, the better the paper. If small sheets of eighteen to twenty square inches are to be sensitized, the above solution is poured into a zinc or porcelain dish, the bottom of which should be covered to the depth of half an inch at least. The gelatin paper is dipped into the solution and left there until it gets soft, which generally takes thirty to forty seconds. It is then taken out and laid, gelatin side down, on a well cleaned glass plate. By rubbing with a piece of india rubber, not too hard, the greater part of the liquid is removed from the paper. On lifting the paper from the glass, it has a fine, smooth surface, on which there will be no streaks or drops formed afterward, as it is already half dry. It is then hung, on laths provided with pegs, to dry. Thus prepared, it will bear a much higher temperature than when the solution is not pressed out. In cold weather, the paper can remain some minutes in the chromate bath; it should be left there until soft and pliable.

In preparing large sheets, another method must be employed. A sufficient number of thin strips of pine wood, three fourths of an inch wide and long enough to rest on the opposite side of the dish, are saturated with shellac varnish, and, when dry, rubbed with cocoa butter, and then polished with an old linen rag. Horizontal sticks are put up in the preparation room with notches to receive these strips. The dish for a large chromate bath is best made of stout zinc. A sheet of gelatin paper is allowed to float on the bath, gelatin side down, until soft, when one end is lifted up and laid on one of the pine strips; another strip is laid on the paper, and the two clamped together. The paper is then drawn, face down, over a glass rod or tube fastened to one side of the dish. In this way small air bubbles are removed, as well as a large portion of the solution. The paper is now hung up by placing the strips of wood clamped to it in the notches on the horizontal sticks. A third strip is pressed gently against the back of the paper just below the others, and drawn down to the lower edge, thus partially removing the solution from the back. It is then clamped to the lower edge. In this manner, says the *Photographische Archiv*, a sheet of paper five feet long may be sensitized in less time than it takes to describe it. The chromate bath should be kept covered to keep out the dust; and before using it, a piece of blotting paper may be drawn over the surface.

AN IRIS AND AN ORCHID.

Our first engraving, extracted from *The Garden*, depicts a beautiful specimen of variegated orchid, the leaves of which are richly colored and highly ornamental, while the flowers are quite insignificant. It is indigenous to the East Indian Islands and Continent, and has short rhizomes, very short stems, and alternate leaves, more or less oval in shape, often heart shaped at the base and pointed at the apex, on very short foot stalks, which embrace or clasp the stem. The flowers are arranged in clusters or terminal spikes. They are of a white or reddish color, and are undeserving of notice in an ornamental point of view. The leaves are velvety, of a dark green color round the margins, while the central part is of a yellowish red. The whole of the upper surface is traversed by a network of veinings of a brilliant golden yellow color. The under surface is red. The plant is also known in gardens under the names of *a. xanthophyllus* and *a. latimaculatus*. The plant should be grown in pots, the lower half of which should, for the sake of securing perfect drainage, be filled with broken crocks, while the rest should be filled with a compost of peat, charcoal, and sphagnum,



ANECTOCHILUS (XANTHOPHYLLUS) LOBBIANUS.

the surface being covered with a layer of living sphagnum. The plants, after being potted, should be placed under a bell glass or cloche, in a warm house, where the temperature during summer should range from 70° to 78° Fah., and in winter from 55° to 60° Fah. A moist atmosphere is indispensable, and this should be maintained equally and constantly during the summer; but in winter, when the plants require some rest, the supply of moisture should be considerably diminished. The plants should at all times be kept well sheltered from the direct rays of the sun, and the inside of the bell glass or cloche, under which they are placed,

should be carefully wiped out every morning and evening, otherwise the condensed moisture, accumulating on the glass, will drip on to the leaves, making holes wherever it touches. As the principal object in cultivating these plants is to bring the foliage to its full perfection of beauty, the flowers should be pinched off as soon as they begin to appear. This will throw more vigor into the leaves, cause them to grow closer together, and vastly improve the luster and richness of the coloring. It is also favorable to the multiplication of the plant, as it causes numerous shoots to spring from the axils of the lower leaves, and also from the rhizome. These shoots, when detached and planted, will form each a new plant. They should, of course, be potted in the same compost, and subjected to the same treatment which has been above described for full grown plants.

The plants of the *iris* family, of which the *iris susiana*,



THE IRIS SUSIANA AS A BORDER PLANT.

represented in the second of the two engravings given herewith, is a very beautiful variety, exist both in the temperate and torrid regions of the globe. There are several species similar to that in our illustration, having bulbous roots or stems, and exquisitely scented blossoms of an elegant pearl white hue. Almost every variety of the flower has some intrinsic value—the root of one species is the orris root sold by apothecaries; the powdered root of another gives a kind of snuff; the same powder of another variety may be used for making ink; and the fresh juice of other species is said to be a valuable cathartic medicine.

Hypodermic Medication.

The day that Alexander Wood, of Edinburgh, discovered "that a solution of morphia injected under the skin, in the vicinity of a painful part, afforded remarkable relief to the pain," the clock of ages marked an epoch in scientific medicine, which indeed rivals Harvey's discovery of the circulation, or Morton's discovery of anesthesia. At that hour, throughout the civilized world, suffering humanity became heirs to a boon which has been to them as a pearl of price, and that particular province in the practice of medicine which looks to the alleviation of pain, which in times gone by was the bane of the physician's life, became so modified that pain presents but a few phases that we may not readily overcome, and but few characters we may not subdue. Such crises in medicine as have been wrought by the discoveries of Jenner, Cinchon, Harvey, Morton, and Wood are precursors of glorious "glorious days" in their departments, and command the admiration and respect of not our profession alone, but the good and noble world over.

Dr. Wood, after his discovery, continued to practise the method from November, 1843, to 1856, a period of thirteen years, and until he became thoroughly convinced of its utility and worth, when he published his first account of the subject in the *Edinburgh Medical and Surgical Journal*—now over thirty years ago.

I have known the hypodermic syringe to be employed almost in every available portion of the body, and on an average of four times in twenty-four hours, for a period of several years, in the same patient, making an aggregate of six thousand and four hundred times, without the slightest accident and without even the formation of an abscess.

My own method of using the hypodermic syringe is as follows: After being satisfied that the instrument is in perfect order, the piston properly fitted, the barrel clean, etc., I draw

up slightly more fluid than I design using, invert the syringe, press up the piston to expel the air which is nearly always drawn in, and the surplus solution; then with the thumb and finger of the left hand, I pinch up a fold of integument, pressing it pretty firmly for a few seconds, to lessen its sensibility; with a firm, steady pressure I introduce the needle at an angle of about 45°, directly into the cellular tissue, to the depth of one eighth to a quarter of an inch, according to circumstances; press down the piston, withdraw the needle quickly, place a finger over the puncture to prevent the escape of fluid, and the operation is complete.

The first drug employed hypodermically was morphia. And its range of application has kept pace, co-extensive with its employment. While its various salts have been used, the sulphate seems to have outgrown all others in favor, for various reasons, and is at present the favorite; it is perfectly soluble in distilled water, which is, for all purposes and under most circumstances, the very best vehicle for hypodermic use, on account of being perfectly unirritating to the tissues and not liable to produce inflammation or abscess.

The physiological effects of morphia are too well understood to require repetition here. It was early—in fact, first—employed in neuralgia, in which a single application cured the disease. It had yielded equally as good results in my own hands a number of times; and although we will often fail to cure so promptly, by perseverance, for a limited time even, we will be satisfied with its results. At present, I cannot call to mind a single case of ordinary neuralgia which I have treated hypodermically that was not speedily and, so far as I know, permanently cured by a few applications.—J. C. Bishop, M. D., in *Southern Medical Record*.

OAK APPLES OR GALLS.

These, says the *Garden*, are produced by an insect known to entomologists under the name of *cynips quercus-petoli*, which deposits its eggs in the tender bark of the young twigs of the oak. Soon afterwards the portion of the bark in which an egg has been deposited begins to swell, and ultimately forms a rounded tumor or excrescence, sometimes over an inch in diameter. "On cutting into these galls," says Dr. Fitch, "the small limb on which they grow is found to have its wood thickened or swollen, and, over it, forming the chief bulk of the tumor, is a corky substance of a yellowish brown or snuff color, between which and the wood are several small hard grains (resembling seeds, each having a cavity in its center), in which, doubled together, lies a soft, white, footless worm or maggot. This, on completing its growth, changes to a pupa in the same cell, and, subsequently, into a fly; whereupon, to escape from its confinement, it gnaws through the corky substance and the external bark, thus producing those small perforations like pin holes, which are always seen in these tumors after the insects have made their exit therefrom." Fig. 2 in our illustration represents a section of one of these galls cut through the middle, and showing the central cavity in which the grub grew to maturity, prior to eating its way to the outside, through the channel which is also shown. The injury done to oak plantations by these insects is sometimes very great. A few years since they appeared in such numbers in England as to create quite a panic among the landowners, who were threatened with the entire loss of their oak plantations. Some of the trees withered and died, others had their leading shoots killed, while the younger trees were seriously checked in their growth. There is another species of *cynips* which deposits its eggs in the same manner in the leaves of the oak, causing them to swell similarly. The tumors, however, pro-



OAK GALLS

duced by this insect are soft and much smaller than the bark galls. In both cases it is probable that the parent insect, when depositing her eggs, injects with each a small quantity of some acid secretion which has a specific effect in so irritating the tissues of the bark or leaf that they at once commence to swell and produce the spherical induration which forms the nidus of the future larva.

Fig. 1 shows the oak gall in its natural size, and Fig. 2 is a section of the same. Figs. 3, 4, and 5 are, respectively the larva, male and female of the *cynips*.

THE FLOWER MARKETS OF FLORENCE, ITALY.

The city of Florence: in which are to be found an unequalled number of art treasures, ancient and modern, where are the "Venus di Medici," the "Niobe and Her Children," the wondrous dome of Brunelleschi, the gates of Ghiberti, the church of Santa Croce (in which are the tombs of Michel Angelo, Machiavelli, Galileo, and Alfieri), and a world of other relics and shrines of beauty, art, and science: is renowned among all the capitals of Europe for the magnificence of the flowers exposed for sale in the markets. It is asserted that nowhere is the trade in flowers so extensive as in Florence, and the exhibitions of the floriculturist's art are numerous and very popular. They are to be found in the "Mercato Vecchio" and "Mercato Nuovo" (the Old Market and the New Market), and in a more modern building, called the Central Market, of which we publish an engraving. It is a large and well built structure, with a lightness and grace in the roof which is admirably in keeping with the purpose for which it was built. In extent it rivals the Floral Hall in Covent Garden, London, and the celebrated *Marché aux Fleurs* at Brussels, while it has an advantage over both buildings in its exterior garden and its open surroundings. We are indebted to *L'Illustration* for the engraving.

RECENT ARCHEOLOGICAL EXPLORATIONS.

Of late years progress in the exhumation of lost relics of ancient life has made such gigantic strides that, viewing the various explorations in the aggregate, it would be difficult to ascribe to any one a special importance as compared with the others. To detail all the interesting discoveries made, or even to trace out the proper significance and bearing of the knowledge thus acquired of past generations, would necessitate both a review of historical facts and an amount of antiquarian discussion, the writing of which would swell the present article to a volume; so that merely a passing glance at recent explorations among the ruins and buried cities of the old world is all that we can hope to offer in the following lines.

Since the removal of the Italian capital to

ROME,

the government has undertaken extensive researches, which have resulted in the discovery of many statues and works of art of great archaeological value. At Ostia, about a dozen miles from the city, extensive explorations are in progress; and, as the locality was once a town of 80,000 inhabitants, many important discoveries are anticipated. Some time ago the Italian Parliament voted \$60,000 for the purpose of excavating the whole of the Palatine Hill, with the slopes around it, as far as the Forum and the Arch of Janus on the north; and it is in this locality that many of the finest remains have been found. The most extensive archaeological researches in the Eternal City have, however, been conducted by Mr. J. H. Parker, C.B., the record of which fills two volumes, recently published in England. Nineteen aqueducts, we are

told, have been traced, which served to convey water to the city from the elevated regions of Subiaco, forty miles away, through pipes of stone. At every half mile great reservoirs or filtering places were located, the construction of which completely disproves the idea that the Romans did not know that water rises to its own level. Within the city the principal buildings belonging to various eras were readily recognized. Portions of the *Arx* of Romulus yet remain on the Palatine Hill. The stones employed are 4 feet long by 2 feet wide and deep, and were split from the *tufa* quarries by iron wedges, exactly as at the present day. They are roughly dressed. Fragments of the wall of Servius Tullius are to be found, connecting, by a great road, the several citadels of the famous seven hills. In this wall the stones are wrought and closely fitted and secured to one another by iron clamps, not run in with lead. Portions of other walls of equal antiquity are built of concrete, the great durability of which is ascribed to the lime used being burnt on the spot where required, and to its mixture with rough and gritty *Pozzolana* sand and broken bricks. From these samples of the art of the mason 2,600 years ago, down to the splendid productions of the time of Hadrian, archaeology can trace the progress of the builder's art and the development of the city.

PALESTINE.

In the Holy Land, the Palestine Exploration Society of England has been foremost in carrying on investigations. Little has been accomplished toward definitely locating the sites of the Temple of Solomon, the sepulchre of David, or of many other structures mentioned in the Scriptures. In Jerusalem a mysterious tomb was opened; and in it, below a bed of rough clay brick, a human skeleton was found, its head turned to the South, but past all identity of race or period. Throughout all the territory there is inextricable confusion of origin and date. There are tombs with Greek inscriptions bordering upon Roman roads, and over all are signs of the changes caused by the wars which have swept over the land. Over two hundred excavations have been made in and about Jerusalem. The remains of a large building facing the cardinal points have been found among the ruins of an entire town which, situated twelve miles west of Nablus, once covered a square mile of area. The edifice was probably an ancient monastery. Some interesting examinations have been made concerning the Holy Sepulchre and the Dome of the Rock, the materials used in the pillars of which appear to be the remains of older structures.

The English Ordnance Survey of Palestine now extends over three elevenths of the area of the country, or 1,800 square miles. This includes a map of Jerusalem, which shows that the original rock on which the city was built is now covered with from 25 to 120 feet of *débris*. There appears every reason for believing the truth of the tradition that Jerusalem was utterly obliterated by the Roman Governor Turnus Rufus, and its site plowed over.

Lieutenant Conder, R. E., has examined the ruins of the

great temple at Basilek, of which but six columns now stand. He concludes that the structure was not of Phœnician origin, and considers that the rubbish about its foundations hides statues and treasures of the greatest archaeological value.

TROY.

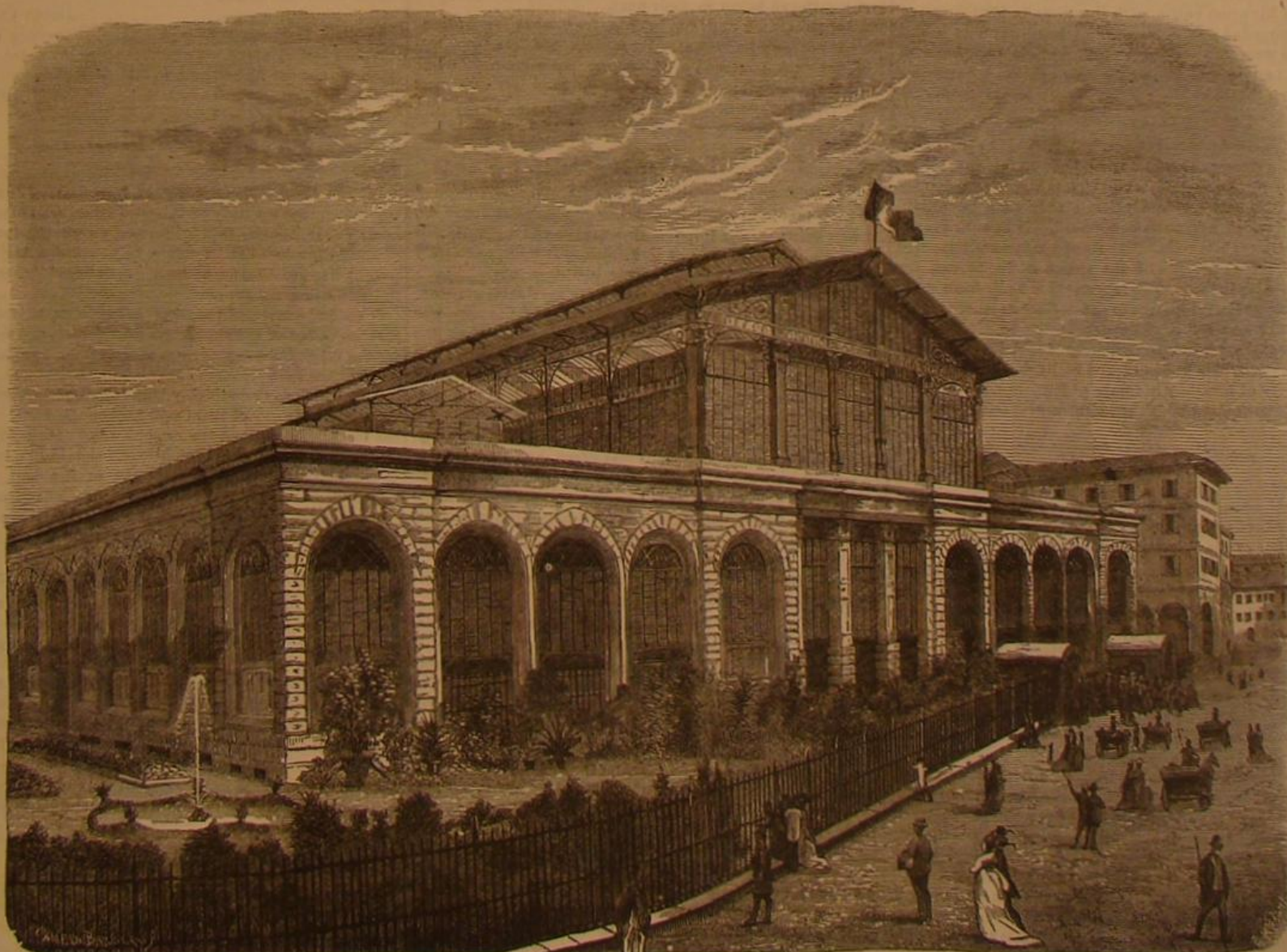
In attempting to prove that the *Iliad* is not a myth, that Paris and Helen, that Priam and Hecuba, and all the Greek heroes did live, Dr. Schliemann undertakes an arduous task, but he bases his speculations on the actual revelations of the relics dug up at the site of the ancient city. About four years ago excavations were begun at modern Hissarlik, and the first discovery was the remains of a city of Greco-Roman origin, in which none of the articles found were of a later date than the seventh century B.C. This town, it is believed, was built about 700 B.C., and destroyed by the Roman Emperor Constantine II. Soon after, within a mound, were found walls of a Greek city, and beneath these a still older structure which served as their foundation. Encouraged by these discoveries, the explorer opened an enormous trench, and laid bare three distinct strata, in the lowest of which, upon the virgin rock, were found fragments of pottery, in the next ashes and calcined fragments, all bearing the marks of a great conflagration, and, in the last, houses of small or cut stone joined with mud.

More extended excavations revealed the walls of a grand temple of Minerva, 240 feet in length, in which were found vases of gold and silver, copper, weapons of war, and ornaments of every description, numbering some twenty thousand in all, and all traceable to a period earlier than that of the Greeks.

The tools brought to light were either of hard stone or of bone. There are saws made of silex and knives of obsidian. Hammers had holes for the reception of handles cut by the action of sand and water. Nothing resembling a lathe was found. Pottery was molded entirely by hand. Mills for grinding grain existed in profusion; but bread could not have been known, as nothing resembling a baking apparatus was met with. The work in gold and silver was beautifully executed, apparently entirely by hand; and from the fact that much of it was made in the figure of an owl, sacred to Minerva, the tutelary deity of the Trojans, the explorer finds additional evidence for his belief that the remains discovered are veritable relics of Homer's Troy.

EPHESUS.

For some time past Mr. J. T. Wood, an English archaeologist, has been making excavations with a view of determining the site of the Temple of Diana. These researches at first uncovered the remains of a gate, with the vestiges of a portico or colonnade. Then another gate was reached, and then roads converging from the two. Following these paths the excavators actually struck upon the angle of the outer wall of the great temple, bearing inscriptions recording its restoration by the Emperor Augustus. The Western face of this wall was followed some 1,200 feet. Soon after, Mr. Wood



THE CENTRAL MARKET, FLORENCE ITALY.—A FLOWER SHOW

came upon a fine white marble pavement, laid in Greek fashion on a lower bed of black marble, the very floor of the temple itself. The remains of the thirty-six massive columns, sixty feet high, perfect in carving and decoration, were dug out and subsequently sent to the British Museum. The excavations will probably be continued until many other vestiges of the magnificent temple are brought to light.

ASSYRIA.

The excavations at Nineveh, carried on many years ago by Layard and others, have lately been continued by Mr. George Smith, of the British Museum, in the interest of the London *Daily Telegraph*. The most important portion of the discoveries lies in the engraved stones from which Mr. Smith deciphers the history of the nation. Deeds of property and private contracts have been found, inscribed and covered with clay, on the exterior of which the substance of the agreement was stamped as a memorandum. No less a document than the will of Sennacherib has been met with, in which that monarch leaves all his "chains of gold, heaps of ivory, a cup of gold, crowns and chains with them, all the wealth that [I have] in heaps, crystal, and another precious stone, and bird's stone" to his son Esar-Haddon. Fables of the beasts have been found; also chronological tablets which enable us to restore the chronology of Western Asia from the ninth to the seventh centuries B.C., and to correct the corresponding dates in the Old Testament, hitherto the despair of historians.

CYPRUS.

General Di Cesnola is still prosecuting researches for pure Phœnician relics on the island. The collection, at present located in the Metropolitan Museum of Art in this city, is the result of seven years' exploration; and as it includes the first known works of Phœnician art, is of the highest interest and value. The island of Cyprus is one vast graveyard, Greek graves being made in the soil which, in the lapse of ages, had obliterated the tombs of the earlier inhabitants. General Di Cesnola identified the site of ancient Idalion, which was destroyed about 500 B. C., and subsequently found the Temple of Venus at Golgos. He then proceeded to excavate the supposed sites of other cities, and in so doing made the collection now on exhibition in New York. This includes a large amount of pottery, among which is a colander still bearing a white stain which chemical analysis has proved to be that of milk. There are also a number of statues, hewn from calcareous stone and very perfectly preserved, beside a large variety of specimens of ancient glassware, ornaments, etc.

SCOTLAND.

Mr. J. S. Phené, F.S.A., has opened a number of mounds in Scotland, which, it appears, served as tombs for the early inhabitants. These tumuli are of exactly the same construction as the similar heaps found in Mexico. Some served as monuments; and in one opened at Largo, Scotland, were discovered particles of bone calcined and mingled with the *dolbris*. Evidence has been found that there the Norse king, Haco, after his great battle with the Scots in 1263, ordered the ships stranded on the shore to be burned. The bodies of the dead were thrown into the burning pile, together with armor, etc.; and when all was consumed, the mound was formed from the ashes.

THE RUINS OF OPHIR.

Mr. Mauch, an African traveler, believes that he has found the veritable remains of Scriptural Ophir, in lat. 20° 15' S., long. 26° 30' E. One edifice is still 30 feet high, and is formed of granite with beams of cedar. It stands on a mountain, the sides of which appear to be terraced. It is built in imitation of Solomon's temple. The second structure, supposed to have been the residence of the Queen of Sheba and her suite, is circular in form, with labyrinthine walls built without mortar. It is still known to the natives as the "House of the Great Princess."

Excavations are now in progress in Athens, Greece; and recent researches in Malta and Sicily have resulted in the discovery of a variety of tombs of Etruscan and Phœnician origin, regarding which we note no especial points of interest.

Correspondence.

Hardening and Tempering Tools.

To the Editor of the Scientific American:

In reply to your correspondent John T. Hawkins, whose letter appeared in your last issue, I would say that he is correct in stating that the difference in the degree of hardness to be obtained, simply by "the different temperatures at which the tool has been originally dipped," is practically very slight, providing, however, that the tool is heated to a red heat. Hence my instructions were to heat the tool to a "moderate red heat," but "not hot enough to cause it to scale," a range of degree sufficient, I think, for all practical purposes.

With reference to the colors produced upon steel, in the process of tempering it, being due to the formation of a film of oxide, it is not my purpose to treat upon the chemistry of metallurgy, but to confine myself to workshop practice as the workman understands it. "The element of time and the greater or less facility for access of the oxygen of the air," I have not found to be of vital practical importance in tempering, probably from the following causes: The tempering of steel tools should proceed slowly, because it is not so easy to determine and to obtain the precise shade of color desired when the lowering of the coloring proceeds rapidly as when it proceeds slowly. A uniformity of color is not

so easily or accurately obtained under a rapid as under a leisurely lowering of the color, especially in the case of taps or other tools having protruding parts or edges, because such parts receive the heat (and hence temper) more readily than the body of the tool. Rapid tempering I therefore always discard. The method commonly employed to impart an even and particular degree of temper to tools excludes the air from the tools to a much greater degree than does the tube process given by me, although the color is, in that case, the universally accepted test. That method is to place the tools in sand heated over the fire (and kept there during the process), and covering the tools with the sand during the first part of the process, and only removing them (at the later stages) sufficiently to expose the upper surface to view that the color may be seen. Excellent results are claimed for and obtained by this process. My objections to it are that it is often advantageous to make one part of a tool softer than the rest (such as the square ends of taps, reamers, etc.), which is very difficult to accomplish in the sand process, and also that the tube process produces a more uniform temper, because the tool can be revolved in the tube, and thus receive the heat evenly all over; whereas the sand is always hotter at the bottom than at the top, and sometimes, from unevenness in the degree of heat in different parts of the fire, and from the uneven depth of the sand, hotter in one part than in another.

To dip a cold chisel in the water in such a manner as to only require "a few seconds" to bring the cutting edge to a blue, as your correspondent asserts may be done, is an error, because in such a case the band of blue will be very narrow, and but very few grindings of the chisel will remove the part tempered. A chisel should be dipped in the water about three eighths inch deep, and held there about ten seconds, and then suddenly immersed, say another three eighths inch, and withdrawn, in which case the band of blue will be a broad one, and the temper of the chisel will remain about the same after many grindings.

If, however, from an error of judgment in heating or dipping, it becomes necessary to impart to the chisel additional heat, to assist the tempering, it should not be imparted by holding the chisel over "the clear coals," because, in such a case, the extreme end of the chisel, from its excessive exposure to the heat and from its being the thinnest part, receives the heat, and tempers, more quickly than the metal behind it; hence, when the extreme end is at the proper degree of temper, the metal behind it is too hard and breaks, when used, in consequence. A better method of imparting additional heat is to take a piece of hot coal from the fire and hold the chisel over it about an inch from its end.

New York city.

JOSHUA ROSE.

To the Editor of the Scientific American:

In my communication on "Hardening and Tempering Tools," published in your issue of August 1, I notice three typographical errors; and as two of them are quite serious ones, particularly the last, I shall ask you to correct the two last mentioned below in your next.

1st column, 18th line from bottom, for "takes" read *taken*. This is not very important. 1st column, 23d line from bottom, for "temperature" read *temper*. 2d column, 29th line from top, for "strongly" read *slowly*. This last is almost exactly the reverse of what is intended.

63 Cannon street, New York city. JOHN T. HAWKINS.

Treatment of Erysipelas.

To the Editor of the Scientific American:

I have just been reading an article on erysipelas (page 40, current volume), and it induces me to give you a remedy. It is powdered charcoal mixed with thick sour milk, outwardly applied with a swab as often as the itching occurs.

One of my children was attacked with erysipelas at noon. In an hour his eyes were entirely closed, and his face was frightful to be seen. I made constant application of the above, and at 3 P.M. the swelling had subsided, leaving his face full of wrinkles. The disease then passed to his neck and thence downward till it traversed every inch of him, getting to his feet at midnight, twelve hours after its first appearance. He then slept quietly till morning, when he appeared languid; a dose of senna was given, and the next day he appeared as well as usual.

I will add that erysipelas is hereditary in my husband and in myself. I have used this treatment many times, and always with the best success.

ITALIA.

The Relations of Planetary Motions.

To the Editor of the Scientific American:

In your issue of July 11, you refer to some recent researches of mine in regard to the asteroids. The second of the propositions quoted, permit me to say, is an error committed by myself in transcribing from my note book. The following instances of remarkable relations between the mean motions of certain asteroids are especially interesting:

Let $n^{(1)}$, $n^{(50)}$, etc., represent the mean motions of Pallas, Pales, etc., the numerals in parentheses denoting the minor planets in their order of discovery; and n^V , n^{VI} represent the mean motions of Jupiter and Saturn. Let also $L^{(1)}$, $L^{(50)}$, etc., represent the mean longitude at a given epoch. Then $n^{(50)} - 3n^{(78)} + 2n^{(11)} = 0$ (1)
 $L^{(50)} - 3L^{(78)} + 2L^{(11)} = 180^\circ$ (2).

The exact similarity of these equations to those found by Laplace, connecting the motions of Jupiter's first three satellites, is at once apparent. The origin of the relation, whether we accept the nebular hypothesis or Proctor's theory of planetary accretion, may be accounted for as in Note VII., Vol. II., of Laplace's "System of the World."

But were the relations expressed by (1) and (2) rendered rigorously exact by the mutual attraction of Pales, Diana, and Parthenope? This, to myself, seems wholly improbable. The required explanation is to be looked for in the perturbing influence of Jupiter and Saturn. A comparison of mean motions gives the following equations:

$$2n^{(11)} - 9n^V + 7n^{VI} = 0 \quad \dots \dots \dots (3)$$

$$n^{(50)} - 3n^V + 2n^{VI} = 0 \quad \dots \dots \dots (4)$$

$$n^{(78)} - 4n^V + 3n^{VI} = 0 \quad \dots \dots \dots (5)$$

Eliminating n^V and n^{VI} from (3), (4), and (5), we obtain equation (1). The mean motions are taken from the *Annuaire* for 1874.

DANIEL KIRKWOOD.

Bloomington, Ind.

A Queer Looking Prescription.

To the Editor of the Scientific American:

Your article in No. 4 of the present volume, entitled as above, is both sensible and just; and the facsimile of the prescription referred to is indeed a queer-looking thing, but it can be matched by those of a Brooklyn M. D., as a number of druggists can testify.

Thinking that some of your readers would like to know what they were taking, should they conclude to have this recipe compounded, I send an elucidation of it:

*R. Tinci. colombæ, 3 drams.
Mistura camphoræ, 1 oz.
Spir. eth. nitr., 1 dram.
Aqu. menth. pip., 1 oz.
Aqua dist., 2 drams.
Capiat cochleare amplum,
ter in die.*

James Clark.

In plain English, it is a mixture of tincture colomba, camphor water, spirit of niter, peppermint water, and distilled water, with directions to take a tablespoonful three times a day.

J. M. HUGHES.

187 De Kalb avenue, Brooklyn, N. Y.

Petrification vs. Putrefaction.

To the Editor of the Scientific American:

In *The Columbian Register*, of New Haven, June 20, it was stated that the body of Alanson Dyer, who died at Rutland, Vt., in March, 1872, of congestion of the lungs, was recently disinterred and found to be petrified. At death the weight was 145 pounds, and when disinterred, 1,200 pounds, the gain being 700 per cent.

If the body retained the same proportions, it seems to me that the claims of the skin worm are rejected, and that petrification takes full sway as soon as the sexton has finished his work.

This bone has undoubtedly been often picked by the savans, but have any of them ever broken the bone, examined the marrow, and found the reasons why? If they have, and will answer the following questions, I should like very much to see their answers in the columns of the best scientific paper in the world: 1. What prevents putrefaction and decay? 2. What elements are combined to produce petrification? 3. From what source or sources comes this tremendous accumulation of weight?

Stratford, Conn.

TRUMAN HOTCHKISS.

REMARKS BY THE EDITOR.—Putrefaction is not a process of oxidation, but the presence of oxygen is necessary to its commencement. Every case of putrefaction begins with decay; and if the decay or its cause, the absorption of oxygen, be prevented, no putrefaction occurs. The most putrescible substances are preserved indefinitely by enclosure in metallic cases from which the air has been completely removed and excluded. Chemical matter recently liberated is ready to form new chemical compounds. This burial undoubtedly took place in very damp ground. This earth was charged with water containing a great amount of lime, silica, alumina, etc., in solution. The water being taken up by the body during putrefaction, the mineral ingredients accumulated in it and formed a hard, stone-like mass.

EVERY day sends to the grave a number of obscure men, who have only remained in obscurity because their timidity has prevented them from making a first effort; and who, if they could have been induced to begin, would, in all probability, have gone great lengths in fame.—*Sydney Smith.*

MEDICAL NOTES.

Dyspepsia and the Use of Pepsin.

The views of Dr. Schacht concerning digestion have been confirmed by Professor Leube (the inventor of Leube's meat solution) of Jena in a lecture just published on stomach diseases. He says: 1. No condition of the stomach has yet been observed in which pepsin is altogether absent. 2. The cause of indigestion is generally the absence of sufficient acid. 3. The action of pepsin in a solution of albumen resembles that of a ferment, and it will continue so to act without end, merely by the addition of more acid. 4. Alcoholic solutions, especially wine, on account of the tannin it contains, should be avoided as vehicles for pepsin. Finally, he recommends, in case of indigestion, a solution of chopped meat with water, adding a small proportion of pure muriatic acid, and some thickening. He finds such a solution very nourishing, and reports excellent results. These views and experiments are not novel, but exhibit the old doctrine as to digestion, and it appears to be the sound one. The secretion of the pancreas is now thought necessary to the digestion of fatty substances; and where these are used to any extent—as in cod liver oil—it would be best to take the new medicine pancreatin, which acts best with an alkali instead of an acid, or to use a little of the solution of the pancreas of freshly killed animals. We conclude with the recommendation that some good medicine-manufacturing firm should prepare a genuinely pure muriatic acid for the use of dyspeptics. It would meet with a large sale, and should be sold in a moderately diluted state.

Benzoic Acid for Ammoniacal Urine.

Professor Gosselin and M. A. Robin recently read a paper before the French Academy of Sciences, in which they detailed experiments upon rabbits and guinea pigs to show how far ammoniacal urine is poisonous when entering the system by a wounded surface. Subcutaneous injections of carbonate of ammonia solution caused death, preceded by convulsive symptoms; but a solution of ammonia in urine or human ammoniacal urine caused the animals to die with febrile symptoms similar to those of urinary fever, without any nervous effects. Normal human urine so injected produced no injury. The conclusion is that ammoniacal urine is poisonous to animals, and probably to man if absorbed into the circulation. It thus becomes important to correct this state of the urine, not only because it favors the formation of phosphatic calculi, but because, in case of injury to the urinary passages, there is also danger of urinary poisoning. Benzoic acid has been shown by Ure and Keller to be rapidly transformed into hippuric acid, which is harmless. The authors above named refer to three cases in which this acid was used, two of the patients having calculi. In one case, the ammoniacal urine was rendered neutral by one and a half to two grammes of benzoic acid daily, given in water or mucilage. The urine soon became acid, and the patient did well. In another case, where the urine became ammoniacal after a third lithotomy *séance*, two grammes of the acid daily for a week restored the urine to a proper state. The third patient, a subject of stricture, had urine containing from four to six grammes of ammonia per litre. Twenty days' employment of the acid rendered the urine harmless to animals. The authors conclude that benzoic and perhaps other vegetable acids should be prescribed for patients suffering from ammoniacal-purulent cystitis, and especially for those who have to undergo operations on the urinary organs.

Vomiting—Sea Sickness.

The well known physician Brétonneau strongly recommended belladonna in the frequent vomiting of pregnancy. He used frictions of the extract diluted with water, rubbed into the hypogastric region for several minutes two or three times a day. This treatment relieved in many instances when all other means failed. For over 25 years Dr. Guéneau de Mussy has extended Brétonneau's treatment to all descriptions of vomiting; but he has found that a plaster is the best way of use, allowing continuous application. He takes diachylon plaster and thierac plaster, each two parts, extract of belladonna one part, the plaster being 12 centimeters in diameter. It may be applied to the epigastrium for 12 or 15 days without being renewed; and out of the thousands which he has employed, he met with only one case in which an idiosyncrasy caused any trouble. In a great number of cases he either stopped or greatly mitigated the vomiting, from whatever cause. Dr. Mussy has tried this remedy in four cases of sea sickness with good results, and has great hopes of the benefits to be derived from such treatment in that painful affection. His plan certainly looks promising in a disorder which seems to resist all other remedies.

While on the subject of vomiting, let us note the method of Dr. Wolliez, who recommends swabbing the pharynx before eating with a concentrated solution of bromide of potassium: this in cases of consumptives and others who vomit their food in paroxysms of cough. The patient is warned not to cough for a few minutes after the application. The same treatment is said to be successful in the vomiting of pregnancy.

Poisoning by Shot.

It is often the case that bottles to be used for wine, cider, and medicines are cleaned by shaking shot and water in the bottle. It has been found that a crust of carbonate of lead adheres to the sides of the bottle where there is much shaking, and especially where the shot and water are left to stand in the bottle. To make the matter worse, arsenic is always present in shot in a poisonous quantity. If people will clean bottles in this way, they should pour out the shot soon, and rinse with vinegar or nitric acid solution.

Hay Fever.

Dr. T. C. Hoover, of Bellaire, Ohio, in the *American Journal of the Medical Sciences*, relates his successful treatment of this curious disease, so baffling to the profession. The first patient was a lady who had fits of sneezing which lasted several hours. She also had a slight cough, and suffered much at times from difficulty of breathing. The doctor made the following solution: Chlorate of potash 20 grains, sulphate of morphia 4 grains, pure water 2 fluid ounces; mix. He used this solution by means of an atomizer. Relief was instantaneous. Continued application kept the patient well for five days. Then the sneezing returned, and the Doctor ordered the use of the following solution through the same instrument: Bromide of potassium one drachm, water two fluid ounces. This also stopped the paroxysms. She was ordered to use these preparations alternately, from 6 to 10 inhalations three times daily, or about one fourth of a drachm. She continued to improve till she discarded the spray, being entirely well. Several other cases were similarly cured, some in a short time.

Chloral for Headache.

Dr. E. M. Nolan, in the *Atlanta Medical and Surgical Journal*, describes the following cure of a very painful headache in a lady. He dissolved 15 or 20 grains of chloral in very little water, and with the tip of a finger rubbed it upon one of her temples until she could sensibly feel the burning, and the skin was reddened. The part rubbed was no larger than a silver dollar. The pain was entirely relieved and remained so. The Doctor has also used this method of applying chloral for headache with success in many other cases, sometimes rubbing on one temple, and sometimes on both. No permanent sign is left.

Etherole of Sulphur.

This is highly recommended as a remedy for Asiatic cholera. It is made by adding one part of washed sublimed sulphur to ether, 65° Baumé, specific gravity, 0.722. The flask may be held a few seconds in warm water to increase the dissolving power of the ether. Well rectified ether dissolves one eightieth of its weight of sulphur. It is given as follows: At the immediate time for exhibition, a glass half full of sugared water has a small piece of ice added, and 25 or 30 drops of etherole are poured in, then the tumbler is filled with seltzer or soda water; the patient drinks this by small mouthfuls. Before adding the etherole, shake the flask well, but let the heavier particles of sulphur settle.—*C. C. Boutigny.*

Lockjaw and Quinia.

Several cases of tetanus have followed hypodermic injections of sulphate of quinia, which will render medical men more careful in thus employing it. M. Bourdon says the following preparation is not irritating, and may be injected without danger: By weight, sulphate of quinia 2 parts, tartaric acid 1 part, water 40 parts; mix.

Iodide of Potassium Improved.

Sir James Paget first called attention to the fact that carbonate of ammonia greatly increases the therapeutic action of iodide of potassium. Mr. J. P. McSweeney states, in the *British Medical Journal*, that he has tried this combination extensively in syphilis with the best results, and finds that 5 grains of iodide combined with 3 grains of carbonate are equal to 8 grains of the potassium salt as ordinarily used.

Prevention of Mistakes in Giving or Using Medicines.

The many deaths that occur through the lack of a proper system in the apothecary business demand a speedy reform. There will be ignorant and careless young men in that as in every kind of employment, and also plenty of ignorant or careless people among the sick or their friends, who, without some better warning than they have at present, will mistake one drug for another. They have a stricter system as to this matter in Germany, and one still more strict in Sweden. In those countries, the poisonous medicines are locked up by themselves in a special closet. We cannot see why this should not be done here. If morphia or any two or three dangerous substances are so much used that they must be handy, let each have its own place and package, so as not to be mistaken for anything else. Some have suggested triangular vials for poisons, so that nurses and patients, as well as clerks, may know the danger by the touch; and the suggestion is a good one. But best of all, we think, is the plan of having every proprietor or chief clerk of a drug store make out a complete list of poisons that he sells, and place it in a conspicuous position on his prescription counter, and compel every clerk who waits on customers to learn the list by heart. The list must of course include the dose within which safety lies. If druggists performed their duties properly, there would be no need for protective legislation.

An Optical Delusion.

The following is an optical delusion which is none the less interesting for being very easily explained.

Let a person, standing before a looking glass, look attentively at the reflection of the pupil of one of his eyes, and then at that of the other—let him look at different parts of the eye, and from one eye to the other, first at one and then at the other. Knowing that thus, in changing the direction of his gaze, his eyes must move about in their sockets, he will expect to see that they do so in the glass. As a fact, they will appear perfectly still.

If he looks at the eyes of another person trying the experiment, the peculiar fixedness of his own will be still more striking, when he looks at them again.

I will not spoil the riddle by giving the answer at the end. —*Nature.*—J. H.

Compressed Air as a Motor.

The use of compressed air as a motive power is destined to receive an enormous development as its capabilities and advantages become better understood. What countless wealth is thrown away in the unheeded fall of our rivers and the flow and the ebb of the ocean tides, simply because few consider that the power thus wasted could be conveyed to almost any distance, at very trifling cost, by means of compressed air, or rope transmission! As long ago as 1837, a series of experiments were made in Coscia, by order of the Italian government, to determine the resistance of tubes to the flow of air through them; it was found that:

1. The resistance is directly as the length of the tube.
2. It is directly as the square of the velocity of the flow.
3. It is inversely as the diameter of the tube.

And as the volume is directly as the square of the diameter when the velocity is given, it follows that, under a given pressure and velocity, the relative resistance, that is to say, the resistance divided by the power, will vary inversely as the cube of the diameter.

There is, consequently, a great advantage in making the tubes and openings through which the air has to pass as large as possible. Experience has shown that tubes can be made so as to allow of very little leakage. At the Mont Cenis tunnel, no leak was ever found in tubes nearly a mile and a half in length, nor did the expansions and contractions of the tubes, due to changes of temperature, appear to affect sensibly the firmness of the joints. On one occasion it became necessary to leave the receivers of compressed air for twenty-four days; the loss in all that time did not exceed 5-1000 part of the daily supply.

It is therefore possible to transmit power by compressed air to very great distances, with scarcely appreciable loss in its transmission. There is, however, a much more important loss than that just mentioned. When air or any other elastic fluid is compressed, there is generated an amount of heat which is the exact equivalent of the force employed in the compression. This heat, in practice, is radiated from the compressor, the reservoir, and the tubes, and is lost; when the compressed air has attained the temperature it possessed before compression, it has lost in cooling exactly as much power as was expended in compressing it; but since the air still remains under a considerable pressure, if allowed to expand its temperature falls below that of the atmosphere, and in so doing it develops work; but inasmuch as the temperature in expansion will not be depressed nearly as much as it was increased in compression, the loss of work will always be considerable, increasing with the pressure to which the air has been subjected; the loss is moreover susceptible of exact calculation. Taking the case of the Mont Cenis tunnel, where a pressure of six atmospheres was attained, the air, instead of being compressed to one sixth of its volume, as would have been the case were no heat generated, actually entered the reservoir when its volume had been reduced but 3-6 times, and, theoretically, the power available would have been but 60 per cent of that expended; practically it was somewhat less than this. If the air were compressed to eight atmospheres, there would remain available but 55 per cent; and for about eleven atmospheres of compression, but 50 per cent of the compressing power could be obtained. If the compression is less, say four atmospheres, 67 per cent would be secured; for three atmospheres, 73 per cent would, according to theory, be available, and so forth; hence we see that where the lower pressures will perform the work to be done, and will not necessitate the use of extra large and costly engines to utilize the power, there is an evident advantage in not using a very high degree of compression.

To this loss of power, practically inherent in compressed air, we must add the loss due to its transmission through tubes; this, where the pressure is not excessive, and where the velocity is reduced by the use of large tubes, is a much smaller item of loss than the other; it would not be over one third or one fourth of it. In carrying the air through, say 10 to 15 miles of pipe, it would not exceed, say, 5 to 8 per cent.

As we have stated, it is impossible, under ordinary circumstances, to utilize more than, say, fifty to sixty per cent of the power expended in compressing the air; yet, from the fact that compressed air enables us to carry, at a small cost, the power wasted in waterfalls to points where it can be used with advantage, the loss of 50 per cent in the motive power is a small matter, and the actual power obtained would cost in general much less than if generated with our most economical steam engines.

The use of compressed air for driving underground machinery, whether it be hoisting engines, rock drills, coal cutters, or other machines, is peculiarly advantageous, for it provides a valuable addition to the ventilation of the mine, and reduces the temperature, which in deep mines is so excessive. It can be carried to much greater distance than steam, which, moreover, is very destructive to mine timber.—*Engineering and Mining Journal.*

That is so.

American manufacturers have, from the first, been only placed at a disadvantage with England in one particular, and that is in the comparative dearthness of labor. To overcome this difficulty has been the task of inventive ingenuity and enterprise in the States for many years past, and the result is such a substitution of machinery for hand labor, and such an application of scientific methods to economize production, as can be matched probably by no other country in the world.—*Colliery Guardian.*

BONE CHARCOAL.—Compact bones, such as marrow bones, give more charcoal, and of better quality, and yield less ammonia, oil, and gas, while the converse holds with light bones.

ORD'S CUT-OFF GOVERNOR.

This invention is a graduated steam cut-off, conveniently adapted to most engines in general use, and designed to take the place of the common governor. In its construction the inventor claims that the valuable advantages of sensitiveness, isochronism, strength of action, durability, simplicity, and cheapness, are all included. How such a result is obtained we shall explain as we proceed, reference being first necessary to the details of the device which are represented in the accompanying illustrations.

In Fig. 1, the complete apparatus is shown in perspective. Motion is communicated to it by the wheel, A, which, it will be observed, is provided with a corrugated periphery. Into the indentations of the latter fit the links of a chain, which is employed to transmit the power, in place of the ordinary belt. In Fig. 2 is represented one of these links, and also a section of the wheel and chain. This device, we are informed, secures a smooth, noiseless, and positive action. The chain is also said to be cheap, readily applied, and durable.

At the inner extremity of the shaft of wheel, A, is a bevel gear, by means of which motion of the same speed is transmitted to an upright shaft, B. Upon the latter is a pinion, C, which, being to the wheel, D, as 1 to 4, causes said wheel, and consequently the valve stem, E, to rotate once to every eight strokes of the piston.

Also, on shaft, B, is a wheel, F, which, by the gear shown, rotates the balls. Below the inner ends of the arms of the latter is a fixed collar, G, on the valve stem, E, and above is a loose collar, H, into grooves in which the extremities of the arms fall, turning the same upon the stem with them during their revolution. It will be plain that, as the balls fly outward, the arm ends will press down on the collar, H, and consequently push the valve stem also downwards.

I is a lever and weight, suitably pivoted to the frame and provided at the inner end with a gear segment, which works in a rack upon a sleeve sliding upon the valve stem. By moving this weight, speed can be increased or lessened, or the device may be used to open the valve in starting the engine.

The valve arrangements are shown in sectional detail in Fig. 3. There is a movable valve, J, secured to the extremity of the valve stem, and a fixed valve, K, in which the former fits, within the steam chamber. In each cylinder are four horizontal rows of eight triangular orifices each, making thirty-two orifices in all, considered jointly, which open and close at every stroke of the piston. It will be seen by reference to the diagram, Fig. 4, that by thus providing a valve with steam port openings, so arranged in connection with a movement that will give the necessary aperture to secure full boiler pressure at the beginning of each stroke of the engine, and which will close at any part of the stroke, according to the power required, that the supply of steam is regulated in an efficient and economical manner. Referring to the steam port, K, which is represented as moving to the right, the upper corner overlapping the lower corner of the stationary port, and touching the horizontal line denoting three eighths, should the governor carry the valve in that line, it will intersect the perpendicular line corresponding to three eighths in the cylinder, which is the point where steam

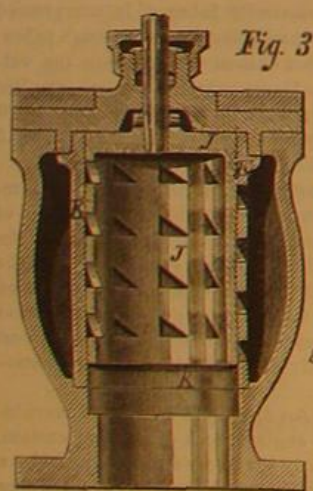


Fig. 3

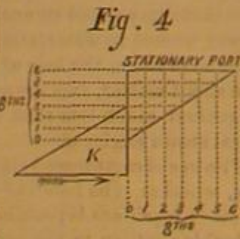


Fig. 4

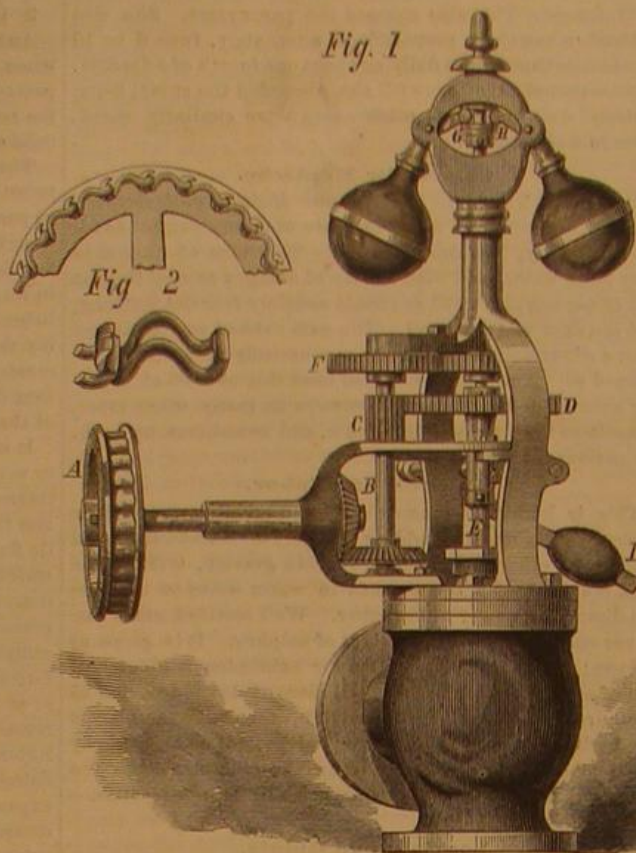
is cut off. Should, however, the engine be more heavily loaded, the balls will drop and give a correspondingly increased opening, cutting off at a later period of the stroke. The increased pressure on the end of the valve stem, together with the changed position of the weight, secures the same rate of speed as when running light.

The valve has a limited up and down motion, and, when at rest, the moving cylinder takes against the steam chamber cover. The openings in the two portions of the valve do not then correspond, so that steam is thus shut off, and a means of safety provided, should anything occur to prevent the proper action of the governor. Similarly, if the movable valve should become disconnected, steam would be again shut off, as the valve would drop to a seat in the bottom of the chamber, and the orifices would not correspond. Steam from the boiler being around the exterior of the valve, the latter is perfectly balanced.

The inventor directs especial attention to the fact that steam is admitted to the cylinder at the point where the

main valve opens to take steam. Consequently the degree of pressure acting on the piston valve is also applied to the end of the valve stem. This has a tendency to force the latter up and enlarge the opening, holding the engine to its speed, although the balls are not carried as high as when running light.

The parts of the valve are made of a fine grade of iron and fit perfectly true. No difficulty, we are informed, has been encountered through expansion. The inventor submits a number of laudatory testimonials from well known firms in Cleveland, Ohio, with reference to the successful working of the device, which also obtained a first premium at the



ORD'S CUT-OFF GOVERNOR.

New Orleans Fair of 1873. Patented May 6, 1873. For further particulars regarding rights, etc., address the inventor, Mr. William Ord, Brooklyn, Ohio.

Oil Fired by Lightning.

An extensive conflagration, in which 60,000 barrels of oil were destroyed, recently took place at the Erie Railway oil depot, Weehawken, N. J., opposite this city. The origin of the fire was due to lightning, an eye witness stating that the flash appeared to descend into the oil tanks, from which, before the reverberations of the thunder had ceased, flames shot up hundreds of feet into the air. Tank after tank burst, adding their contents to the already burning streams, from which a tremendous blaze and dense clouds of smoke poured almost uninterruptedly for over forty-eight hours. Several buildings in the yard where the material was stored were destroyed, the total losses aggregating an estimated sum of \$250,000. The tanks were of iron. The ignition is supposed to be due to the contact of the electricity with the light, inflammable gases which are given off by the oil and rise in the air above the oil tanks. It has been suggested that high masts, with lightning rods upon them, should be erected in such positions, in the vicinity of oil tanks, as to protect them from such disasters as the present.

Screw Propellers.

Mr. J. E. Wilson, of Brazoria, Texas, writes to say that Mr. Griffiths' screw propeller, inserted in a channel within the bow or stern of the vessel, appears to be similar to his invention of a spiral screw placed between two keels of a ship so constructed. Mr. Wilson applied for a patent, but the application was rejected on the ground that a patent had already been issued for a screw to be worked in a channel running the entire length of the vessel. In the latter, a cog wheel was on the screw shaft and in the water, and it would need a larger cog wheel, also in the water. "The most ordinary mechanical intellect," says Mr. Wilson, "would unhesitatingly and truthfully decide that a spiral screw arranged after the manner of my invention could be driven with greater speed and with half the power that it would take to drive one with cog wheels thus submerged, besides avoiding the liability of the latter to be broken or clogged by drift." Mr. Wilson is making further experiments, and will communicate the results thereof.

Metal Ornamentation.

Mr. W. C. Aitken, in a paper recently read before the British Society of Arts, gives the following interesting details regarding some ornamental processes connected with metallic industries: Enamel is simply glass, composed of lead and sand. When transparent, oxide of tin renders the transparent glass opaque; mixed with oxide of gold, it changes the clear or opaque glass into a purple; red is produced by the addition of sulphate of iron; oxide of copper produces green, violet is produced by manganese, blue by oxide of cobalt.

The enamel is poured from the crucible in which it is

melted into flat cakes; these cakes are broken up and reduced to a fine granular condition in a mortar, or to an impalpable powder by grinding with a muller on a slab; it is applied on metal which will stand a red heat without changing its form or fusing. Gold, silver, copper, brass, or iron can be enameled. There is no true enamel which has not been fused at a red heat. The modes of application vary; applied on a flat plate or plaque, it is worked with a brush. Of this class are the Limoges enamels. Other methods of application consist in incising or cutting small troughs in the surface of the metallic object intended to be enameled. In these the enamel is placed or applied; this method of application is called the *champlevé*. Another method of reproducing is by means of electro-deposition.

The next variety of enamels is the partitioned or *cloisonné*; in this variety the cells are formed by bending a flat narrow strip of metal in such a manner as to form the retaining walls. These, after being prepared, are arranged on the object and soldered to it. The various colors of enamel are then applied in the cells, and fired by subjecting the object to be enameled to the heat of a muffle. Repeated applications of enamel with repeated firings are required to fill the cells. The superfluous enamel is finally removed by grinding it away with pumicestone, and smoothing it with stones of different degrees of fineness. Apart from the labor of forming and placing the minute cells, there are difficulties attending the firing operation. Should one part of the muffle be too hot, and the solder become melted which holds the cells, the more the enamel is in a fluid condition, the colors mingle, and a confluent mixture of colors is the result.

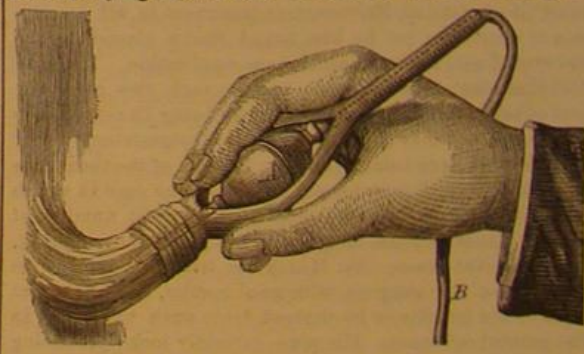
Niello may be called a metallic enamel composed of silver, copper, lead, and sulphur; in its preparation the most difficult metal to fuse is first melted, the next fusible added, and so on; the melted metals in the crucible are stirred with stick charcoal to insure homogeneity; the result is a black compound, which, poured from the crucible, is beaten into strips. The design to which it is applied is engraved on the metal object to be decorated, the lines being more pronounced and stronger than on an ordinary copper plate for printing from. The mode of applying the niello is by heating the object and rubbing the niello into the lines; when skillfully applied, the niello adheres firmly; excess of it is removed by files, the surface is then stoned, and finally polished.

Niello is undoubtedly by far the best means for decorating in a quiet, rich manner surfaces exposed to friction or wear; it is tougher than enamel.

Damascening, or inlaying one metal in another, is an art which has been practiced for a very long period, introduced chiefly on armor and caskets, etc. There are two methods of practicing the process. By one method the surface of the metal to be damascened is raised up into a file-like surface; the artist, by his skill, causes to adhere, to the roughened surface, threads of gold or silver, which are applied and burnished down. Broad surfaces are produced by working the threads or wires side by side. Heat is applied; the degree necessary requires great judgment. In the other the surface to be damascened is incised or cut into, the incision at the bottom being expanded; into this channel gold or silver is introduced and beaten down.

IMPROVED PAINT BRUSH.

A convenient device for painters' use, recently patented through the Scientific American Patent Agency, by Mr. Amasa S. Thompson, of Little Falls, Minn., is represented in the accompanying illustration. It consists in constructing the



handle of an ordinary brush to contain an india rubber syringe bulb, A. One end of the latter communicates with a rubber tube, B, which, connecting with the upper and hollow portion of the handle, dips into the paint. The other extremity of the syringe carries a short pipe, which terminates, as represented in the dotted lines, among the bristles of the brush. Through the working of suitable valves within, the bulb, on being compressed, draws up and discharges the paint into the brush, so that the latter is kept constantly supplied.

GEORGE M. MANN, C. E., of Brooklyn, N. Y., was recently killed by an accident on the Canal Railway, near New Haven, Conn. He was a young man of brilliant promise in the profession. The recent surveys of the harbor of New Haven were conducted by him, also the West River Canal and other engineering works. He was also assistant engineer of the new Quinnipiac bridge.

SCIONS and cuttings of fruit trees have been worked with success nine months after being severed from the parent stock.

THE MESSRS. STEVENS OF HOBOKEN, AND THEIR IRONCLADS.

One of the greatest engineers living at the commencement of the present century was Colonel John Stevens, of Hoboken, N. J. He was born in this city in 1749, but early became a resident of New Jersey, of which State he was a prominent and public-spirited citizen. In 1787, while driving on the bank of the Delaware, he saw the steamboat of John Fitch on one of its trial trips; and its partial success induced him to attempt the solution of the same problem, and he was assisted, until 1801-2, by Chancellor Livingston, who then went to France and there met Fulton. In 1789, Stevens asked of the Legislature of New York an exclusive right to steam navigation of the Hudson, stating that he had perfected the plans of his vessel, that they were entirely new, and that they did not interfere with any then existing inventions. In 1803 he built, and in 1804 actually had in use, a steamboat embodying ideas a half century or more ahead of his time. Steam was furnished under 50 lbs. pressure by what we today call a "safety" tubular or sectional boiler. The engine was quite similar to that built many years later for the French steamer *Etoile*. The propelling apparatus consisted of a pair of twin screws. His boiler was forty years ahead of his age; the engine was copied thirty years later; the screw came into use only when Ericsson and his rivals brought it forward, thirty years after Stevens, and twin screws are hardly yet recognized as standard practice under proper conditions. The machinery of this vessel is still preserved in good condition at the Stevens Institute of Technology. An engraving of it has been published in the *SCIENTIFIC AMERICAN* and in the *SCIENCE RECORD*. The British patent on the boiler is still to be seen at the Stevens Institute.

The success of this little craft was such that he built another in 1806, 50 feet long, 12 feet wide, and 7 feet deep, with a single screw. What remains of this screw—the hub and one blade—is to be seen at the Stevens Institute of Technology. The success of this latter and larger boat encouraged him to construct quite a large steamboat, the *Phoenix*, which was brought out and which very closely contested the claim of Fulton for the monopoly of steam navigation on the Hudson River. Beaten by it, it is stated, a quarter of an hour in time of completion and trial, Stevens sent his boat, in June, 1808, in charge of his son, Robert L. Stevens, around into the Delaware, and the latter thus had the honor of being the first to make a sea voyage in a steam vessel. Stevens' boats were successful on the Delaware and on the Connecticut for many years, and, after the expiration of Fulton's monopoly, became the most successful on the Hudson.

In 1812, Colonel John Stevens proposed to construct an ironclad floating battery, which was identical in all its leading features with the circular battery, proposed sixty years later by the late John Elder, of Glasgow, and which has recently been illustrated in foreign engineering periodicals. This odd craft was intended for harbor defence. It was to be a saucer-shaped vessel with a bomb-proof deck, and armed with a number of the heaviest guns. It was anchored by a swivel at its center, about which it was to be rapidly turned by a set of submerged screws driven by a steam engine. As each gun during its revolution came into the line of fire, it was discharged and was reloaded before the completion of another revolution brought it into line again. The plan evidently resembled somewhat the "monitor" in principle. This was probably the first ironclad of which plans were ever prepared. In 1812 Colonel Stevens proposed and urged upon the New York State Legislature the construction of a railroad to connect the waters of the Hudson with those of the great lakes, and insisted that economy of first cost, and of maintenance, as well as convenience and speed of transportation, dictated the adoption of his plan rather

than the construction of the canal proposed by De Witt Clinton, Gouverneur Morris, and other distinguished men of that time. He published a pamphlet in May, 1812, embodying his views and arguments. He describes precisely



EDWIN A. STEVENS.

the modern railroad and even the non-condensing locomotive engine, with wheels fast on the axle, with flanges and every modern detail. He states, with wonderfully prophetic judgment, that the probable practical average speed may be ex-

and engineering skill, and who had also the necessary energy and enterprise to carry out their great schemes. Robert L. Stevens seems to have been the most persistent worker in the field in which his father had first labored. In 1814 he started the Philadelphia, and attained the then wonderful speed of thirteen and a half miles an hour. This was the first boat of the first day line to Albany. He subsequently added a false bow to this vessel and, by thus fining her lines, increased her speed considerably. Fulton introduced steam ferry boats, and, in 1822, Robert L. Stevens built the Hoboken, the first ferryboat of the now standard form in the United States.

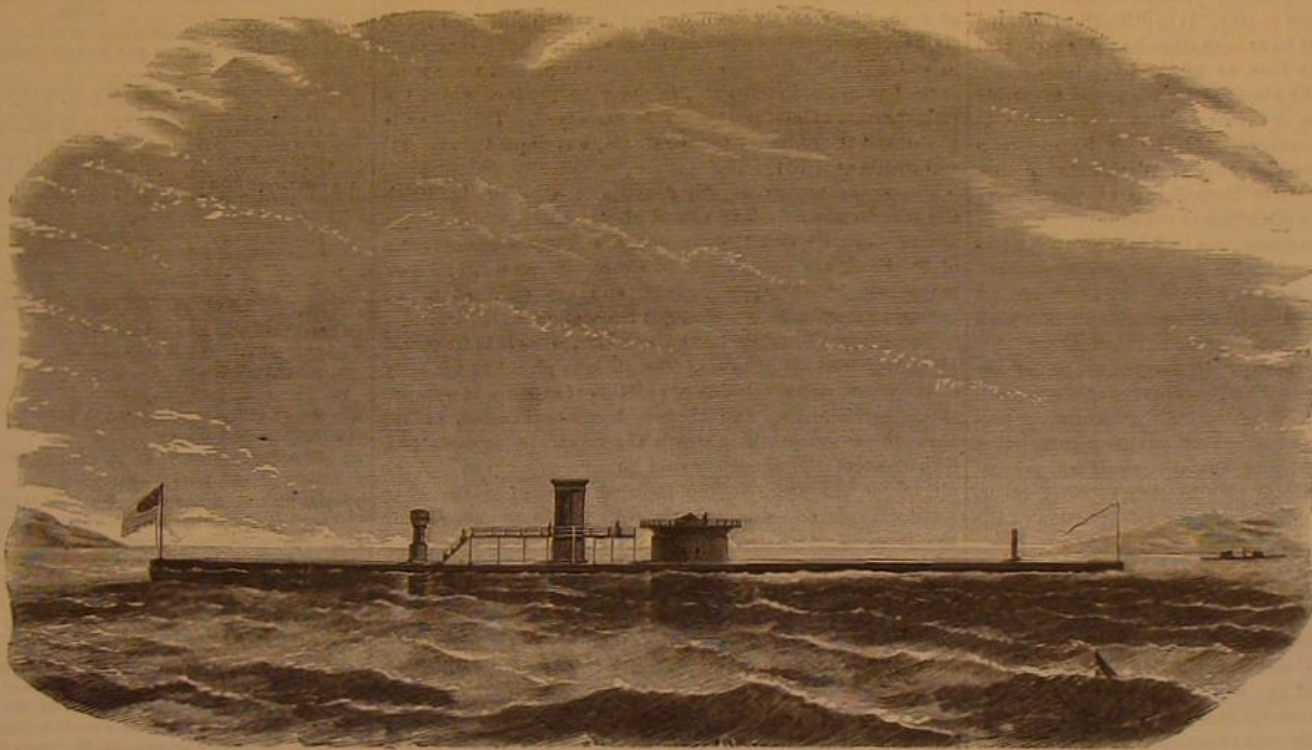
The locomotives used on the Camden and Amboy Railroad were built from the plans of R. L. Stevens, either at his own shops in Hoboken or in England, where among his correspondents was Robert Stephenson. An autograph letter from the latter to the former, dated 1833, descriptive of his "large" locomotive, which weighed nine tons and could draw a hundred tons at the velocity of "sixteen or eighteen miles an hour on a level," is preserved in the "Relic Corner" of Professor Thurston's lecture room at the Stevens Institute of Technology.

This ingenious man invented the now almost universally used wrought iron T rail; and when the great Dowlais Works of South Wales were unable to find a man to roll the new form, Mr. Stevens himself went abroad and accomplished the self-set task successfully. He had already made many valuable improvements and inventions. In 1808 he had induced his father to introduce hollow water lines in the *Phoenix*; and in the succeeding year he invented the feathering paddle wheel, now so generally used in Great Britain, and the A frame and guard beam which is now always used on our own side wheel steamers. In 1813 or 1814, during the war with Great Britain, he invented elongated shot and shell to be fired from smooth bored guns, and the shell were fitted with a percussion fuse so arranged that only the tremendous shock of striking the object fired at would explode them, and were thus safe against explosion by any percussion produced by ordinary accidents. Being hermetically sealed, they could not deteriorate with age.

In the Philadelphia, in 1813, he used steam expansively; in 1818 he used coal in the cupola furnace, and a little later in the steam boilers of the *Passaic*. He invented the now universally known American skeleton walking beam, with its cast iron center and forged strap, and used it on the Hoboken in 1822. He placed the boilers of the Trenton on the guards, in 1824, a custom now universal here; he used blowers, for the first time, on the North America in 1827; and, in the same vessel, he applied the hog frame to stiffen the long, slender hull. He brought out the New Philadelphia, in 1833, with spring bearings under the shafts, which, it is worth knowing, were of cast iron and are still running. In this boat, also, he used the first double puppet balance valve. He built an ice boat in 1833 for the Philadelphia and Camden ferry. At that time he built fire tubular boilers, a form which had hitherto only been used on locomotives, and gave them the shape now known as "marine." He used steam packed pistons in 1840, in the Trenton.

With Mr. Francis B. Stevens, his nephew and still the well known superintendent of the Camden and Amboy repair shops at Hoboken, he invented, in 1841, the Stevens cut-off valve gear, which is still used on the larger number of marine beam engines. He built, at about the same time, locomotives with cut off valves, brought out eight wheeled engines, and used anthracite coal in their furnaces. In 1848 he used anthracite successfully in passenger locomotives; and at various times he made numerous minor inventions which cannot be even named here.

When a very young man, Robert L. Stevens commenced experimenting on the shot-resisting power of



THE STEVENS IRONCLAD BATTERY.

pected to be twenty or thirty miles per hour, and that he can "see nothing to hinder a steam carriage moving on these ways with a velocity of one hundred miles an hour." And all this was before the British engineer, George Stephenson, had begun even the rude Killingworth machine which drew its little train with so much velocity.

A little later this great man had an experimental locomotive in operation on his own premises, and subsequently, with his sons, he was the prime agent in setting in operation, in 1831, the first New Jersey railroads. In all of his engineering operations, Colonel Stevens was aided by his sons, who inherited much of their father's peculiar talent



THE STEVENS BATTERY IN THE DRY DOCK, HOBOKEN, N. J.

iron plates. As a practical result of his investigations, his brothers, James C. and Edwin A. Stevens, addressed a letter, August 13, 1841, to the Navy Department, proposing, as the idea of Robert L. Stevens, an ironclad vessel of great speed, with machinery entirely below the water line, driving the screw. The armament was to be the heaviest breechloading rifled ordnance, with elongated projectiles, both shot and shell. The usual delays deferred the decision of the government, and the preparation of plans and preliminaries occupied several years; but finally, in 1843, a contract was made, and, in 1854, the keel of the ironclad was laid, and the work progressed intermittently, as changes of plan and of naval administration interrupted it, until Mr. Stevens' death. The vessel as first proposed was to have been 250 feet long, 40 feet beam, 28 feet deep, of 900 indicated horse power, and protected by armor $4\frac{1}{2}$ inches thick. At Mr. Stevens' death he had made a far more formidable vessel. The dimensions, when General McClellan was engaged to rebuild and complete the ship, were: length, 415 feet; beam, 45 feet; depth 22 $\frac{1}{2}$ feet; and thickness of armor proposed, 6 $\frac{1}{2}$ inches. The power of the machinery was estimated at 8,624 horse power, and her twin screws were to drive the vessel twenty miles an hour. The vessel was in this form at the commencement of the late war, but without armor or armament. The Navy Department appointed a board to examine the vessel, the majority of which board after, as claimed by Mr. Stevens, a cursory inspection, reported against completing the vessel, except on terms unsatisfactory to Mr. Stevens. Professor Henry, in a minority report, urged prompt completion and her employment against the enemy. It is difficult to imagine what good work might not have been done had this powerful vessel been placed in our fleet, as might have been done, early in 1861. Mr. Stevens obtained for his vessel favorable professional opinions from the most distinguished engineers and shipbuilders in the country. R. L. Loper, Samuel Harlan, Jacob G. Nease, Theodore Birely, Washington Jones, Erasmus W. Smith, and Meigs Coryell, all of whom were acknowledged as the best authorities in the country, endorsed Mr. Stevens' plan; but the vessel was still looked upon without favor by the government. No generally acknowledged authority on the subject seems to have had influence against the ship; yet, notwithstanding the exigencies of our civil war, she was allowed to remain idle upon the stocks.

After his death, the brothers of Mr. Stevens continued the effort to obtain the completion and acceptance of the vessel, with no greater success. Commodore Goldsborough presented a somewhat ambiguous report, advising completion and trial before purchase, and the distinguished present Chief of the Bureau of Steam Engineering reported favorably as to the machinery, which was the vital portion of the plan.

Finally, Mr. Edwin A. Stevens, who inherited the property of his brother, died, leaving the vessel to the State of New Jersey, and appropriating a million of dollars to complete her. The executors, in accordance with the known desire of the testator, appointed General McClellan as engineer to carry out the provisions of the will.

Under the direction of General McClellan and his assistant, Mr. Isaac Newton, the ship was completely rebuilt and new machinery constructed; and the vessel was converted into a monitor. The funds, however, proved insufficient to complete the vessel on the new and elaborate scale proposed, and, at last, work was stopped. A question arose as to ownership, and the State Legislature directed that the vessel be sold as she stands, and the proceeds paid into court.

The commission appointed to effect the sale, Governor Parker, Vice-Chancellor Dodd, and Mr. Stevens' executors, have now employed Professor Thurston as their consulting engineer, and have issued a pamphlet containing his report, in which the vessel and machinery are minutely described, and the calculations of strength, of speed, and of other important particulars are given at considerable length. The pamphlet is beautifully gotten up and is illustrated by drawings of the vessel and machinery, and views of the premises where the ship now lies. From this book we learn that the vessel is intended to be made a turreted ironclad, as here illustrated. She has a greater displacement than has any vessel in our navy—over 6,000 tons. She has four main engines, is 6 feet in diameter of cylinders, and of over 6,000 horse power. The details are shown to have great strength, and the journals to have ample bearing surface. The drawings show the lines of the vessel, and the engines are shown in plan and in side and end elevation. The boilers are of immense size, having 876 square feet of grate and 28,000 square feet of heating surface. Air is supplied by several large blowers which force it into the airtight fire room. The sides are to be protected by armor 10 inches thick, while the turret, 16 or 18 inches thick, can protect the heaviest ordnance in the world. The speed is estimated, on the basis of ordinary everyday performance, at 16 $\frac{1}{2}$ knots as a maximum. Could the apparently unusually favorable conditions of the case be relied upon with certainty, Professor Thurston informs us, the speed would become not far from 20 miles an hour. The estimates of speed are made in several different ways, that usually considered most reliable—Professor Rankine's method—giving highest results. The slip of the screws, in consequence of their great area, is calculated at but 9 per cent, and this will effect considerable economy of power. At 16 knots the vessel will steam 100 hours, on 800 tons of coal, making a run of 1,744 nautical miles. At 6 knots, she will steam 30 days and 5,256 miles. As a merchant steamer, carrying 1,600 tons of coal, she would go from New York to Liverpool in 8 days, or to Queenstown in 7 $\frac{1}{2}$ days, with favoring winds and smooth sea. As a steam ram, she would strike a blow of 60,000 foot tons energy, which is equal to the concentrated impact of

eight or nine British 600 pounder rifles, of six 20 inch Rodman shot, or of four of the 81 ton rifles recently designed for the British navy.

We give overleaf a view of the vessel as she lies in dry dock at Hoboken, not far from the Stevens Institute of Technology. Our advertising columns contain Professor Thurston's advertisement, which gives the main dimensions. We are indebted to that gentleman for many of the interesting particulars which have been given above.

The vessel is to be sold either as an entirety or in detached parcels, in November next, and the public, as well as naval men and engineers, will await the result with interest. It would certainly be sad if a splendid ironclad vessel, upon which millions of dollars and a vast amount of the finest engineering talent ever known had been expended, should go into the scrap heap because of the indifference of our own Navy Department, or in consequence of the reluctance of officers to trust their own judgment when the value of the vessel is so plainly shown them. It would be even more unfortunate if the superior intelligence or enterprise of some foreign government should add the fastest ironclad in the world to a foreign navy, where it may at some time act against what miserable remnant of a navy we may then still retain. Should it seem probable that such may be the case, it is to be hoped that some public spirited citizen may buy her and present her to our impecunious Navy Department.

A New Refrigerating Process.

A new process of refrigeration, adapted to the preserving of food, has recently been devised by M. Tellier, a French civil engineer. It consists in maintaining, in the receptacle in which the material to be preserved is placed, a temperature of from 30° to 32° Fah., in order to produce which the condensation of methylic ether is employed. This ether is gaseous at the ordinary temperatures, but liquefies at -32° and distills at +5.8° Fah.

The apparatus principally consists in a cooler, in which the ether is placed. The vapors of the latter, which escape at a tension of about 1 $\frac{1}{2}$ atmospheres and at the temperature of 58° Fah., are compressed in a condenser at 6, 7 and 8 atmospheres. They then liquefy, and are returned to the cooler, so that there is a constant circulation.

The cooler resembles a tubular boiler, since it is traversed by a large number of tubes. The ether is placed in the body of the vessel, and a solution of chloride of calcium is pumped through the pipes, and thence, becoming cooled, is led through the receptacle in which the meat, etc., is contained. The effect of the intensely cold liquid current is to cool the air in the chambers to the freezing point of water, when watery vapor and atmospheric germs become deposited in the form of hoar frost. The solution is then conducted back to a reservoir, and thence through the cooler pipes again. A committee from the French Academy of Sciences, deputed to examine this invention, speak of it very highly, and state that meat thus kept for months, and subsequently cooked, was found to be in perfectly fresh condition.

Compressed Gun Cotton.

A series of experiments is in progress at the Royal Arsenal, Woolwich, Eng., with a view of further elucidating some of the various attributes and characteristics pertaining to compressed gun cotton. Interesting facts as to the extraordinary rapidity of detonation of gun cotton were brought to light about a year ago. It was ascertained that this was unprecedented, the swiftness of the action being marvelous; indeed, with the exception of light and electricity, the detonation of gun cotton traveled with greater rapidity than anything we are cognizant of. Thus, detonation would take place along a line of compressed gun cotton disks, placed so near as to touch each other, with a velocity only inferior to that of electricity or light, igniting a charge or conveying a signal, if desired, almost instantaneously; 20,000 feet, or nearly three miles per second, was calculated to be the rate of transit, according to Noble's electro-chronoscope. A powder quick match of the most delicate construction ignites so leisurely that the process can almost be observed with the eye. Now, comparing the velocity of detonation of gun cotton with some other speeds, we find that it is eighteen times greater than that of sound, fifteen times greater than that of a rifle bullet and actually one hundred and eighty times superior to that of the swiftest express train. One important characteristic in the detonation of compressed gun cotton is its power of self-transmission, unimpaired in violence and vigor of action, through a continuous train of disks. It is carried on from one disk to another, each in its turn being acted on by its neighbor behind, and setting up a similar action on its neighbor in front.

The present experiments are to determine the relative effects of the detonation of various classes of gun cotton, nitrated and common, when performed in the open air. A "crusher gage" has been employed. It consists of a cast iron body with an orifice at the top, into which a socket is screwed. Within this a piston works up and down, which is recessed around for packing. Pellets of copper are placed upon an anvil beneath the piston, and they are kept in position by a little india rubber washer placed around them. The crusher gage is then securely screwed to a large wrought iron plate at its three corners. The pellets employed are cylinders of copper $\frac{1}{2}$ inch high, diameter 2.306 inches, and area, $\frac{1}{2}$ inch. The means adopted for determining the amount of pressure exerted upon the piston by the shock of an adjacent explosion are by measuring, with a delicate micrometer, the extent to which the pellets are compressed. Several 5 lbs. charges of compressed gun cotton were detonated, each at about a foot's distance from the crusher gage, and in the open air. In some instances the compression of the copper pellets was equal to 3 $\frac{1}{2}$ tons per square inch.

The concussion given to the air, then, by the detonation of a large mass of gun cotton must be simply prodigious. But we were prepared to find that it was extreme from observations taken during experiments recently instituted at the Arsenal with disks of gun cotton detonated upon wrought iron slabs, 1 $\frac{1}{2}$ inches, 1 $\frac{1}{4}$ inches, and 1 $\frac{1}{2}$ inches thick. Although loosely placed upon the slabs, with only a light tamping of sand over them to keep the detonating fuze in position, and not in any way confined, upon firing the charges, consisting of $\frac{1}{2}$ lb. compressed gun cotton, the slabs of iron were split into fragments. Moreover, a band of disks placed around the trunk of a large tree at Upnor, and detonated, severed it instantaneously as though felled by a single blow from an ax.—*The Engineer*.

DECISIONS OF THE COURTS.

United States Circuit Court—Southern District of New York.

PATENT BRACELET.—BARCLAY AND KNAPP vs. THAYER AND CUSHMAN. Blatchford, Judge.

This suit is brought on reissued letters patent granted to John Barclay, December 6, 1870, for an "improvement in the manufacture of plated metal bracelets," the original patent having been granted to him as inventor August 24, 1869.

This patent bracelet is constructed by turning over the two edges of the under plate until they rest on the base metal, and form a bead on each side, and then fastening by solder between the beads the edges of a single outer plate, so that a section of it is the form of an inverted U. Held by the court (Judge Blatchford) that this is the subject of a valid patent, although a previous patent covered a bracelet with its under plate of a similar form, but which was completed by sliding bits of metal with projecting lips under the beads.

[J. Van Santvoord, for the plaintiffs.
Carroll D. Wright, for the defendants.]

United States Circuit Court—District of Massachusetts.

PATENT ALPHABET BLOCKS.—SAMUEL L. HILL vs. J. T. HOUGHTON.

[In equity.—Before Clifford and Lowell, Judges.—Decided May 20, 1874.] Lowell, Judge.

Placing the letters of the alphabet upon cubical blocks of wood, or spelling blocks, having been practiced many years, and also placing two such letters upon some of the blocks, it is not patentable to place two or more upon each block, even if they are placed more systematically, and with the design of rendering the blocks more useful.

Letter blocks with pictures upon some of their faces do not infringe upon a patent for such blocks with figures upon some of their faces, by which they can be selected in accordance with a key accompanying them, so as to spell particular words, such blocks with pictures having been long known.

Bill dismissed.
[J. Van Santvoord, for complainant.
A. A. Ranney, for defendant.]

NEW BOOKS AND PUBLICATIONS.

IMPROVEMENTS IN STEAM ENGINES. By John Houpt, Pennsylvania. With Diagrams. Philadelphia: J. B. Lipincott & Co.

Mr. Houpt has invented and patented a long list of improved steam engine details, and he here reprints, in pocket book form, the specifications and drawings thereof.

EL ATENEO. \$6 a year, 50 cents a number. Office, 31 Park Row, New York city.

This is the title of a new and beautiful monthly periodical, in the Spanish language, the first number of which is before us. Its contents include literature, the arts and sciences, each department being copiously illustrated with plates or engravings, while the general typography is most excellent. Taken altogether, it is a very beautiful publication, full of interesting and valuable information. We trust it may have a very wide circulation.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From June 19 to July 25, 1874, inclusive.

BARKER'S CHAIR.—W. M. Golden (of Brooklyn, N. Y.), London, England.
BEARING, JOURNAL BOX, ETC.—W. W. Crane, Auburn, N. Y.
BUTTON AND FASTENER.—D. Heaton, Providence, R. I.
CARD FASTENER.—J. H. Small, Buffalo, N. Y., et al.
CHANGING COSTUMES.—J. Morris (of New York city), London, England.
GAS BURNER.—A. T. Welch, Brooklyn, N. Y.
GAS ENGINE.—G. B. Brayton, Boston, Mass.
GAS MANUFACTURE.—W. Harkness, Providence, R. I.
GUANO BAG, ETC.—B. R. Crossdale (of Philadelphia, Pa.), London, Eng.
HOLDING AND PUNCHING TICKETS, ETC.—J. H. Small, Buffalo, N. Y.
INSECT-TRAP.—R. Brower, New York city.
LAWN MOWER.—D. Williams, New York city.
LUBRICATING COMPOUND.—R. French, Rochester, N. Y.
MAKING FISH NETS.—R. Arnold, East Greenwich, R. I.
METALLURGICAL FURNACE.—S. P. M. Tasker, Philadelphia, Pa.
PULLEY HUB.—W. W. Crane, Auburn, N. Y.
REAPER AND MOWER.—W. N. Whitely, Springfield, O.
REFRIGERATOR.—J. J. Bate, Brooklyn, N. Y.
SOLDERING PIPES, ETC.—W. A. Shaw, New York city.
SURFACING TEXTILE FABRICS.—W. Bell, New York city.
WHARF TUBE FOR WOOL SPINNING MACHINES.—J. C. Wellens, Phila., Pa.

Recent American and Foreign Patents.

Improved Screw Driver.

James A. Wakefield, Minneapolis, Minn.—This consists of a combination of a screw driver and one or more countersinks or other similar tools. When the screw driver is in use, the countersinks are drawn back toward the brace, with the backs in contact with the screw driver. When a countersink is required, it is turned on a pivot pin, as on a hinge, to the proper position. A small slit in the back of the head of each countersink receives the end of the screw driver. The faces of the countersinks are fitted to the sides of the screw driver, and the screw driver turns the countersink as it would turn a wood screw.

Improved Combined Wheat Sifter and Cockle Extractor.

Lourens Arentsen, Gibberville, Wis.—In using this machine the wheat flows from the hopper into a cylinder, where it is cleaned from dust and other substances that may adhere to it. If the wheat is free from cockle a sieve is adjusted to uncover the hole through a partition and allow the wheat to pass through a tube or spout to the wheat spout, where the dust is withdrawn through the spout by the air blast. If the wheat contains cockle seed the sieve is adjusted to close the hole in the partition, and open other holes, allowing the wheat to pass into the space between a screen and cone. As the wheat passes down through the said spaces, the cockle seeds enter the recesses in the screen, where they are held by the pressure of the air, which passes in with the wheat and through the openings in a ring plate. As the cockle seeds come opposite openings between the parts of double threads between cylinder and screen, they are forced through said openings by the current of air passing through the holes in the screen, and through the said openings between the parts of the threads as it makes its way through the spout to the fan. The cockle seeds drop through the interior of the cone to the air spout, whence they escape through the valve door.

Improved Plow.

William Wariner, Creelsborough, Ky.—This is an improved plow for loosening the subsoil around small plants, and at the same time throwing soil around them, which may be readily adjusted to throw less or more soil around the plants, as may be desired. The essential features are the adjustment of the wings for the last mentioned purpose and the arrangements for strengthening and supporting handles and beam.

Improved Corn Planter.

William A. Watkins, Culleoka, Tenn.—This invention is an improvement in the class of seed planters whose hopper slide is vibrated or reciprocated, by means of arms or other projections on the inner side of the transporting wheels. The essential features are rectangular or polygonal plates, pivoted in the ends of a platform, the seed slide, and the blocks attached to the wheels, which are fast on the axle, all constructed so that the slide is reciprocated and its movement arrested by the pivoted plates in alternate succession.

Improved Sewing Machine Table.

Ellis R. Clark, Marshfield, Ind., assignor to himself and William L. Hamilton, same place.—This invention consists of a table top, to which the sewing machine is connected, which is detachable from the top of the stand, and a sliding top for said stand, contrived in a peculiar and simple manner, to take the machine off the stand, when not in use, and inclose it within the case under the sliding top; and when it is in use, to adjust the sliding stop so as to be used as an extension of the top of the machine.

Improved Lamp for Heating.

James Iredale, Toronto, Canada.—There is an adjustable frame outside the wicks for regulating the flame, which frame is raised and lowered by means of the arms on a shaft. The arms enter holes in the flanges of the frame, and the shaft is turned by means of a thumb piece. A strip of metal is arranged diametrically in the mouth or top of the air tube for the purpose of dividing the air current, and diverting it laterally to the wicks. See illustration, page 88, present volume.

Improved Revolving Scraper.

Wilkins J. Webb, Butler, Ill.—The scraper is of semicircular form, having circular heads, and is attached by means of gudgeons in the center of the heads, with suitable bearings in a frame. The tongue, which is hinged to the cross piece of the frame, is adjustable as to height. The position of the scraper in reference to the frame is governed by a long lever, which extends back over the scraper, and is controlled by the attendant who walks behind. Pins come in contact with catches when the scraper is filling; and when the scraper is loaded, it is prevented from revolving by the pins and catches, until the load is conveyed to the desired location to be dumped. When this point is obtained, the catches are thrown from under the pin by turning a rock shaft, which is done by drawing back a lever. This allows the scraper to revolve and deposit its load, and then to serve as the wheels of a cart in moving it back to its work.

Improved Method of Facing Porcelain-Lined Vessels.

John C. Milligan, South Orange, N. J., assignor to Lalance and Grojean Manufacturing Company, New York city.—It has been the custom, in the manufacture of porcelain-lined ice pitchers and the like, to inclose the porcelain-lined bowl or pot in an outer shell, plated on the outside to obtain the necessary exterior finish. Hence two bowls or pots have been used when one would answer as well, provided its exterior surface could be properly finished. This the present inventor has succeeded in doing by plating the iron pot with a heavy coat of tin, or copper, or other cheap metal, by the battery process, after it has been lined. The surface is then brushed with strong revolving brushes to level down the high places and fill up the low ones. Smoothing and burnishing follows, and afterward plating the tin, copper, or other cheap metal used for the preparatory coating, with the finishing coat of tin, silver, or nickel, thus obtaining a smooth and even surface.

Improved Draft Equalizer.

Josiah Dodge, Grass Valley, Cal.—This is an improved double tree, so constructed as to give the horse which may get in the rear of the other and which is generally the weaker or slower, an advantage of leverage, so that he may be able to get even with the other horse while both horses are exerting their full strength, and without its being necessary to check or old back the forward horse. The invention consists in the arrangement of the bolt or hammer hole of a double tree in the rear of its axis, and in an iron strap or plate attached to the rear edge of the double tree to sustain the draft strain.

Improved Anchor.

Alphonso H. Cobb, Detroit, Mich.—This anchor has a joint in the shank, near the arms. The latter, the flukes, and the stock are all turned in the same plane. It is claimed that the anchor will hold in whatever position it is dropped. The stock can be laid parallel or detached; the arms may be laid parallel, or, by taking out the pin, the parts may be separately stowed or shipped, and afterward joined with but little trouble.

Improved Pen Holder.

George W. Jolly, Knoxville, Iowa.—There is a clip in the shape of a truncated triangle, two sides of which are bent in tubular form. Through one tube passes the pen holder, and through the other a guide staff. The plate is formed on the angle necessary to give the inclination of the guide staff required for carrying it forward of the pen sufficiently to control the hand properly and hold the pen in proper position. The staff slides up and down in the clip to regulate the extension of it below the point of connection of the pen holder to suit the particular case in hand. A ring on the holder is slipped on the fore finger as near to the upper joint as may be, and the staff is placed between the second and third fingers below the pen holder, and over the thumb above the holder, for using the apparatus. The essential effects of the attachment are: holding the hand up to the proper level; holding the fingers so as to compel the movement of the fore arm to work the pen; and keeping the wrist off the paper, so that the arm only rests upon the table on the muscle or fleshy part a little forward of the elbow.

Improved Bob Sled.

William L. Mosher, Maunton, Wis.—The cast iron knee, which rests on the top of the runner, is held in place on the runner by long bolts, extending from the shoe of the runner up on the top of the rave, along grooves in the sides. These grooves it is proposed to make wider, from the bottom upward for a short distance, than the bolt, so that the foot may shift a little laterally when the sled lurches heavily, and thus ease the effect on the bolts. The runners also are arranged to rise up at the front end independently of each other, to pass over objects or irregular ground without straining the joints.

Improved Cultivator.

Alexander P. Carnaghy, Summer Bridge, Del.—The upper ends of the teeth are inserted in sockets, attached in proper positions to the under side of the beams, where they are secured in place by the wedge bolts, which are inserted in the cavity of the teeth, pass up through the beams, and are drawn up into place and held by nuts screwed upon their upper ends. By this construction the teeth will be firmly held, and at the same time may be readily detached when desired.

Improved Telegraph Key.

Randall W. Walker, Oxford, N. Y.—This is a combined telegraph key, by which a dispatch may be sent over two or more lines at the same time, or over one or more separate lines, as desired. The invention consists of a telegraph key made of as many insulated plates as there are lines to be worked, which plates are provided with sidewise projecting logs for attachment to the connecting wire. Any one or more lines may be worked separately for transmitting dispatches by cutting the remaining wires out by circuit closers.

Improved Car Ventilating Apparatus.

Henry A. Gouge, New York city.—The inlet devices are placed at the alternate angles of the car. Each is made in two parts, with funnel-shaped mouths, the mouth of the one part being forward, and that of the other part rearward. The parts of the device unite into a single tube, which passes down through the roof of the car, and its upper part is divided into two passages, one for each mouth, by a partition, which extends a little below the roof. In the sides of the car, just below the roof, are formed openings leading into the tube. By this arrangement, as the car moves in either direction, the air passes in through the forward mouths of the devices, and passes down through the tube, which induces a strong current of air through the openings. Suitable arrangement enables the air to be heated before being introduced into the car; and by other devices, the forward movement of the car will induce an upward current of air through the device which draws the impure air from the car. By this construction also, a downward wind cannot blow into the car, but will only induce an upward draft through the device.

Improved Glove Fastening.

Isaac Hermann, New York city.—Each button is made of an upper plate and a lower plate, which are connected through a small perforation of the glove by means of a central screw bolt of the top plate, turning into a threaded socket of the lower plate. The firm position of both plates is secured by prongs of the top plate, which penetrate partly into the leather of the glove, and clamp it rigidly on screwing on the socket plate. The top plate of one button is provided with a small ring, while the top plate of the opposite button has a common or swivel hook soldered thereto. The connecting chain is attached to the hook, passed then through the ring and back to the hook, to be adjusted to the length required. This seems to be a useful improvement over the ordinary glove button or hook, as it can be made in ornamental form of precious metal, and transferred from one glove to another as the articles wear out.

Improved Portable Fare Box.

Henry R. Gillingham, Baltimore, Md.—This invention relates to boxes which are carried by conductors with them through horse cars while collecting the fares from passengers, and consists in certain means whereby each fare will be separately dropped into the box, and a registry thereof made for the inspection of the railroad superintendent, while, at the same time, a gong is sounded to notify and acknowledge the receipt of fare to each passenger.

Improved Harness Saddle Tree and Harness Saddle.

Samuel E. Tompkins, Sing Sing, N. Y.—The first of these inventions consists of the terret nuts, fastened to the back band, in combination with the upper elevated and lower depressed bridges of the tree, instead of being fastened to the upper bridge or to the under bearing plates, as they have heretofore been arranged. The object is to enable the saddles to be made and kept in store ready for sale without fitting on the terret mountings, to allow the purchaser to select the mountings to his taste, also to preserve the mountings better until sold by keeping them in their packages. The invention also consists of an improved construction of the crupper loop, whereby it can be removed at any time and another put in place without removing the filling or middle piece of leather usually placed between the seat and the frame where the crupper loop is attached. The same inventor has also devised an improved method of constructing harness saddles so that the back bands and terret nuts can be readily applied and removed after the saddle is completed, to allow of the application of terret mountings to suit the fancy of the purchaser. In this invention the essential features are a short tree with a bridge extending nearly the whole length of each side, having screw holes in the margin, at the lower end, for use in certain kinds of saddles, for screwing on the under plate from the lower side; also nail holes in the margin of a flat tree for fastening the flap when put on the top side; and also a metal plate attached to the upper end of the back band, having a socket for holding the terret nut, and a covering plate for the socket, to secure the nut without being fastened to the plate by rivets or screws. The covering plate is pivoted at one end to the socket plate, so as to swing forward and back to open and close the socket when the back band is not connected to the saddle, and be kept in place to secure the nut by the saddle when the back band is connected.

Improved Plow Supporter.

Francis M. Shields, Haskins, Miss., assignor to himself and John C. Holmes, same place.—The supporter is made of cast iron, with a flange, which receives the shank of the shovel. The under side is hollowed out to fit the stock, and the edges of the hollowed inner surface are provided with a series of points which penetrate the wood and hold the supporter in place. There is a slot hole through the supporter, a bolt which passes through the stock, the slot hole, and the plow, by which means the plow is held firmly to the stock. The slot allows the supporter to be raised or lowered on the stock, so as to fit the share. In this kind of improvement a variety of plows or shares is employed, to adapt it to various crops and soils, varying in form as may be found necessary, and each used as may be required, but all fitting the supporter and fastened in the same manner.

Improved Lathe.

Benjamin B. Ockington and Andrew J. Ockington, Stratford Hollow, N. H.—There is a double stationary holder for the blanks in the middle portion of the machine, into which the blanks are dropped on each side behind guards, and upon rests, to be taken therefrom by the lathe centers. Said lathes are mounted on a frame which slides forward and backward on the ways, being actuated by a cam and bar. The lathes are arranged on opposite sides of the blank holder, so that, when one moves up to it, the other moves away from it. In front of each lathe is a shaping cutter, so fixed on the upper end of a swinging frame that, when the blank is moved outward, it will come against the cutter and be reduced to the required shape by it, the cutter being the whole length of the blank, and, after the blank comes against it, moving back with it during the time it operates on the blank, and until the frame carrying the lathes arrives at the end of its movement. The frame carrying the cutter is then engaged by the spring catch and held back while the lathe returns.

Apparatus for Destroying Animal and Vegetable Life.

John M. McGee, Milton, Fla.—This is a box which is turned bottom upwards on the ground and provided with tubes which enter the latter for a foot. Steam is forced into the device through the top, and its heat kills animal or vegetable life over the surface included.

Improved Process for Baiting and Cleansing Hides.

William Stack, Sussex, Canada.—In a vat containing water is placed bran, oil vitriol, and salt, and in this mixture the skins are allowed to remain for several hours. The skins are next placed in another vat, commonly the one called the pool, with sufficient water to cover them, and tar water and soda is added. This completes the process, and makes the hides ready for the tan liquors.

Improved Carpet Stretcher.

Pulaaki Hays, Cool Bank Station, Ill.—The heads are made three feet in length, and have forward edges provided with hooks, upon which the edges of the carpet are hooked to be stretched. The heads are strengthened by braces and have guard blocks attached to their ends, which keep the heads at such distance from the walls that the carpet can be conveniently tacked. To the middle parts of the heads are attached the outer ends of bars. One bar is slotted longitudinally to receive others. The latter bar is made in sections hinged to each other, so that the stretcher may be more conveniently handled. To the upper side of the bar are attached spurs for the engaging end of a pawl to take hold of in applying power to the stretcher. A small block fits into a compartment to act as a pawl to hold the bars in place while the pawl is being drawn back for another purchase.

Improved Car Wheel.

George W. Millmore, Janesville, Wis.—A tubular bushing has a flange that fits against the outside end of a wheel hub, and also a nut that screws against the other end of a wheel hub, and on the inwardly projecting threaded end of the bushing. Between the tubular bushing and the inside of the hub is located a rubber ring that takes up the shock with great efficiency, while it may be readily applied or removed. In order to prevent the possibility of rotation in the bushing and nut independently of the wheel, a perforation is made transversely through the nut, and at right angles thereto a groove, through the former of which passes an arm, and in the latter of which lies the arm of a right angled key. In the bushing is a slot that receives one arm, while in the hub is an aperture that receives the other. As one arm is in the open slot of that face of the nut that fits against the shoulder of the axle, the key cannot come out unless the wheel is removed from the journal.

Improved Cork Sole for Boots and Shoes.

Edwin A. Brooks, New York city.—Making the cork in two parts or layers prevents the dampness from passing through, however thin or thick the cork may be. A band of sole leather is pasted around the edges of the cork, and is covered with a strip of fine French calfskin. The cover and the upper edge of the sole leather band are sewn in with the upper to the inner sole. To the middle sole, the upper, the lower edge of the sole leather band, the cover, and the welt are sewn by a second seam. The upper is taken up in both seams, which gives great firmness and strength to the sole. The outer sole is sewn to the welt by a third seam in the ordinary manner.

Improved Bridle Snip.

John Kennedy, Ossage Mission, Kan.—The shank of the hook has transverse rear slot and circular top flange. The latter is a groove in which slides a snip having from its point a sloping upward extension or thumb piece. This slide is slotted to allow it to move upon the guide pin and against the tension of a spring. The point of the slide is held by the spring against the end of the hook, thus effectually preventing its escape from the bridle ring. By simply pressing the snip from ring upon the inclined surface of the thumb piece, the slide will recede and allow of the entrance of the ring within the concavity of the hook.

Improved Machine for Raising and Smoothing Panels.

Jacob P. Beck, James F. Shoemaker, and John H. Weaver, Lock Haven, Pa.—Cutters clamped between washers are arranged for cornering or grooving out the edge of a panel at the same time that it is sand-papered. The sand paper is attached to pads which fit in apertures in the same disk to which the cutters are secured.

Improved Boiler Washing Machine.

Franklin H. Biesecker, Cashtown, Pa.—The wash boiler is of cylindrical shape, and on a flange near the bottom is a second false bottom. Below the false bottom, and also near the top, are perforations which are connected by hot water channels tapering from the bottom toward the top for the purpose of discharging the hot water forced up by the generation of steam in the lower part of the boiler with considerable force on the clothes in the upper part. The false bottom has also a central tube through which the water is discharged in connection with a cylindrical cap attached to the under side of the false bottom, and extending to the real bottom of the boiler. The cap is perforated at the side for admitting freely the water, and forming thereby a kind of secondary chamber for developing steam and forcing up the boiling water. The false bottom has apertures closed by valves hinged to the lower side. A rubber block is placed, by its central hollow shaft, over the central hot water tube, the upper solid end of shaft fitting closely into the lid or cover of the boiler. The rubber block placed over the central hot water tube has radial arms and is rotated by a lever handle, keeping thereby the clothes in continual motion and constantly exposed to the action of the boiling water.

Improved Breast Collar for Harness.

George P. Cole, Johnstown, N. Y., assignor to himself, Michael D. Murray, and James F. Murray, same place.—This is a neck strap consisting of an elliptical piece, top piece, bottom piece, and internal spring, the last serving to prevent the breast and neck strap from doubling short in the middle, and also to distribute the pressure evenly.

Improved Dental Coffer Dam Clamp.

Clarkson Bancroft, Brooklyn, N. Y., assignor to Samuel S. White, Philadelphia, Pa.—The jaws of the clamp for gripping the tooth and binding the rubber coffer dam upon it are formed on the edges of steel plates about as wide as will allow of applying to teeth of different sizes, and widening each way from the clamp backward a suitable distance for strength. The ends of the outer edges are connected by bow springs, which rise sufficiently high to extend over the top of the teeth; also to allow of introducing the tool under them to work at the tooth if necessary; and they are also sufficiently wide apart to allow of applying the tool between them when necessary. The jaws, springs, and the tongue guard are all made of a single plate of spring steel. The tongue guard is also adapted for holding a small mouth mirror to aid the operator, the mirror being fastened on it by a clamp of any kind.

Improved Machine for Cutting Soap.

Joseph Seibert, New York city.—The object of this invention is to furnish to soap factories an improved machine for cutting large soap blocks into smaller pieces of any required marketable size by the successive operations of the machine without passing any part of the block a second time through the machine. The main frame supports on its lower part the laterally slotted base piece on which the soap blocks are placed for cutting. The cutting wires of the frame are firmly stretched at the required distance by stretching devices, and extend across the base piece in the lateral slots thereof below the surface. The soap block is placed thereon and firmly secured in position by a clamping plate adjusted by a hand wheel and screw at the top of the frame. The horizontal cutting frame is then slowly raised by the hoisting mechanism, dividing the soap block into lateral parallelepipeds until arrived below the clamping plate, which is screwed up to give space for the suspension of the horizontal frame below the top of the main frame. A check pawl secures the position of the frame until detached therefrom for lowering the frame for cutting the next block. The crank shaft is then thrown into gear with the cog wheels of the feeding mechanism, to intermesh with toothed racks, which are guided on suitable friction rollers in longitudinal direction, and firmly applied with their fore ends to socket plates of a follower block, imparting to the same motion in either direction, according as the crank is turned. The follower carries the vertically divided soap block between side guide plates toward the vertical frames. The vertical cutting frames are made up with varying width of wires, to be readily interchanged, according to the size of the pieces to be cut. By forcing the soap block through the vertical cutting frames, the same is cut into the pieces required, which are carried on to a table or platform to be taken off for further storage or use.

Improved Device for Sharpening Stone Tools.

Knock L. Moore, Steubens, Me.—There is an iron plate on the back of the device to which the other parts are attached, and upon which the movable part of the swage slides. The swage is formed of two parts. The lower and stationary part is placed in a hole in the anvil, and supports the instrument in an upright position, where it is fastened by means of a key. This stationary part of the swage is confined to the plate by a clip. Between the stationary part and the under side of the clip is a forming swage, to upset and give the proper bevel to drills. The movable part of the swage is also kept in position by a clip. There is an opening between the beveled ends of the two parts of the swage in which the tool is placed to be swaged and sharpened. Blows with the hammer are struck upon the end of the movable part, and the chisel or drill is readily brought to the form or bevel of the opening, leaving the sides of the chisel smooth and uniform in shape.

Improved Combined Locket and Smelling Bottle.

Friedrich Wächter, New York city.—The body is divided by a partition plate into two sections, of which one is arranged in the usual manner as a locket with a hinged cover. The other part forms a space around the locket back of the partition plate, and connects, by a top aperture, with a neck, which is provided with a hinged cap having rubber lining for producing the hermetical closing of this part, to be used as a smelling bottle. Any desired perfume may be placed into this space, and the whole device be finished in any desired artistic design and corresponding ornamentation.

Improved Extension Roller.

Wilhelm Valentin, College Point, N. Y.—This invention consists in hinging a series of leaves together and folding them on a larger base leaf, which is applied to a central supporting foot or pillar by a socket plate, so that the pillar may turn therein. A quick screw thread at the lower end of the pillar turns in a female threaded socket with legs, and raises or lowers the leaves, as required. The pillar is placed centrally to the main frame of the table, and forms the support for the table.

Improved Boot and Shoe Nailing Machine.

Lemuel R. Mears, Brooklyn, N. Y.—The object of this invention is to provide a power machine for nailing on the soles of boots and shoes, and at the same time automatically feeding the shoe or boot and supplying the nails. For the nail it is proposed to use the kind made in the form of a long comb, and now used with hand-nailing machines, the nails being connected together by the heads, so as to feed into the machine like a bar, and be detached, one by one, as they are driven. The invention consists of a nail driver and a bender, arranged together in a stock, and geared by rock levers with cams for operating them; also automatic feed mechanism, for feeding the nails to the driver, and also automatic feed mechanism, for feeding the boot or shoe, all so combined and arranged that the nail bar and the boot or shoe feed along simultaneously; and immediately after each feed movement, the bender moves down a little in advance of the driver to adjust the nail to the driving channel, and then the driver moves down and drives the nail into the shoe.

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S. will find directions for making a gutta percha varnish on p. 379, vol. 39.—H. C. H. will find instructions for frosting window glass on p. 264, vol. 39.—X. Y. Z. will find a recipe for lemon sugar on p. 373, vol. 39.—G. F. will find directions for making starch polish on p. 371, vol. 39.—W. P. P. will find a recipe for taking stains out of marble on p. 383, vol. 39.—A. W. and A. P. should refer to some good work on the dog; one was published by the late Mr. Butler, the famous dog fancier.—C. M. will find directions for making an aquarium on the editorial pages of this issue.

J. M. D. says: In No. 15, vol. 39, I saw a recipe for making fulminating powder. I followed the directions given, but failed. The mercury, instead of being dissolved in the acid, formed a white sediment. What was the fault? A. To prepare fulminating mercury, 1 oz. of mercury is dissolved in 8 1/2 ozs., by measure, of nitric acid, by the aid of a gentle heat. The acid should be of specific gravity 1.4. Pour the solution into 10 measured ozs. of alcohol of specific gravity 0.830; action soon ensues, with the evolution of copious white fumes, and the fulminate separates in white crystalline grains, which are washed in cold water and dried at a very gentle heat. If this recipe be followed and your acids are pure, there can be no further trouble.

J. C. H. asks: 1. How can I make steel to cut iron, and what kind of acid is used with it? A. The steel is made in the usual way, and is forged and repeatedly hardened and tempered. Acid is not used. 2. How is fulminating silver made? A. When nitric vapor is passed into a solution of nitrate of silver in alcohol, the fulminate of silver is deposited and forms delicate white crystals, which explode with terrible violence by friction with any hard body, even under water. It should be thoroughly washed and dried with very gentle heat. Your other questions are business matters.

J. E. D. asks: 1. How can I preserve a nickel-plated pistol clean, and save it from rusting? A. In cases like this, where the plating has partly worn or chipped off, or oxidized, because of the thinness or an imperfection in the covering, the best method that we can recommend is that of re-plating. It might also be lacquered. 2. Did M. Coggia discover the comet at Marseilles, or Versailles, France? A. Marseilles.

O. F. M. asks: 1. How can I make a galvanic battery for electrotyping? A. Several since cells would answer your purpose, and may be constructed as follows: Take two plates of zinc, about 3x5 inches, and one of carbon, of about the same dimensions. The zinc must face the carbon, which is supported by a piece of dry wood that at the same time serves to separate or insulate it from the zinc. The zincs are held in position by a brass clamp. Place the elements, thus arranged, in a glass or earthen jar nearly filled with a solution of dilute sulphuric acid and bichromate of potash. 2. How could I restore the color of the backs of books, bound in cloth or leather, which has faded under the light of the sun? A. This cannot be practically accomplished; and if it could, the process is in two cases would be similar. 3. What would be a good cement for holding together the edges of 5 pieces of squarely cut glass for making a tank about 7 x 10 inches? The cement must be watertight and not be destroyed by acids. A. Try diamond cement.

B. F. M. says: 1. In your last issue, C. D. S., in his reply to J. H. P., says there is no trace of glacial action in the tropics. Is it not well established by the researches of Professor Agassiz that there has been such action in the valley of the Amazon? A. The theory of glacial action in the Valley of the Amazon has been a subject of dispute. Humboldt said that the geological formations of the valley belonged to the old red sandstone period. Martius attributed them to the new red; Agassiz called them drift, or the glacial deposit brought from the Andes. The latter claimed that they were all fresh water formations, that there were no evidences of marine origin, no marine shells or fossils, and no tertiary deposits. Against this, Professor Orton, who conducted an expedition up the Amazon in 1863-64, brings opposing evidence. He found a fossiliferous bed intercalated between the variegated clays which are peculiar to the Amazon, that was crowded with marine tertiary shells. From this he concludes of course that the deposits are tertiary and of marine or salt water origin. This bed was found about 200 miles farther up the river than Agassiz went. It would seem as though the conclusion of Agassiz, that, because he saw no fossils in the formation, it was not of marine origin, was a rash one. Professor Orton states, as further proof against the glacial theory, that seams of a highly bituminous lignite are found interstratified with the clay deposits; these seams were traced for a distance of 400 miles. Agassiz acknowledged that he failed to find many of those proofs which we are accustomed to regard even in temperate latitudes as essential to demonstrate the former existence of glaciers where none exist now. He found no glaciated pebbles, no far-transported angular blocks with polished and striated sides, no extensive surface of rock, smooth and traversed by straight and parallel grooves. Mr. Charles Darwin, who travelled in the valley of the Amazon, also opposes the idea of Agassiz in regard to glacial action. Professor Orton says of the geology of the valley: "Around the rim of the basin are the outcroppings of the cretaceous deposit. This rests on mesozoic and paleozoic strata which form the ribs of the Andes." Above it, covering the whole basin from New Granada to the Argentine Republic, are the following formations: first a stratified accumulation of sand; second, a series of laminated clays of different colors, without a pebble; third, a compact sandstone; fourth, a coarse porous sandstone, very ferruginous; fifth, over the sandstone an ochraceous, unstratified sandy clay. "The fourth deposit was originally 1,000 feet thick. But in all the region covered by his travels, Professor Orton nowhere found the evidence necessary for the support of the theory that these formations are the result of glacial action."

2. In one of your issues I notice a statement to the effect that steam or oxygen and hydrogen dissociated,

was present in the atmosphere of the sun. In other words I have seen it stated that the spectroscopic had never revealed oxygen in that body. Will you please tell me and your readers if it is present? A. Of all the elements known as metalloids, hydrogen is the only one which the spectroscopic reveals to us as existing in the sun. At the same time no one who has been engaged in spectrum analysis is ready to pronounce definitely upon the absence of the rest of these elements; but on the other hand, such men as Lockyer, Norton, and Angstrom fully believe in their existence in the sun, and have each advanced plausible reasons to account for their not being detected by the spectroscopic. The following, in substance, are the conclusions of Angstrom, as put forth in a memoir on the subject in 1868. The temperature of the sun is on the one hand too high to permit of such combinations as carburetted hydrogen, cyanogen, etc., being formed, and on the other hand too low to allow of carbon being converted into a gaseous state, so as to form its spectrum or to produce the spectra of oxygen and nitrogen. These conclusions were mainly based upon the results of investigations on the spectrum of the atmosphere and of carbon with the electric current.

H. L. asks: Is there a vortex called the Maelstrom, and where is it? A. Yes, on the coast of Norway.

2. Can a monkey swim? A. Yes.

3. I have noticed, when cutting out stock for cabinet making, that planks are often winding, and (that eight out of ten are winding the one way. My opinion is that it is caused by the heat of the sun on the tree always being on the one side, causing the tree to twist in growing; therefore trees growing in the southern temperate zone would wind in the opposite way. Am I right? A. Trees are unquestionably affected in this way, particularly those standing in exposed positions.

J. E. F. asks: Of what are the red and green stars, used in Roman candles and similar fireworks, made? A. Make a solution of isinglass 1/2 oz., camphor 1/2 oz., alcohol 1/2 oz. For red stars add: 61 per cent chlorate of potash, 16 sulphur, 23 carbonate of strontia. For green, 73 per cent chlorate of potash, 17 sulphur, and 10 boracic acid. For dark blue, 60 per cent chlorate of potash, 16 sulphur, 22 carbonate of copper, 12 alum. For yellow, 61 per cent chlorate of potash, 16 sulphur, 23 dry soda. Make into balls of the requisite size, roll in gunpowder, and dry in the sun.

J. H. D. asks: 1. Does a heavy cannonade cause a rainfall? A. There have been many discussions on this subject, but as yet nothing definite has been arrived at.

2. Is there any society connected with aerostatics? A. There is at present no society of this kind in this country. We shall be pleased to receive the paper you speak of.

J. P. N. asks: In making vinegar from cider, sirup, or alcohol, how can I ascertain when the acetic fermentation is finished, the whole of the alcohol having been changed to vinegar? A. By testing, and seeing whether the percentage of alcohol has decreased, or that of acetic acid increased.

A. R. asks: What is the quickest way to cure moss, to turn it black? A. Oak moss is treated in the following manner: Bury underground until the outside fiber has rotted, then cleanse, dry, and dye.

S. W. J. asks: Is there any preparation of sulphur, not containing mercury, of a light vermilion color? A. A vermilion color cannot be made of any other sulphide but vermilion. Oxysulphide of antimony, or red antimony ore, is of red color.

W. D. S. asks: 1. A neighbor maintains that a cask with a vacuum formed therein will be more buoyant on the water than if filled with air. I say that the vacuum will have no effect as regards the buoyancy. Which is right? A. The cask would certainly be lighter after the air had been exhausted than before, for the reason that air has weight.

2. Are the compartments in ships airtight chambers, or are they rooms that are used for other purposes, such as storage, etc.? A. Airtight chambers.

W. L. D. asks: 1. What can I use to fill the hole in a flower pot, so that it can be used for a battery? A. Fire clay, rubber, paraffined wood, etc.

2. What is the cost of a strip of platinum, such as is used in a Grove battery? A. It depends upon the size of cell. Platinum is worth about 25 cents per gramme, or between 2 and 3 cents a grain.

M. V. & Co. ask: How is an electro-magnet made? How many times must the insulated wire be wrapped around the soft iron? A. This depends wholly upon the size of the magnet.

2. What kind of wire should it be? A. Copper wire is the only kind used.

3. How should it be insulated? A. By winding it closely with silk or cotton.

4. How must the wire be wrapped around the iron? A. In the same direction throughout.

G. G. G. asks: What sized gasometer would it require to contain gas enough to supply 4 burners or lights for 24 hours, allowing the pressure that is usually required to supply small cities with gas? A. You fail to mention the size of the burner to be used. If one consuming three feet per hour be used, you will require a gasometer about 8 feet in diameter and 6 feet high.

M. N. M. asks: 1. How are elastic india rubber stamps made? A. A number of manufacturers have been visited, who decline to describe their processes. 2. How can brass be deposited by the battery? A. We believe this has never been satisfactorily accomplished. 3. I burnished a piece of steel, washed with cream of tartar, and rinsed in running (Potomac) water, taking care not to touch it with my hands. I deposited a heavy coat of nickel by the battery. While burnishing, the nickel all peeled off. I never failed before. Can you suggest the cause of my non-success? A. After cleansing thoroughly as before, coat with copper by dipping for a moment into a solution of blue vitriol (sulphate of copper).

A. H. McK. asks: 1. How do electro-platers charge for plating? Do they charge by weight or by surface? A. In gold or silver plating, the charges are gauged by the acquired weight. Some nickel plating establishments estimate the surface and charge by the square inch. 2. What do they put in the plating solution to make the bright appearance and high polish? A. The metal after being removed from the bath is burnished. 3. What makes the silver peel off? Is the battery too strong? Sometimes it will not stick at all. What would be a good amalgam or preparation to put on the article to make the silver (and gold) stick? A. Articles of copper, brass, and German silver should be first thoroughly scoured with white sand, and then dipped into dilute acid to remove all oxidation, etc. They are then washed in clear water. If these directions are faithfully observed, your trouble will probably disappear.

J. G. C. asks: How many feet of No. 32 wire will be required to produce the electric light with carbon points, using two Grove's cells? A. You cannot obtain a satisfactory light in the way you mention, although with a large coil you might obtain a very long spark.

W. S. H. asks: Is there any way to prepare a copper-plating solution from the pure metal? A. Sulphate of copper is a solution of the metal (or oxide of the metal) in boiling sulphuric acid. A solution of the crystals in water forms the copper bath most generally used in electro-copper plating. It will be much cheaper for you to buy the salt than to attempt to make it.

H. H. P. asks: How can I clean a cask that has contained varnish, so that it would be fit for root beer? A. If the cask contained shellac varnish, it would probably be necessary to use alcohol; other varnishes are mostly solvent in turpentine. However cleaned, we think the cask would not be fit for your purpose.

F. H. B. asks: 1. What is the best mode of purifying butter? How can I make patent butter? I have seen a preparation for this purpose which looks like finely pulverized sugar. A. See p. 119, vol. 30 of the SCIENTIFIC AMERICAN, and p. 190, Science Record for 1874. 2. How can I take mildew out of cotton? A. Wet the spots with a solution of chloride of lime (bleaching powder). Wash out at once with warm water. 3. What can I use in place of rennet liquid that will answer the same purpose? A. Various substances can be used, as pure curd, greenish old cheese, and extract of malt. Curd can be prepared as follows: Heat a quantity of milk which has stood 5 or 6 hours, cool it and separate cream completely. Add to the milk a little vinegar and heat gently, pour off whey, wash and knead with water repeatedly. Then press and dry for use. 4. What will restore colors on carpets, caused by water that has run the colors together? A. Nothing but a process of bleaching and re-dyeing.

F. R. says: I have an ice box 20 feet long, 12 feet high, and 8 feet wide, double walled and packed with fine charcoal, and lined throughout with galvanized iron. I have reduced the ventilation from 4 inches to 1/2 inch, and covered the ice with blankets; and still I cannot keep the ice. Its capacity is 3 1/2 tons, which lasts from 7 to 10 days. It has 3 divisions, each with a door 3 feet by 7 feet, packed with charcoal and lined with galvanized iron also. The ice is overhead, in a large pan (6 x 14 feet) of galvanized iron. The large ventilator is at the top and runs into a flue in the chimney. The waste pipe runs out of the wall into the cistern, and at the bottom of the pipe I have a cup that fits over the waste pipe, keeping the hot air from going up in the top of the ice box. Can you tell me how to make the thing work? A. The cooling power of the refrigerator depends on the melting of the ice, therefore if your box is kept cool the ice must melt. If your ice pan overhead has an open space each side of it, the following arrangement might be adopted to provide a circulation without any ventilating holes: Place a thin partition parallel to and 10 or 12 inches from the back, so as to make the cold air descend in this narrow space, and pass under the bottom of the partition. In the space between the ice pan and front wall, place a box of wire gauze filled with charcoal. Increase the height also of the front side of the ice pan. Then the air entering at the bottom of the apartment, becoming slightly warmed, will rise, but, having to pass through the charcoal box, it will be freed from impurities. There will always be some circulation, and it will be increased when the door is opened.

C. A. H. asks: 1. What is the cheapest mode of making oxygen gas in quantity? A. The method of obtaining the gas from chlorate of potash, mixed with one quarter its weight of black oxide of manganese, and strongly heated in a retort, is perhaps best and in the end cheapest, because of the large volume of nearly pure gas obtained in a short time and with simple apparatus. 2. Is there any cheaper mode of making hydrogen gas than by using sulphuric acid and iron? A. If nearly pure hydrogen is desired, perhaps this will be the cheapest method. Large quantities of hydrogen may be obtained by passing steam through a red hot iron tube filled with iron filings. Charcoal or coke may be used instead of the filings, but the gas will have to be passed through a solution of caustic potash or lime to remove the carbonic acid. 3. If the armature of a permanent steel horseshoe magnet be rapidly detached and brought into juxtaposition, alternately, what will be the effect on the magnet? Will the portative force increase or decrease? What effect will the magneto-electric current produced have upon the magnetic fluid? A. Please state your question a little more explicitly.

W. C. B. says: A man says that he has invented a pump for condensing air which will condense air to 500 lbs. to the square inch without heating the air. Is not this contrary to the principles of natural philosophy? A. The greater number of substances are raised in temperature by compression; air is one of these. If, however, the compression is slow, the heat developed may be carried off by the cylinder in which it is compressed without being noticed. There may also be special contrivances arranged for abstracting the heat as fast as developed.

W. R. O.—A speaking tube will convey the voice 500 feet. The diameter of the pipe must be increased in accordance with the distance.

L. C. says: I have been told that tomatoes induce cancer. In view of the large quantity my family consume, that is to me an appalling statement, and I would like to hear on the subject from some of your medical correspondents. The world wants the best advice on cancers, and I know of no medium so sure as the SCIENTIFIC AMERICAN. A. It is well known that too free a use of raw tomatoes produces cancerous sores, but we call to mind no case of cancer thus induced. Perhaps some of our medical readers can give further information.

C. D. F. says: 1. In your vol. 26, p. 393, it is said that Professor Hough has found that if leather instead of clay is used for the porous cell in a Daniell's battery, the quantity of electricity is nearly doubled. What kind of leather is used, and how is it prepared? A. Common unsoiled leather of moderate thickness. 2. About how many cells of Hitt's or Callaud's battery will it take to make a relay of ordinary resistance work satisfactorily on a line 500 feet in length? A. About 300 square inches of zinc. 3. How many feet and what sized wire is used in a relay of 150 ohms resistance? A. About 800 yards of No. 28.

N. P. J. asks: What is a recipe for an axle grease with tallow for its basis? A. Water 1 gallon clean tallow 3 lbs., palm oil 6 lbs., common soda 1/2 lb. The mixture should be heated to about 210° Fah., and well stirred till it cools down to 70°, when it is ready for use.

C. L. W. asks: 1. How can I find the amount of cyanogen in cyanide of potassium? A. The amount of cyanogen in cyanide of potassium is 38.32 per cent by weight. Thus, if you have 2 ozs. of the cyanide of potassium, 0.77 oz. is cyanogen.

2. I have tried to make a 3 gallon silver-plating solution for the battery process described by A. Watts. I used 3 one gallon cells. I find that the silver dissolves at the rate of 1 grain an hour. Can you inform me where the trouble is? A. If the recipe had been followed in detail, we think you would have had no trouble. Your failure may be due to impure chemicals.

J. W. B. asks: 1. Is alcohol a stimulant proper? A. Yes. Owing to its high diffusive power, it soon enters the blood and exerts a temporary stimulating power.

2. Does it increase nerve force? A. Temporarily, yes.

3. Does it increase the calorific of the human body? A. It decreases it. As the result of many experiments, it has been found that in moderate doses the fall is slight, not amounting to more than 0.4° or 0.6° Fah. But after poisonous doses, the depression in one instance reached 3°.

4. Is it in any sense a food? A. The formula for alcohol is C_2H_5O . When taken in proper quantity for the needs of the system, the carbon is set free and utilized by the body, acting as food.

5. Is it antagonistic to health and life? A. If taken in excess, yes. If not, no.

6. Does it weaken and thin the blood? A. Yes, if taken in excess, since the system exerts itself to throw off the poison, and the blood suffers from the temporary dilution caused by the high diffusive power of the alcohol.

7. Does it kill in the same manner as opium? A. It does not. It kills as chloroform and ether do, except that the first stage, that of stimulation, is longer, and greatly increased quantities of the poison are necessary to produce fatal results.

8. Is it an anesthetic or a narcotic poison? A. An anesthetic.

J. H. R. asks: 1. How can I apply paraffin to heavy masonry paper, or to wooden walls? A. Paraffin is readily soluble in naphtha, to form paraffin varnish.

2. Is it to be put on cold, with a brush, like paint, or melted and applied hot, as pitch? A. It may be applied with a brush.

G. G. M. says: I. It is said that nations living largely on potatoes deteriorate in brain. Is so, why? A. The saying is not true.

2. Why does alcohol evaporate faster than water? A. Because of its greater volatility.

3. Is a person who drinks a great deal of water more inclined to have the dropsy than one who drinks but little? A. No.

K. asks: 1. What sort of water colors are used in the coloring of fashion plates, etc.? A. Fashion plates are all printed by a process known as chromolithography. Barnard's "Theory and Practice of the Art of Painting in Water Colors" will give you full instructions.

2. Has a rifled piece a greater range than a smooth bore, and why? It appears reasonable that the furrows should to some extent diminish the speed of the projectile, and still all modern small arms are rifled, with an increase of range. A. Yes, because of the motion given to the ball on its emerging from the gun, which gives it additional energy to overcome the resistance of the air.

M. H. R. asks: In making a large aquarium, would it be of any use to coat the cement over the joints inside with liquid glass? The frame being of wood, would it be better to cover the rabbit, where the bottom and side glass meet, with liquid glass or paint? A. Use paint; liquid glass dissolves in water.

W. N. W. asks: Please give me a formula for making carvacrol. A. Carvacrol ($C_{10}H_{16}O$) is obtained by treating oil of caraway with potash, or again by treating the same oil with iodine, cohabitating several times, and washing the product with potash; as thus obtained, however, it is mixed with carvene. Carvacrol is also found among the products of the action of iodine on camphor. It is, when pure, a colorless, viscid oil, lighter than water and soluble in water to a small amount. It has an unpleasant odor, and an acid, very persistent taste. It boils at 40° Fah, giving off vapors which irritate the organs of respiration. It burns with a bright, very smoky flame.

A. V. N. asks: What is the power of a coiled spring that is $\frac{1}{4}$ inch thick, 3 inches wide, and 16 feet long? A. The power of coiled springs depends on the number and diameters of the coils, the quality of the steel, and the degree and evenness of the temper, and is, under any circumstances, variable in size so large as you describe.

J. J. H. S. S. says: I have a good spring 1-16 inch thick, $\frac{1}{4}$ inches wide, and 6 feet long; this spring I have permanently fixed to, or near to, one extremity of a round steel bar or axle one foot long. About midway between both ends of this axle or steel bar, I have fixed or attached a toothed wheel, which plays into another (5 times smaller) toothed wheel. This smaller toothed wheel is fixed on to another steel axle about 9 inches long, at the left hand extremity of which is a proportionate fly wheel, and on the right hand extremity a belt wheel. How many pounds can I make this machine lift when once put in motion? A. There is no rule by which the power of springs, such as you here describe, can be calculated; experiment with the individual spring must be depended upon, because no two such springs, though of equal proportions, would give a like result. The power given out by the spring will, however, always be an exact equivalent to the power required to wind it up, less the friction of the working parts of the mechanical device to which it is attached. See our answer to A. V. N., on this page.

J. H. asks: How is gelatin rendered sensitive to light, so that it still retains its normal appearance? A. We have seen the following given as one method of sensitizing gelatin: Take 20 ozs. gelatin and 14 ozs. bichromate potash, dissolved in 8 ozs. warm water; when cooled to 110° Fah, add 2 ozs. albumen from perfectly fresh eggs, and mix the whole well. Coat sheets of paper on one side and hang up in a dark room to dry; when dry, glaze them by pressure if desired.

W. F. B. asks: How can fabrics be rendered waterproof by paraffin? A. By saturating them with the varnish, a solution of paraffin in naphtha.

W. M. asks: How can emery wheels be softened, so that they can be turned? A. Emery wheels are not softened to turn them; some may be turned by simply wetting them as they run, others are turned with a piece of red hot iron, still others are turned with a diamond tool. You had better consult the maker of the wheels, who will probably instruct you as to the method of turning your particular kind of wheel.

A. W. P. asks: 1. Can you give me a good recipe for removing fly specks off picture frames and other gilt woodwork? A. Use tepid water and a fine sponge.

2. Can you tell me how engraving on wood is done, and what are the principal tools? A. There are only four kinds of tools necessary in wood engraving, namely: gravers, flat tools, gouges or scoopers, and flat tools or chisels. The graver is used for nearly all kinds of work except for series of parallel lines, technically called "flints"; flat tools are chiefly used to cut parallel lines, forming an even and uniform tint, such as is usually seen in the representation of a clear sky in wood cuts. Gouges of different sizes are used for scooping out the wood near the center of the block; while flat tools or chisels are chiefly employed in cutting away the wood towards the edges. Refer to some good work on the subject.

D. D. D. asks: 1. What is meant by the swing of a lathe? A. The swing of a lathe means twice the distance from the center to the nearest edge of the bed, or, what is the same thing, the diameter of the largest piece of work the lathe will take in.

2. Joshua Rose says: "All screw-cutting tools, such as taps, dies, etc., reamers, and cutters, should be tempered to a brown color, drills to a bright purple, and chipping chisels to a blue. How are the different colors imparted to the tools? A. A piece of steel made red hot and dipped in water is hardened right out; if it is then placed on a piece of hot iron or in a tube, as explained in No. 2, current volume, the colors will come on the steel of themselves, beginning with straw color and ending with blue. After the steel has been dipped, clean one face bright with a piece of grindstone or with emery paper, to make the colors show brightly. As to binding the SCIENTIFIC AMERICAN, suit your own convenience.

W. P. B. asks: 1. Why is white harder to see in the dark than any other color? A. You have evidently made a mistake. White may be perceived in a dark room in which all the other colors and tints are invisible, for the reason that it is the presence of all the colors. In a room which is perfectly dark, no color or object whatever is visible.

2. Does the moon affect the growth of plants during the night? A. No.

3. How are the common toy torpedoes made? A. Fulminate of mercury is mixed with a quantity of small pebbles or coarse sand.

L. A. H. asks: 1. What are the properties of the Conte crayon? A. The Conte crayon is principally composed of carbon.

2. Does it act as a preserver when thoroughly rubbed into the material upon which the drawings are made? A. No.

3. Is the Conte crayon drawing known to be absolutely durable, and incapable of fading or changing as pictures of other material are known to be? A. Yes; carbon is affected by acids, gases, or sunlight.

4. Will the material alluded to crack or scale off? A. Not if properly cared for.

S. asks: Has the art of photography ever been brought to a degree of perfection, such as to enable an artist to take the photograph of a span of horses while drawing a sleigh at the rate of ten miles per hour? A. Yes. Instantaneous photographs may be taken of all kinds of objects in motion.

W. A. B. asks: 1. Will the copper injure the silver solution, when using a coin silver anode? A. Yes. 2. How can I separate the copper from the nickel in the five cent piece? When separated, how shall I make it into nickel solution without melting it? A. By precipitating the copper as a sulphide from a solution in nitric acid. 3. Will a nickel five cent piece, hammered out, do for an anode in nickelizing small articles? A. Yes. 4. How can I change Ag Cl into metallic silver without melting it? A. By placing it with a small piece of zinc in dilute sulphuric acid. The silver will be found at the bottom of the vessel in a very minutely divided condition. 5. Can a regular gold 15 carat plate be thrown on by electricity? A. Yes, but we cannot give you the process. Send a specimen of your platinum silver, and we shall have it analyzed for you.

T. C. H. says: While walking along a railroad track on a cold, windy day, I observed a strange shimmering or hazy appearance of the telegraph poles whenever I approached one on the windward side. These poles were of cypress, stripped of the bark, very smooth and straight. They looked as if the wind, in striking them, would divide and pour off on each side in a stream that was clearly visible at a distance of 20 yards. Pursuing the subject further, I took a polished hand saw and held it up by the handle, the blade pointing up towards the sky and the side inclined to the wind at an angle of about 25°; then, by sighting along the back, I could see a perfectly transparent substance (like pure water) flowing upon the blade and trailing to leeward for 2 inches or more. Any inequality or obstruction on the blade would show a corresponding ripple in the stream. This way of "seeing the wind" is entirely new to me, and I have never read anything that explains the phenomenon. A. When the wind strikes against an object, as a tall pole, it becomes divided, pouring off on each side; there is thus a slight condensation of the air as it streams off. Behind the pole there is a slight rarification. Something analogous may be seen as a vessel plows through the water. On each side of the prow the water is heaped up, while at the stern the vacancy left by the moving vessel is immediately filled by water rushing in. Now the two strata of air, just behind the pole, being of different densities, there is a reflection of light from their bounding surfaces which is sensible to the eye. This, we think, is the phenomenon you observed.

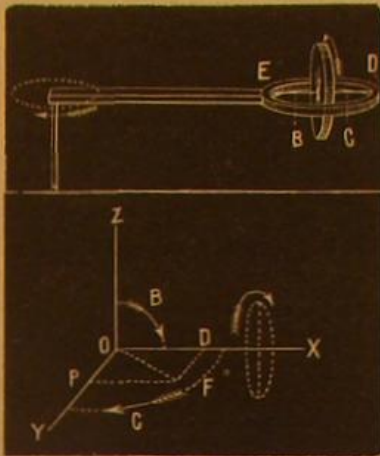
T. A. H. says: 1. I have a small magneto-electric machine, such as is used for medical purposes, and I wish to use the current to produce an electromagnet, but have not succeeded thus far. Please let me know what length of coil to use, and how to apply it. A. You could not possibly use such a machine as you speak of in making an electro-magnet; you have evidently made a mistake. 2. What motions would be produced in a mass of iron filings resting on a bar of wood that passed through a galvanic coil? A. Your bar of wood would probably take no part in influencing the arrangement of the filings, although they might form on the wood something resembling magnetic curves, due to the induction from the coil itself.

M. R. S. asks: Will it kill shade trees (soft maple) to fill around them to the depth of 18 inches? They are filling in the street in front of my house, and I do not wish to lose the trees, which are large ones, 25 years old. Would you box them for a short distance around the trunk? A. Our attention has often been called to this subject; and we have noticed, in cases where hundreds of trees were partially buried in a similar manner, that in no instance was the result injurious to the tree.

H. B. asks: 1. How many divisions or points are there in a mariner's compass? A. The face of the compass has a star with 32 branches marking the eight points or rhumbs of the wind, the semi rhumbs, and the quarters.

2. Can you give me a simple way to tell the weight of atmosphere by barometer? A. Weigh an amount of mercury precisely equal to the column of mercury in the barometer, that is, an amount of mercury contained in a tube of the same bore and of equal length as the barometric column. The weight found will be the weight of that much of the atmosphere which presses upon an area equal to the bore of the tube.

3. Can you give me a theory of the gyroscope? A. Suppose all motions of rotation in the direction of the arrows to be positive. Suppose the axis of the



wheel of gyroscope to coincide with the axis of X, taken horizontally. Let the standard coincide with the axis of Z. Set the wheel in motion, and leave it to the action of gravity. During the first instant, the force of gravity will give it a positive rotation about Y. Let v = angular velocity of wheel about X. Let v' = velocity of wheel about Y. Lay off, on X, $OD = v$ and on Y, $OP = v'$, and complete the parallelogram. Then will O F represent the resultant axis of revolution and the angular velocity. In moving to its new position, the axis has a retrograde orbital motion about the axis of Z. To construct the resultant axis for the second instant, we must compound these angular velocities. Lay off on a perpendicular to O F and O Z, the angular velocity due to gravity, on O Z the angular velocity in the orbit, and on O F the angular velocity of the wheel. Construct a parallelogram on the three velocities and draw its diagonal through O. This diagonal will represent the axis for the second instant. For the next and succeeding instants, proceed as before. Since in each case the diagonal is greater than either of its components, it follows that the angular velocity will continually increase; and were there no harmful resistances, this increase would go on indefinitely. The effect of gravity is continually exerted to depress the center of gravity of the instrument, while the effect of the orbital rotation is to elevate it. When the latter prevails, the axis of the gyroscope rises; when the former prevails, the gyroscope descends. Whether one or the other of these conditions is fulfilled depends on the velocity of wheel and position of center of gravity of the instrument. If the center of gravity were over the pivot, there would be no orbital motion, nor would the instrument rise or fall. Were the center of gravity on the opposite side of the pivot, the rotation due to gravity would be negative and the orbital motion would be direct.

4. What is the medicine called moxa? I cannot find it in a medical work. A. Moxa is a term employed to designate small masses of combustible matter, burnt on the skin for the ordinary purposes of a cautery. The Chinese moxa is made from leaves of wormwood. Linen, cotton, and spunk from the agave of the oak is sometimes used for the purpose. The fibers, of whatever kind, may be saturated with combustible matter to further the end.

5. I make a cement for sticking felt and wood together, made from shellac and acetic acid. For what purpose is the acetic acid used in this connection? A. With a view, probably, of preventing the action of the air upon the varnish.

6. Why is it that some steel will not harden? A. If the metal is really steel, it will harden. If all the carbon has been removed, it is not steel but wrought iron, and in that case is not capable of being hardened, or at least but very slightly.

7. What is aluminum, its symbol, melting point, and specific gravity? A. Aluminum is one of a group known as metals of the earths. It is a white malleable metal, nearly resembling zinc in color and hardness. It may be rolled into very thin foil and drawn out to fine wire. It conducts electricity nearly as well as silver. It is remarkably sonorous, and emits a clear musical sound when struck with a hard body. It may be heated intensely in a current of air without undergoing more than a superficial oxidation, and is only slowly oxidized when heated to redness in an atmosphere of steam. The symbol of aluminum is Al. The melting point of aluminum is somewhat lower than that of silver. Silver melts at 1573° Fah. Its specific gravity is from 2.5 to 2.67. The price of aluminum is \$3 per ounce.

8. What is chloral hydrate, and has it any other name? A. Chloral is a thin colorless oil, greasy to the touch, making grease spots on paper, which, however, soon disappear. Its specific gravity is 1.502. Mixed with a small quantity of water, it solidifies, forming hydrate of chloral = $C_2H_3Cl_2O, H_2O$.

W. H. says: I have a recipe for a water-proof glue made by soaking glue in water just sufficient to soften it, then dissolving in linseed oil, it does not mix thoroughly; the glue settles to the bottom. I tried dissolving in oil without softening, but it will not dissolve. What shall I do? A. Cut 5 parts India rubber into small pieces, and dissolve by heat and agitation in 21 parts cold naphtha, chloroform, or benzine; add to this 61 parts of powdered shellac, and heat the whole with constant stirring until the shellac is dissolved; then pour it while hot on metal plates, to form sheets. When used it must be heated to 245° Fah., and applied with a brush.

A. J. J. asks: 1. What are the complexion, color of the hair, eyes, and general appearance of a person who is of a sanguine bilious temperament? A. Complexion florid, hair auburn to red, eyes gray to blue, form finely developed and muscular. 2. What are the lost arts? A. They have never been catalogued. Many relics of antiquity show peculiarities of structure and color which moderns are unable to imitate.

T. W. P. asks: 1. Will you give me a description of the Sargasso or weedy sea? A. Where the Gulf Stream is deflected from the banks of Newfoundland land eastward and sends off its more southern branch toward the Azores, is situated the Sargasso sea, "that great bank of weeds which so vividly occupied the imagination of Christopher Columbus, and which Oviedo calls the seaweed meadows." (Humboldt). This Sargasso sea is simply a floating mass of sea weeds of the genus *Sargassum*, two species of which are found (*S. vulgare* and *S. bacciferum*) floating in various parts of the Atlantic, Pacific, and Indian Oceans. They are tropical plants, but are often carried about by the winds and currents. The frond is very long and furnished with distinct, stalked, nerved leaves, and simple axillary stalked air vessels. The receptacles are linear in small axillary clusters or racemes. The genus has only been found floating, but there is reason to believe that it is first attached to the bottom in shallow parts of the sea. It floats in large fields, or more frequently in long yellow lines, in the direction of the wind. In crossing the Atlantic, its presence is regarded as a sure indication of the Gulf Stream, by which it is carried north and east. The quantity of weed is often so great as to impede the progress of vessels. Multitudes of small marine animals accompany it, with fishes ready to prey upon them. 2. In rowing, should the right hand cross above the left, or vice versa? A. The right above the left.

E. L. S. asks: 1. How can I mount a map so as to have it proof against flies, etc.? A. Common flour paste may be used, to which add $\frac{1}{4}$ its weight of flour of powdered resin. After it has dried, it should be varnished with either dammar or mastic. From the surface so prepared the specks may be washed with tepid water and soft sponge.

2. Could I convert the whole thing, with its printing and coloring, into parchment paper without injury to the map? A. This could not be done. As to your other question, address the Smithsonian Institute.

W. V. W. says: In reading your article on the *dionea muscipula*, I am led to ask this question in regard to the *Helianthus*: What causes it to follow the sun during the day, then, during the night, to return to the east in anticipation of the sun's rising? A. This is a popular notion which, examined into thoroughly, will disprove itself. Several years ago a gentleman of great culture planted an immense number of seeds in shady, sunny, woody, and wet places, to prove or disprove this idea. The majority of the plants faced the sun, and it would be natural for any other plant to do the same. A large number faced to the north, some were bent facing the earth, and the rest faced at different points of the compass. In every instance it was proved that the flower did not move or change its inclination after the bud was formed. Those facing the north never saw the sun, and the others only partially, and they were as healthy as those that faced the sun. Whoever will carefully examine the inclination of a number of sunflowers will find that the heads do not vary from the position in which they first appear, that that position indiscriminately points in every direction, and that the rigid, unyielding, fibrous stalks remain uncontracted by the heat of the sun, and possess no elasticity whatever.

M. G. P. asks: 1. How can I make a kaleidoscope? A. Take two strips of glass 8 or 10 inches long, 1 to $\frac{1}{4}$ inches broad at one end and about $\frac{1}{4}$ as broad at the other. Blacken one side of each with black varnish. Put two smooth straight edges together and form a hinge by gluing a strip of cloth over the two edges. Make the angle between the strips of glass an aliquot part of 180°, as 30°, 36°, or 45°. Cover the open side of the triangular prism with black velvet. Place in a tin or pasteboard tube so that the angle of the smaller end of prism is nearly in the center. Cover top of tube with clear glass and cover this with paper except a small hole in center. In bottom of tube form a cell by placing two pieces of glass $\frac{1}{4}$ inch apart (the lower one of ground glass). In this cell place fragments of broken colored glass, beads, etc. They must be capable of free movement in the cell, when the tube is turned in the hand.

2. Is there any substance which becomes phosphorescent when a galvanic current is passed through it? A. Yes, mercury for instance.

3. How is champagne cider made? A. By bottling before fermentation is complete.

C. H. C. asks: 1. How can I center the lenses of a telescope correctly? How can I tell when they are right? A. Direct your telescope to a star. Place the eyepiece inside of the focus; if in collimation or line with the objective, the light of the star will be arranged in a series of concentric rings; if not in collimation the rings will appear nearer on one side than on the other. Now see that the tall piece of the instrument is as nearly in line as possible with the tube, and then adjust the objective, not interfering with the eyepiece until the rings appear perfectly concentric. 2. Is the rising and setting of the sun reckoned from the middle or the edge? A. From edge to edge measured from the western edge in rising and the eastern edge in setting.

J. M. says, in answer to L. A. G., who asks how he shall build his cistern: Having had some twenty-five years of experience in that business, I would not recommend you to undertake to build a cheap one, as it will be only a waste of time and material. The proper way is to dig your hole in a circular form not exceeding 12 feet in diameter, and deep enough to hold the quantity of water you wish to have in store. Take care to put your hole down as straight as possible, so that when your wall comes to be laid up, all the intervening space between bank and wall may be filled up solid leaving no place to give from the pressure of the water. If there are large spaces that require filling with earth, you should ram it down tightly. Your wall should be at least nine inches thick. Your mortar should be one half bushel of cement to two bushels of good lime mortar, with the joints laid as closely as can be in order to have a good job. A cistern of the diameter I mention can be built without a pier to support the crown; after being finished, it should have a good coat of cement mortar, which I generally make of one half cement to one half of good sharp sand. Your crown and bottom should be equal to the thickness of the sides, unless you have sand to contend with, in that case your bottom should be four inches more.

A. L. G. says, in reply to T. H. R., who asked how to wash a chamela shirt without shrinking or injuring it: Wash in the same way as flannel. Avoid wringing or twisting, and rub between the hands occasionally while drying. Buckskin and sheepskin should also be treated in this manner.

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

W. T.—It is scintilla, or naturally crystallized gypsum.—G. A. C.—The substance contains organic matter silica, and a trace of iron.

A. D. B. asks: How can I make cement gravel walks?—J. A. J. asks: How can I kill or drive away house flies?—J. P. A. asks: What effect will a daily application of tincture of ammonia and rain water have on the hair? Is it injurious thereto?—J. W. asks: 1. Can you recommend any practical work on the manufacture of writing inks? 2. Can any of your readers give me the formula of the British government for manufacturing a black, gall ink? 3. Is it better to dissolve aniline crystals and extract of logwood at a boiling or lower temperature? 4. What, if any, is the advantage of adding gum or acetic acid to aniline inks?

COMMUNICATIONS RECEIVED.

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

On Steam Cars. By F. G. W.

On a Cooperative Restaurant. By G. H. K.
On the Benefits of Using Steam Expansively. By F. C.

Also enquiries and answers from the following:

G. T. U.—H. A. H.—D. J. B.—T. W. P.—L. B. S.—L. B.—L. 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 mullage? 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

July 7, 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:	
30,290.—ONE SEPARATOR.—W. O. Bourne. Sept. 23.	
30,291.—REFLECTING LANTERN.—H. Cathcart. Sept. 23.	
30,292.—IRON CHICKEN TOP.—J. Pettengill. Sept. 23.	
30,293.—FLOW.—M. G. Simmonds. Sept. 23.	
30,294.—WASH BENCH.—S. Wiswell. Sept. 23.	
30,295.—CUTTING BOOT HEELS.—E. T. Green. Sept. 23.	
30,296.—SOCKEY COUPLING.—E. P. Gleason. Sept. 30.	
30,297.—FILING GIN SAWS.—S. Yeatman. Sept. 30.	
30,298.—MAGAZINE FIREARM.—B. T. Henry. Sept. 30.	
30,299.—PUMP.—W. J. Johnson. Oct. 7.	

EXTENSION GRANTED.

29,008.—CENTER BOARD VESSEL.—C. E. Ketchum et al.

DESIGNS PATENTED.

7,525 and 7,526.—CARPETS.—J. Hill, Philadelphia, Pa.
7,527.—NON-CONDUCTING PLATFORM.—H. L. Palmer, Brooklyn, N. Y.
7,528 to 7,530.—CARPETS.—T. J. Stearns, Saxonville, Mass.
7,531 to 7,533.—SHAWLS.—C. H. Landenberger, Phila. Pa.
7,534.—IRON CORNICER, ETC.—J. A. Niman, Mansfield, O.

TRADE MARKS REGISTERED.

1,812.—HAIR DRESSING.—D. Benliss, New York city.
1,808.—STOVES.—Burdett & Co., Troy, N. Y.
1,804.—OLIVE SOAP.—W. Conway, Philadelphia, Pa.
1,805 and 1,806.—FAMILY FLOUR.—Day & Co., Minneapolis, Minn.
1,807.—COLOGNE WATER.—F. F. Drexel & Co., Baltimore, Md.
1,808.—OATMEAL.—A. M. Johnston & Co., Rockford, Ill.
1,809.—BOTTLED BRANDY.—H. B. Kirk & Co., N. Y. city.
1,810.—CIGARS.—Seidenberg & Co., New York city.
1,811.—CANDLES.—W. H. Woods & Co., Cincinnati, O.

SCHEDULE OF PATENT FEES.

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 (34 years).....	\$10
On application for Design (7 years).....	\$15
On application for Design (14 years).....	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA
JULY 8 TO 16, 1874.

3,513.—F. Paterson, Kingston, Frontenac county, Ont. Improvements on portable apparatus for loading and unloading vessels, called "Paterson's Portable Loader and Unloader." July 8, 1874.	
3,514.—F. Paterson, Kingston, Frontenac county, Ont. Improvements on steamboats, called "Paterson's Steamboat." July 8, 1874.	
3,515.—H. M. Caffall, Alton, Hants county, England. Improvements on appliances for and means of automatically preventing the back rush of gas from gasometers for purifying the gas, and for improving the brilliancy of the lights or flames of gas, called "Caffall's Self Acting Safety Valve." July 8, 1874.	
3,516.—J. Scott and A. Scott, Richmond, District of St. Francis, P. Q. Improvements on force pumps for elevating water, etc., and also adapted to fire engines, called "Scott's Improved Pump." July 8, 1874.	
3,517.—R. M. Caffall and A. Thomas, London, England. Improvements on apparatus or movable extension pieces for sealing and unsealing dip pipes in gas hydraulic mains when required, called "Caffall & Thomas's Movable Seal for Gas Dip Pipes." July 8, 1874.	
3,518.—J. S. Perry and A. Dickey, Albany, Albany county, N. Y., U. S. Improvements on heating stoves, called "Improvements on Heating Stoves." July 8, 1874.	
3,519.—G. M. Hinkley, Milwaukee, Milwaukee county, Wis., U. S. Improvements on saw guides, called "Hinkley's Saw Guide." July 8, 1874.	
3,520.—T. Robertson, Toronto, York county, Ont. Improvements in lozenge-making machines, called "Robertson's Lozenge Machine." July 8, 1874.	
3,521.—S. P. M. Tasker, Philadelphia, Philadelphia county, Pa. Improvements on a metallurgical furnace, called "Tasker's Metallurgical Furnace." July 8, 1874.	
3,522.—H. Straut, Troy, Rensselaer county, N. Y., U. S. Improvement on potato diggers and gatherers, called "Straut's Potato Digger and Gatherer." July 8, 1874.	
3,523.—A. Strange and K. H. Cornish, London, England. Improvement on machinery for preparing spinning or throwing and doubling cotton, silk, wool, and other fibrous or filamentous substances, called "Strange & Cornish's Spinning Apparatus." July 8, 1874.	
3,524.—T. Barnes and R. H. Hudgin, township of Harwick, Kent county, Ont. Improvements on farm and carriage gates, called "Barnes & Hudgin's Farm and Carriage Gate." July 8, 1874.	
3,525.—J. H. Wentworth, Boston, Suffolk county, Mass., U. S. assignee of B. Simpson, same place. Improvements in stoves, called "The Improved Stove." July 8, 1874.	
3,526.—B. Scott, Brighton, Beaver county, Pa., U. S. Improvements on rail joint for railways, called "Scott's Clamp Truss Joint." July 8, 1874.	
3,527.—H. Switzer (administrator of the late W. Switzer), township of Stephen, Huron county, Ont. Improvements on fanning mills, called "Switzer's Improved Labor Saving Fanning Mill." July 9, 1874.	
3,528.—J. Hedges, West Wareham, Plymouth county, Mass., U. S. Améliorations aux ravaudeurs de boyaux, dit "Havandeur amélioré de boyaux." (Improvements in hose.) July 9, 1874.	
3,529.—H. M. Welch, Cowansville, Missisquoi county, P. Q. Improvements on steam cooking apparatus, called "Welch & Lewis' Steam Cooker." July 13, 1874.	
3,530.—T. H. Price, Lafayette, Tippecanoe county, Ind., U. S. Improvements on heating apparatus for sleighs and carriages, called "Price's Heating Apparatus for Sleighs and Carriages." July 13, 1874.	
3,531.—G. Walkey, Toronto, York county, Ont. Improvements in refrigerators, called "Walkey's Refrigerator." July 13, 1874.	
3,532.—Levi Sutton, Ottawa, Putnam county, O., U. S. Improvements in automatic car couplings, called "Sutton's Automatic Car Coupling." July 14, 1874.	
3,533.—John Noyes, Barnston, Stanstead county, Quebec, assignee of H. A. Cook, Boston, Suffolk county, Mass., U. S. Improvements on artificial stone, called "Noyes' Artificial Stone." July 14, 1874.	
3,534.—J. J. Lappin, Toronto, Ont. Improvements on car couplers, called "Lappin's Improved Self Acting Car Coupler." July 14, 1874.	
3,535.—J. Vivian, London, Ont., assignee of C. Luxton, Rudon City, N. J., U. S. Improvements on peat machines, called "Luxton's Cutting, Compressing and Filtering Peat Machine." July 15, 1874.	
3,536.—A. Walker, Mornington, Perth county, Ont. Improvements on broadcast seed sowers, called "Walker's Broadcast Seed Sower." July 15, 1874.	
3,537.—J. Milton House, Orillia, Simcoe county, Ont. Improvements on shingle and heading machines, called "House's Shingle Machine." July 15, 1874.	
3,538.—H. Thorne, assignee of P. Oakley, Toronto, York county, Ont. Extension of No. 8, called "Oakley's Lock Washer." July 15, 1874.	

3,539.—J. Lott, Liverpool, Lancaester county, England. Improvements on an apparatus for trimming the edges of straps, called "Lott's Strap Trimmer." July 15, 1874.	
3,540.—J. G. Scott, St. Thomas, Montserrat county, Quebec. Improvements in brakes for stopping railway cars and generally to arrest the revolution of wheels, called "Scott's Patent Brake." July 15, 1874.	
3,541.—H. Henika, M. F. Carder and O. M. Allen, Kalamazoo, Kalamazoo county, Mich., U. S. Improvements on burial caskets, called "Henika & Carder's Globe Burial Casket." July 15, 1874.	
3,542.—G. F. Simonds and J. A. Farson. Improvements in tempering and forming articles of steel and steel mixed with iron, called "Simonds & Farson's Improved Process for Tempering and Forming Articles of Steel." July 15, 1874.	
3,543.—J. E. Landers, New Bedford, Bristol county, Mass., U. S. Improvements in flower pots, called "Landers' Improved Double Interlocking Flower Pot." July 15, 1874.	
3,544.—W. Duchemin, Boston, Suffolk county, Mass., U. S. Improvements in turned shores, called "Duchemin's Improvement on Turned Shores." July 15, 1874.	
3,545.—A. D. Cable, assignee of T. Gill, Montreal, P. Q. Improvements on faucets, called "The Dominion Compression Valve Cock." July 15, 1874.	
3,546.—J. Prince and M. D. Martin, North Troy, Orleans county, Vt., U. S. Improvements on milk pans, called "Prince & Martin's Milk Pans." July 15, 1874.	
3,547.—C. Robinson, Cambridge, Middlesex county, Mass., U. S. Improvements on combined washing and wringing machines, called "Robinson's Combined Washer and Wringer." July 15, 1874.	
3,548.—R. M. Wanzer, assignee of J. B. McCune, Hamilton, Wentworth county, Ont. Improvement in sewing machine, called "McCune's Reversed Feed for Sewing Machine." July 15, 1874.	
3,549.—L. Harrington, Brooklyn, Kings county, N. Y., U. S. Composition of oleaginous substances and improvement in the art or process of preparing the same for the manufacture of artificial butter, called "Harrington's Manufacture of Artificial Butter." July 15, 1874.	
3,550.—D. N. B. Coffin, Jr., Newton, Mass., U. S. Improvements on screws for imparting motion to machinery, called "Improvements on Screws for Imparting Motion to Machinery." July 15, 1874.	
3,551.—A. Anstead, Gananogue, Leeds county, and R. Cross, Lansdowne township, Leeds county, Ont., Machine for holding the bar of reapers and mowers when being ground, called "Anstead & Cross' Holder for Grinding Reapers and Mowers." July 15, 1874.	
3,552.—S. W. Shorey, Boston, Suffolk county, Mass., U. S. Improvements on cutting and trimming attachments for sewing machines, called "Shorey's Cutting and Trimming Attachment for Sewing Machines." July 15, 1874.	
3,553.—A. Gould, Bangor city, Penobscot county, Me., U. S. Improvements on machines for cutting and embossing leather, etc., called "Gould's Leather Cutting and Embossing Machine." July 15, 1874.	
3,554.—D. V. Wood, Hoboken, N. J., U. S. Improvements on steam hammers, called "Wood's Steam Hammer." July 15, 1874.	
3,555.—W. Hamilton, Erie, Erie county, Pa., U. S. Improvements on lubricators, called "Hamilton's Steam Needle Lubricator." July 15, 1874.	
3,556.—J. Newhall, Hunterstown, Muskogee county, P. Q. Improvements on attachments for wash boilers, called "Newhall's Adjustable Attachment for Wash Boilers." July 15, 1874.	
3,557.—T. D. Hodgson, London, Middlesex county, Ont. Improvements on gas generators for manufacturing gas, called "The Hodgson Improved Gas Generator." July 15, 1874.	

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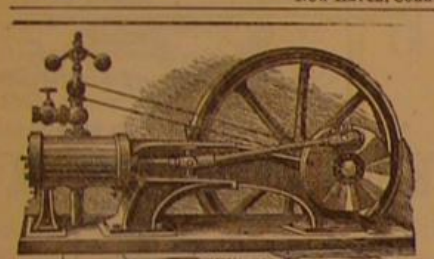
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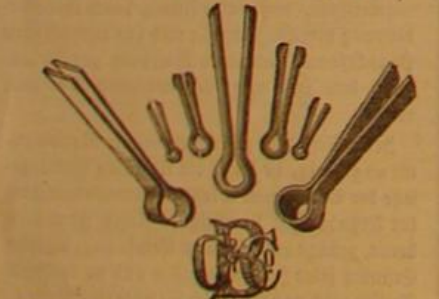
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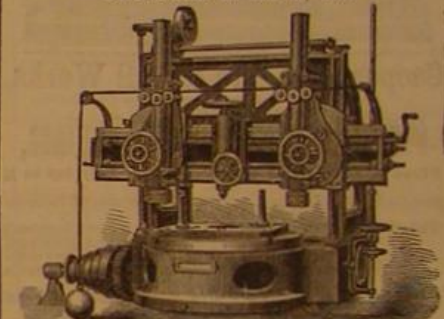
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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XXXI.—No. 7.
(NEW SERIES.)

NEW YORK, AUGUST 15, 1874.

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IN ADVANCE.

THE GARTSHERRIE IRON INDUSTRY.

The career of Mr. James Baird, principal of the great Gartsherrie iron-making firm, illustrates, perhaps more forcibly and vividly than any other, the immense development of the pig iron trade of Scotland, and the avenues to affluence and power which it was the means of opening up.

Born in 1802, Mr. Baird is the fifth of a family of eight sons and one daughter, whose ancestors for several generations had been farmers in the parish of Old Monkland, and whose father was a tenant on both Drumpellier and Rosehall estates of the farmers of Kirkwood, Newmains, and High Cross. All unconscious of the great destiny that was before them, the elder members of the family aided their father in agricultural operations until they had passed maturity. The father, Alexander Baird, died at the age of 68, after having seen his sons established in the Gartsherrie Works and on the high road to fortune. Seven of the brothers became partners in these works, the eighth brother, John, having preferred to stick to agricultural pursuits. All of them, with the exception of James, have long since met the shadow feared by man and gone over to the great majority.

By industry and economy, exercised almost to the verge of parsimony, the Messrs. Baird were enabled to make some little money out of their little colliery, albeit at that time coal owning was not nearly such a profitable occupation as it is in our own day. Other pits were afterwards opened out in Maryston and Gartsherrie, but no works of any consequence had yet been started in this country—now the Black Country of Scotland—for the manufacture of iron. Indeed, the iron trade appeared to concentrate rather on and towards the east coast, where the Carron Works were carried on. As for Coatbridge, which is now environed with a crescent of blast furnaces, it was, to all intents and purposes, a purely pastoral locality.

The Gartsherrie Ironworks were commenced in the year 1829, and the first furnace was put in blast in May, 1830, or simultaneously with the invention of the hot blast.

From time to time the Gartsherrie Works were extended until they reached their present exceptional proportions. They are now, says the *Practical Magazine*, to which we are indebted for the engraving, with perhaps the solitary exception of Dowlais, the largest works of their kind in the world. They comprise sixteen blast furnaces, placed in two parallel rows. The two rows of furnaces are placed face to face, with their pig beds bordering the canal, and the lines of rails for the supply of raw materials placed at a higher level behind each row. A railway bridge connects the two lines of rails crossing the canal and the lower level of the works. The blast is heated to about 800° in hot blast ovens of the pistol pipe form. This is an invention of Mr. James Baird. It was adopted first at these works thirty-five years ago, and led to a higher temperature of blast than had up to that time been reached in the Scotch furnaces. Since then the pistol pipe hot blast oven has come into general use throughout the rest of Scotland. The stoves are fired with slack. They are placed behind the furnaces at the level of the railways supplying the coal. Originally Mr. Baird placed the hot blast stove on the top of his blast furnace, and tried to utilize the flames escaping from the latter for heating the blast; but this mode did not prove a real success in Scotland until Mr. Ferrie's furnace was devised.

The ore used at Gartsherrie is pure black band, which is delivered from the mines in a calcined state. A very large stock of iron ore, varying from 80,000 to 120,000 tons, is always kept in stock at Gartsherrie. Besides the native black band there is generally a considerable quantity of hematite used, and the firm work hematite mines of their own near White-

haven. The black band is calcined in open heaps of about 2,000 tons, covered over with a small material, so as to exclude an excessive supply of air. Before being charged into the blast furnace, the calcined black band is carefully sorted, and all foreign and impure matter is extracted by hand.

It is probably due to the care bestowed upon the purification of the ingredients used in the blast furnace that the Gartsherrie brand is so much esteemed. It is more like the assaying of precious metals than the rough-and-ready mode of treating the materials used in the furnaces of Cleveland and other districts. When thus carefully picked and purified, the Gartsherrie ironstone contains a very large percentage of

when in full going order, from 1,200 to 1,500 tons of iron per day. At the present time the output of pig does not exceed 800 tons daily. Altogether, the firm employ upwards of 9,000 men and boys. And here it may be remarked that the Gartsherrie iron is more valuable than any other brand in Scotland, that of Coltness alone excepted. As a well known engineer has put it, "a ton of pig iron marked Gartsherrie will command a price in the market which is above the average of the general quotations, but which is also entirely unaffected by the smaller fluctuations in the prices of pigs, the general variations between supply and demand having no influence upon that select brand. The same pig iron, taken to any distant port, will find itself in a similar position by

virtue of its brand; and the act of effacing this brand, although it could not possibly alter the intrinsic value of the material, would reduce its market price by 10 or 12 per cent."

From these premises we may almost draw a conclusion which will be tolerably certain and safe as to the probable profits of the Gartsherrie firm. Assuming that their total annual production were only 200,000 tons—and it has often been much above this—its value, at the present quotations for pig, would be \$7,500,000. It is no secret that something like one half of this enormous amount finds its way, in the shape of profits, into the pockets of the Gartsherrie firm.

From first to last Mr. James Baird has been the most active, practical, and plodding member of this great firm, and he is now the only one of his name that is associated with its management. With a constructive and inventive genius that was eminently sound and correct, if not very brilliant, he devised many improvements in blast furnace practice. We have already alluded to the assistance he rendered in the perfecting of Neilson's invention of hot blast. But that was only one of his many achievements. It was he who led the way in Scotland to the adoption of the modern shape of the blast furnace, which is very much less in bulk and cost than those used in the early history of the trade, when square bases and other cumbersome and unnecessary features, now obso-

lete, or nearly so, were in vogue. It has been said that Mr. Baird excelled in suggesting and applying different modes of saving labor in every department; and so skilled was he in all the various processes of manufacture, that the workmen all regarded him as a master of his handicraft.

Protection from Yellow Fever.

In a report on yellow fever, recently published in the United States, it is shown that this disease has never appeared in any climate at the height of 2,500 feet. In the island of Dominica, a hill top not more than 1,500 feet high is always healthy, even when the fever is epidemic at its base. In San Domingo, similar observations have been made. The highest elevation at which yellow fever has occurred in the United States is 460 feet, in Arkansas; and the medical men of this country now hold that the stratum of air infected by the poison is heavier than pure air, and therefore sinks, and they recommend that in unhealthy districts houses and hospitals should be built on tall piles, so as to be above the fever stratum. But where hills are near, the best remedy will be to carry the patients up to a height of 500 feet.

From the experiments of W. F. Donkin, it appears that the Sprengel pump may be made to give an exhaustion down to 10^{-6} in its simplest and most convenient form, namely, without an air trap and with an india rubber joint immersed in glycerin; but that if a very complete exhaustion is required, the air trap must be used, and the vessel to be exhausted must be sealed hermetically on to the pump.



JAMES BAIRD, OF GARTSHERRIE, SCOTLAND.

metallic iron; and it only requires 32 cwt. of ore to the ton of iron, or even less.

The weekly production of the Gartsherrie furnaces is about 160 tons each; they are tapped every twelve hours, and produce each about twelve tons of iron at each cast. The production of the works for 1873 was over 120,000 tons, about 80 per cent of this being "No. 1 Gartsherrie," which is the highest quality of foundry iron made, and at the present market value realizes from \$40 to \$50 in gold per ton.

Besides the establishment at Gartsherrie, the Messrs. Baird acquired the Lugar, Eglinton, Portland, and Blair Ironworks, all in Ayrshire, and in 1856 they acquired the Muirkirk Ironworks, also in Ayrshire, which, after the Clyde and Carron, are the oldest ironworks in Scotland. In 1864 the firm acquired the Portland Ironworks, with five blast furnaces, to which one has since been added. In 1852 the Blair Ironworks came into the market. These works were started by the Ayrshire Iron Company, which became bankrupt through the mismanagement of its affairs. The works of the company were increased at a rate out of all proportion to the capital. Iron was bought on credit and sold for cash at a ruinous sacrifice, and when insolvency followed it was found that there were \$1,250,000 of liabilities, without any assets except the works at Dalry. These works, which originally cost \$450,000 or \$500,000, were ultimately sold to the Messrs. Baird for \$100,000, or \$350,000 less than it cost to build them. At the present time, therefore, the Gartsherrie firm own forty-two blast furnaces, capable of producing,

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VOLUME XXXI, No. 7. [NEW SERIES.] Twenty-ninth Year.

NEW YORK, SATURDAY, AUGUST 15, 1874.

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A NEW THEORY OF THE FORMATION OF DIAMONDS.

The natural history of the diamond is one of the puzzles of geology, the place of its origin being until recently as great a mystery as the manner of its formation. Happily, however, the first part of the problem has been solved; the diamond has been tracked home; and though the process by which it attained its crystalline isolation remains as obscure as ever, a clue, at least, has been gained to the conditions of its development.

We need hardly remind our readers that in South Africa diamonds are found under two very dissimilar conditions: first as water-worn pebbles associated with pebbles of quartz, agates, zoolites, and the other common attendants of the diamond in other localities; second, in circumscribed pits or shafts filled with a chalky or clayey earth, more or less hardened. The famous Colesberg Kopje is a fair example of the latter sort, several of which have been discovered in the Vaal River country. In all these cases, the diamond bed is surrounded by a rim of rock dipping outward from the center, but attaining within a short distance the horizontal position characteristic of the rocky strata of the district. Inside the rim or "reef," as the miners call it, the diamonds are found at home and untraveled; outside they are absent, or occur only in layers of gravel, itacolumite, or other products of running or dashing water.

That the gems within the shaft have rested undisturbed since their formation, save by the pick and shovel of the miner, is attested by the nature of their matrix, which at Colesberg has been mined to the depth of two hundred feet without any apparent decrease in the richness of the yield, by the sharpness of the edges and angles of the crystals; and still more by the tendency of the gems thus found to check, flaw, and even explode with violence on being brought to the surface and subjected to the action of light and air. No such accidents occur to diamonds found in drifts, for the simple reason that they are the survivors of a similar process of natural selection, all their sensitive comrades having been eliminated by exposure in past ages.

Obviously, if we can decipher the geological history of these singular diamond beds, a very long step will be taken toward the solution of the question how the diamond originated.

The record begins apparently at a time when the great interior basin of South Africa, in which they occur, was the bed of a vast inland sea. The physical geography of this region reminds one of our own Utah basin. There is first a mountain ridge from 4,000 to 10,000 feet high, roughly following the line of the coast, except where it crosses the

continent toward the equator, broken only by the Orange and Limpopo rivers which drain the basin. Toward the sea the descent is abrupt, often precipitous; inward, the slope is gradual, sometimes almost imperceptible, the bottom of the basin lying several thousand feet below the average crest of the rim. Everywhere throughout the interior are abundant and unmistakable proofs of the former presence of water, filling the basin as a vast inland sea, at one time the scene of great volcanic disturbance, more recently of a process of desiccation like that which turned the Sahara from a sea to a desert, or that which dried up the sea of fresh water which, but a little while ago, geologically speaking, filled the now arid Utah basin to the brim.

The period of diamond production appears to have been while the sea prevailed, their distribution in the gravels resulting from the subsequent movements of water, to which the widespread gravel beds bear witness. While the sea yet filled the basin, volcanic action was going on more or less vigorously, evolving gases, rending the overlying rock, and producing all the other well known effects of igneous disturbance. Among the minor effects we can imagine the formation of vents or craters, to be filled, when the violence was passed, by the silty deposits of the sea bed, washed in by returning water.

Here, then, we have the conditions of future Colesberg Kopjes—minus the diamonds.

Let us follow the process a little further. A constant product of volcanic action, we know to be carbonic acid gas, which contains the basis of the diamond combined with oxygen—a gas capable of being liquefied by the pressure of a column of water less than fourteen hundred feet high, and the ancient South African Sea was several times that depth. We know that this same gas is frequently imprisoned in the soft mud of stagnant pools, where it lies unabsorbed, escaping as bubbles when the mud is disturbed. It is not unreasonable to assume that the less energetic discharge of this gas from the heated depths below the sea bed might be stopped in the muddy filling of the vents, where, liquefied by the pressure of the superincumbent water, it might remain until deprived of its oxygen by some process of Nature's chemistry, leaving the free carbon to crystallize as the sparkling gem so eagerly sought for by the miner.

This, of course, is a mere hypothesis, for we know of no process by which the oxygen could be so withdrawn; but in every other respect the supposition is based on known conditions, and there is apparently no other way in which the raw material of the diamond could be so readily distributed in crystallizable condition throughout these natural diamond factories. The matrix in which the diamonds are found is unquestionably of aqueous origin; and we know, from the vegetable and other substances found enclosed by diamonds, that they could have been formed only in the presence of water. The two seem, therefore, to be contemporaneous.

It is a well known fact also that diamonds sometimes contain cavities enclosing a transparent liquid. We have seen it stated, but are not sure of the authority, that diamonds of this sort have been broken and their contents found to be carbonic acid: a fact which, if true, would add materially to this new theory of their formation.

THE EXPLORATION OF THE LIBYAN DESERT.

Nearly a year ago the staid citizens of Leipzig gathered in crowds in their streets to stare at two queer-looking wagons which were remarkable for enormous height, and which were slowly dragged through the city en route for the Austrian port of Trieste. These were the water carts of the great expedition, soon to start for the exploration of the Libyan desert under the command of the intrepid German traveler, Gerard Rohlfs, of Weimar, and under the liberal patronage of the Viceroy of Egypt. From the European journals of the day, we gleaned a brief account of what the explorers proposed to accomplish, which, in the first number of our last volume, we laid before our readers, mentioning, at the same time, the departure of the caravan for the oasis of Koufra, in the center of the desert. Brief notes of progress have since appeared, but in so disconnected a form that little could be learned from them. Mr. Bayard Taylor, in a recent letter to *The Tribune*, now states that the expedition has returned, and gives an outline of its journey into the interior of the vast but little known African continent.

By New Year's eve, the party had reached the oasis of Farafrah, hitherto unvisited by any European since Cailliaud in 1819. Here they celebrated the holidays, and astonished the natives by kindling a magnesium light; and then, after a rest of three days, started on the more arduous portion of their journey. A week's travel brought them to a sudden and astonishing change in the scenery, the chronicle of which reads more like a page from the Arabian Nights than a sober scientific statement of facts. "On both sides," says the writer, "arose detached limestone rocks, increasing in height as they advanced, and assuming the wildest forms. It was a labyrinth of lions, sphinxes, pyramids, obelisks, even semi-human statues, extending for miles. Then followed a colossal gateway of rock, the summits of which were 1,500 feet high. When this was traversed, they entered a second and still grander labyrinth, terminating in a second gateway, the towers of which overhung the cleft between them. The way then widened; the tremendous walls of rock fell apart, and the path descended toward a sandy plain. In another hour there came a fresh surprise: the final descent to the level of the oasis lay before them; the vast, mournful, sandy landscape vanished as by a miracle, and wheat fields of deepest green, dark palm groves, white walls and minarets sparkled in the light of the sinking sun."

This was the oasis of Dakhel, a large area of garden land

inhabited by 17,000 people. Near the town a large number of powerful springs burst from the earth, the water being at a temperature of 110°, and carried by irrigating canals over many miles of soil. A stratum of chalk underlies the whole oasis, and, wherever pierced, there a spring rises. This water, it has been supposed, came from the Nile; but the examination of the explorers upset the theory, and proved its derivation from an independent source.

Four days' journey from this favored region brought the expedition to a poor camel pasture, destitute of water or trees, which was believed to be the supposed oasis of Zer-zoora. A further march of two days to the southwest showed that no further progress could be made. Nothing but mountains of shifting sand was before it; nowhere a foothold, even for the broad-footed camel. Several attempts were made to penetrate this terrible region, but without avail; so the expedition skirted along the sand sea to the northward, seeking a crossing place. This was found in lat. 25° 11' N., and long. 27° 40' E., and the locality was named *Regenfeld* (rain field) on account of a steady two days' fall of rain there encountered. Steering a course by compass and astronomical observations (there was not a vestige of a trail), the explorers continued onward. The weather, it is said, became unexpectedly cold, varying from 29° to 23° Fah. in the morning; ice was formed upon vessels of water. Finally on the 20th of February, the oasis of Jupiter Ammon in Northern Libya was reached.

The journey from Dakhel to this point occupied thirty-six days, during which period not a single well was reached, although a distance of 500 miles was traversed. The iron tanks carried contained a plentiful supply of water for men and beasts during all this time. When it is considered that no other traveled route in all the Sahara has a longer space than a seven days' journey without water, the possibility of penetrating almost everywhere by the aid of Rohlfs' device becomes evident.

The oasis of Jupiter Ammon was found to have a depression of 100 feet below the Mediterranean level. From this point the expedition went to the great oasis of Kharjeh, 100 miles south and east, where photographs of the Egyptian temples were made. The inscriptions on these ancient monuments, it is said, give the names of eight Libyan rulers which have never hitherto been found recorded.

By April 15, the expedition had returned to Cairo, after traversing 1,700 miles of desert, two thirds of which distance was before totally unexplored. The oasis of Kufrah was not reached, nor is it believed that the same exists; and even if it did, the vast sand sea would prevent its practical connection with Egypt.

The results of the labors of the expedition are, in detail, said to be rich in scientific discovery. In general, however, the problem sought to be solved has only been negatively answered; that is, it is proved that the Libyan desert is absolutely uninhabitable, and cannot be explored without the most careful preparation, and good luck added thereto.

CAN YOU SWIM?

We do not mean: Can you swim for fun, or for sanitary refreshment; but can you swim for your life, with your boots on?

Swimming as an accomplishment is common; we should like to say common enough, but that would not be true so long as there remains a single individual who cannot swim at all, and unhappily such individuals are numerous. We can say, however, that swimming as an accomplishment is common compared with the art of swimming as a safeguard against drowning.

This is a distinction with a difference. There are multitudes, who are quite at home in the water in Nature's costume or with a light bathing dress on, especially when they know how far it is to the bottom and how far to the shore, who would go to the bottom with discouraging haste if suddenly pitched overboard in a strange place with their usual clothing on. The conditions are entirely different from those of ordinary swimming; and to one unaccustomed to the feeling and effect of clothing in water, the difference is very apt to nullify for the moment all his experience as a swimmer. The consequence is a sudden loss of self-control, which too often results disastrously, whereupon the friends of the victim marvel that such a good swimmer should drown so easily.

An accident of this sort occurred but a few days ago. The victim was the master of an excursion steamer, a good swimmer, his numerous friends say; yet when he found himself in the water unprepared for swimming, he acted as wildly as one wholly unable to swim. With all his swimming, he had probably never been in the water before in full dress; and the confusion of mind which ensued, when he found his limbs muffled with clothing, his buoyancy reduced, and all the usual conditions of swimming changed, kept him from making good use of the knowledge he possessed. So he tired himself and strangled himself with frantic struggles, and went to the bottom before a boat could reach him, though it was near enough to have saved one who could not swim at all, had he been cool enough to keep perfectly still.

The moral is plain. With all your swimming practice, don't neglect to accustom yourself to conditions such as you will be pretty sure to find yourself in should you ever have occasion to swim for your life. When you can keep your self afloat with heavy boots on, when you can tumble out of a boat in ordinary dress and strip in the water, and not waste your strength in suicidal attempts to overcome the resistance of clothing that cannot be removed, then you can safely answer in the affirmative the question: Can you swim?

There is a forceful proverb about teaching old dogs new tricks. We do not imagine that many adults will act upon

the suggestion we have made. But the boys will, if they have half a chance. And we would urge upon parents the propriety of allowing their sons to vary their watery sports in the way we have described. They cannot put their old clothes to better use. We can say from personal experience that the boys will like the fun, and that they will never regret the saving knowledge they will gain by it.

Of course we would not exclude the girls from such knowledge, if circumstances are at all favorable. At least let them learn to make the most of the temporary advantage their clothing offers for buoyancy, and also how to relieve themselves of entangling skirts in case of emergency.

PROFESSOR HUXLEY AND HARVARD.

The rumor that the Faculty of Harvard University are endeavoring to secure Professor Huxley as the successor of Agassiz is making, it appears, quite a breeze among the English scholars. The *Academy*, one of the ablest literary periodicals, hopes there is no truth in the statement, and asks, "are the English universities so rich in really eminent professors, and so poor in money, that they can or must allow Professor Huxley to go to America to find leisure to work?"

The universities are so rich that they could beggar the whole world. Will they allow themselves to be beggared by Harvard? We do not agree with our contemporary in its intimation that money would be the mainspring of Professor Huxley's action, should he consent to occupy Agassiz' vacant chair. The work of such men is not to be measured in pecuniary compensation, nor does it belong to any country, but to the entire world. We greatly mistake the spirit of our great modern investigators if, should they determine that they could accomplish greater ends and achieve greater triumphs in the cause of Science by changing their abodes to the remotest corner of the earth, either a feeling of patriotism or a desire to make money would deter them from accepting the duty. Professor Huxley's decision, we venture to say, will be based on the question of where he can do the most good, not on the matter of pecuniary gains.

DISASTROUS FLOODS.

The two heavy floods which have recently occurred at Eureka, Nev., and Pittsburgh, Pa., have been so terribly destructive to life and property that they may be fairly classed among the extraordinary calamities of the year. They are beside phenomenal in their nature, one being due to a greatly overcharged cloud breaking against a lofty range of mountains, and the other to the meeting of two vast masses of vapor which united in a deluge which is described as resembling the descent of a torrent. Both storms appear to have been local in destructive effect, although heavy rains and freshets have taken place over Ohio, Indiana, and Kentucky, and have everywhere caused damage.

The report of the Nevada deluge states that, within ten minutes after the beginning of the rain, Eureka was flooded. The water poured through the streets for half an hour, tearing up houses and uprooting trees, damaging property in the end to the extent of \$100,000, and killing twenty people.

In Pittsburgh, the destruction was much more extensive. From the descriptions given of the rising of the storm, two great black clouds appeared at opposite points of the compass and slowly approached each other. Blinding flashes of lightning shot between them as they neared, until the gradually narrowing space appeared a mass of fire. The meeting was heralded by a terrible thunderclap, followed by a few heavy rain drops, and then down poured the deluge with fearful fury. Pittsburgh lies at the junction of two rivers, and its suburbs, built on the hillsides and valleys adjoining the streams, are traversed by gulches and natural water courses, which form channels for the rain to run off. Several ravines empty into Butcher's Run Valley, about two miles north of the center of Allegheny City, along which numbers of houses had been erected. Here the damage began, and the flood rushed down the bed provided for it by Nature, sweeping away everything in its path. In other valleys deluges appeared, working like disaster, and small streams suddenly became roaring torrents. Over one run, two new iron bridges and five wooden ones were carried off. Large salt works, refineries, and factories were destroyed, and barges and vessels in the rivers were torn from their fastenings and swept away. The total loss of life is placed at 219 persons, and a rough estimate places the pecuniary loss at \$3,000,000.

Both floods, besides being owing to the phenomenal circumstances mentioned, were also greatly due to the situation of the towns, Eureka, at the foot of the mountains, receiving the deluge pouring down their sides; and Pittsburgh, also in a valley surrounded by high land, lay in the path of the torrents which naturally sought to empty into the rivers.

TIDES IN THE GULF OF MEXICO.

A correspondent asks us whether it be true that at Pensacola, Florida, there is but one daily tide, and inquires whether, if such be the fact, how it is that at Havana, Key West, and other points in proximity, the tides take place twice a day in the ordinary manner.

Professor Bache, in his coast survey reports, mentions that the tides of the United States are divisible into three distinct classes. Those on the Atlantic coast are of the ordinary type, ebbing and flowing twice in twenty-four hours, and having but moderate differences in height between two successive high or low waters, one occurring before and the other after noon. Those on the Pacific coast also ebb and flow twice in twenty-four hours, but the morning and

evening tides vary considerably in height. The intervals also between successive high and low waters may be very unequal. The irregularities are due to the moon's declination, as, when the moon travels to the north of the equator, the vertex of the tide wave follows her, giving the highest point of one tide in the northern, and the highest point of the opposite tide in the southern, hemisphere. Hence, when the moon is in northern declination, the tide at any place in the northern hemisphere caused by her upper transit will be higher than that caused by her lower transit. This variation in the heights is called the diurnal irregularity, and has a period of one lunar day.

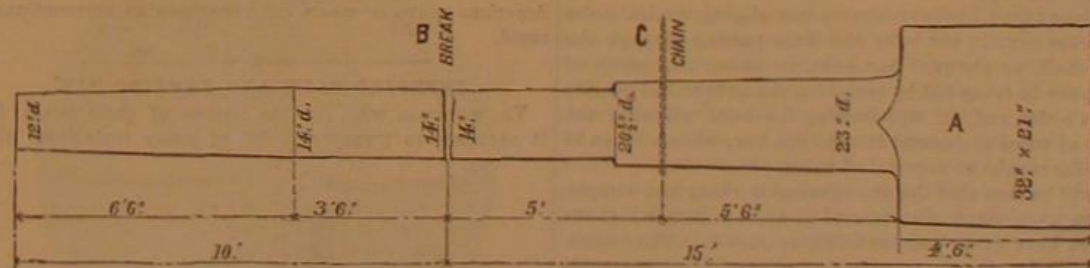
The effect of this phenomenon is to materially modify the tides, more especially on the Pacific coast and in the Gulf of Mexico. In the latter, however, the tides vary greatly according to locality. On the coast of Florida, from Cape Florida around to St. George's Island, near Cape San Blas, the tides are of the ordinary kind, with a large diurnal inequality. From St. George's Island, in Apalachicola Bay, to Derniere Island, they happen but once a day, that is ebbing and flowing once in 24 hours. At Calcasieu entrance, the double tides reappear, and exist for some days about the period of the moon's greatest declination. The tides are double at Galveston. At Aransas and Brazos Santiago, the single day tides are at perfectly marked as at Pensacola. The probable cause of these discrepancies is the formation of the islands and entrances. If the tides arrive at the same place by two different channels, and one of them is retarded six hours behind the other by traveling a longer route or through shallower water, the semi diurnal tides will be destroyed through interference of the waves, the high water of one being opposed to the low water of the other; the diurnal inequality will, however, not be destroyed, but merely modified in height and time, leaving a single tide in the lunar day outstanding, which is small in amount. This is doubtless the case at Pensacola, where the mean tide is but one foot, and the extremes of rise and fall one and a half feet and four tenths of a foot.

In this connection, we may add that to the difference in tides of the Atlantic and Pacific oceans is due the erroneous idea that the level of the latter body of water is the higher. At Panama the tides rise over twenty feet, while at Aspinwall about as many inches is the limit. The mean tide, however, of both oceans is the same.

FRACTURE BY LONG-CONTINUED JARRING.

In one of the articles recently published in the *SCIENTIFIC AMERICAN*, the well known fact, that a long continued succession of even moderate shocks, or jarring, sometimes produces rupture in even large masses of iron, was illustrated by the account of the breaking of one end of a very large shaft at the Morgan Iron Works, while the other end was under the hammer. We are now indebted to the same authority for the account of a similar incident, which occurred at the West Point Foundry some months ago.

In forging masses of iron of such shape that they are difficult to handle, it is usual to weld to them a porter bar, by which they can be moved about conveniently until they are nearly finished, when the bar is cut off and laid aside until again required for a similar purpose. The same bar is often kept in use many years.



The above sketch represents a porter bar thus used at the West Point Foundry, as nearly as can be ascertained, about twenty years. The large mass of iron, A, measuring, in section, two feet eight inches by one foot nine inches, and four feet and a half long, weighing over four tons, could not well be handled on account of its weight and its awkward shape. This porter bar was therefore welded on it, as shown in the sketch. The whole mass was then slung by the chain, in which it was nearly balanced when the point of support came at C, ten feet from the larger end and fifteen feet from the smaller end. While the hammer was at work upon the forging, the bar suddenly broke at a point ten feet from the smaller end, B.

The appearance of the fracture is described as highly crystalline and a clean break. The piece thus broken off weighed, probably, a ton and a half. The force which, applied at the extremity, would have been required to break it off by a steady pressure, would have been at least twelve tons. The cause of this remarkable accident is, as has already been explained, the gradual separation of particles by successive shocks, each of which forces them a minute distance beyond the limit of elasticity. This action continually repeated must, sooner or later, produce rupture, although the effect of each shock is quite imperceptible to the senses. The most singular and least understood phenomenon is the structure of the metal at the surface of fracture. It is by no means well established that what are described as crystals are true crystals, or even that wrought iron can have a crystalline structure under any circumstances, as a crystal has usually, if not invariably, definite axes and facets, making fixed angles with each other, and the crystal, as a whole, is without a semblance of ductility. This phe-

nomenon is not an uncommon one; but it is not yet well understood, and demands careful investigation by the use of the best known appliances and the application of scientific methods. The subject is one of great importance. The breaking of railroad axles in this manner has probably sacrificed many lives and much valuable property.

Could it be definitely ascertained what amount of deformation carries those particles which are most strained beyond their limit of elasticity, and could rules and formulae be obtained which should express the existing relation in such cases, between the resisting power of the material and the forces of impact and inertia which thus attack it, a most valuable addition to our knowledge would be made. At present we can only adopt, as a general principle, the rule to make parts, exposed to shock, of such form as will distribute resistance as uniformly as possible throughout the piece, and to adopt every practical method of reducing the violence and frequency of shocks and jars. The most elastic materials are best fitted to withstand this kind of stress.

ENGLISH FOOD ADULTERATION.

The English Adulteration Act imposes a fine for the selling of any adulterated article as pure; and also provides that any mixed materials, such as mustard, cocoa, etc., shall be designated by a label setting forth the fact. A large number of dealers have attacked this law, stigmatizing it as unfair and coercive, and a parliamentary committee is now inquiring into its workings. The evidence thus far adduced is not only interesting in itself, as showing the many falsifications of the commonest articles of food, but is of especial importance to American dealers, inasmuch as it is stated that it is a common practice for the owner of a spurious article on the other side of the Atlantic, on finding that it is in danger of seizure under the law, to lose no time in getting it aboard a steamer for New York. In this way, it appears, from the statements of the *New York Herald's* London correspondent, that shipments of spurious teas, adulterated wines and spirits, and fraudulent packages of Roman cements, together with a number of other commodities, all more or less adulterated, find their way to our markets.

Tea is doctored in order to improve its appearance, increase its bulk, and add to its weight. For the two last mentioned purposes, finely ground quartz and iron or steel filings are employed. Catechu gum, an astringent substance, is also used, but the favorite ingredient seems to be "lie" tea, or old tea leaves once used and then worked over. This is mixed with low grades of new tea, and placed in cylinders under steam, together with a quantity of carbonate of magnesia, Dutch pink, and Prussian blue. The adulteration with "lie" tea is usually done in China before export, but the "facing," as the coloring is termed, is performed by people in England who become skilled in the fraud as a business. The dealers face the tea to render it back or green, according to the desires of customers. Out of 170,000,000 pounds of the commodity annually consumed in England, it is asserted that one fifth, or about 35,000,000 pounds, is open to suspicion.

British wines, according to the testimony of several analysts, are largely adulterated with potato spirit; sherry is doctored with sulphuric ether, and to other liquors fusel oil and French treacle or brandy, which is often nothing more

than beet root spirit colored and flavored. Beer is now comparatively pure, and the main adulteration is simply water.

In butter, often as much as forty per cent of water is found; patents have recently been obtained for a compound called "butterine;" and two other artificial mixtures, known as "Australian" and "Dutch" butter, have appeared in the markets. The Australian stuff is bone fat extracted by steaming refuse bones. It sells for fifteen cents per pound, and smells horribly. Dutch butter is a mixture of genuine butter and American lard. There is, beside, a French butter, compounded of drippings and kitchen stuff colored with annatto.

Corn flour, a material largely used for food for children, is described as generally worthless and unhealthy. Thirty-three out of seven thousand grains, a pound, one analyst states as the proportion of nutritious matter contained, where there should be at least eight or nine hundred grains. The article is nothing more than starch, a fact proved by the circumstance that a dog fed upon it died of starvation.

Other well known adulterations in bread and milk are noted; but as these commodities do not come under the head of possible exports, allusion to them is unnecessary.

J. H. says: "Please call the attention of your numerous readers to the great danger of buying cheap cans, for fruit, vegetables, etc., as a mixture of lead and tin is used for their manufacture (instead of the bright tin), by unprincipled manufacturers."

It is only by the thorough study of details and their mastery, that one can hope to attain eminence or position in any profession.—Graham Smith.

IMPROVED VERTICAL BOILER.

We give herewith an engraving of a vertical boiler, exhibited at the recent exhibition of fuel-saving appliances at Manchester, England. *The Engineer*, from which we select the illustration, states that the details of construction will be obvious at a glance. Fig. 1 and plan show an ordinary boiler; Fig. 2 and plan show a boiler in which the whole outer shell is enveloped in a smoke box which can be lifted off in a moment. Internally the boilers are nearly alike. Vertical water tubes are fixed in the fire box. This has been done before repeatedly, but not as in this case. The tubes, instead of being bent and fitted directly into the tube plate,

These figures all refer to January 1, 1873. Of the capital 38 per cent is obtained by loan in England, and 48 per cent in America. Bondholders in the United States obtain an average revenue of 6.7 per cent against 4.25 per cent in England. Dividends distributed to stockholders represent in America but 3.91 of the capital obligations, in place of 5.14. The difference of these figures is considerable in view of the irregularity in value of capital in the two countries. But in America, says M. Malézieux, railroads give such additional value to land, mines, and natural resources that capitalists whose funds are engaged in the most varied enterprises are content with the smallness of the revenue. But he con-

inventors, Messrs. Allen Wright and Albin F. Tew, of Westfield, Chatauque county, N. Y., propose making the handle part of the bar tubular and of sufficient diameter to suit the hand naturally. The tamping attachment, B, crow, C, and claw, D, are all provided with screw shanks, so that they may be readily attached to the handle. A head is secured to the upper portion of the latter either permanently or detachably, and serves the ordinary purposes.

The Great Centennial Exhibition.

The Director of the Centennial Commission officially announces that the exhibition will open April 19, 1876, and close

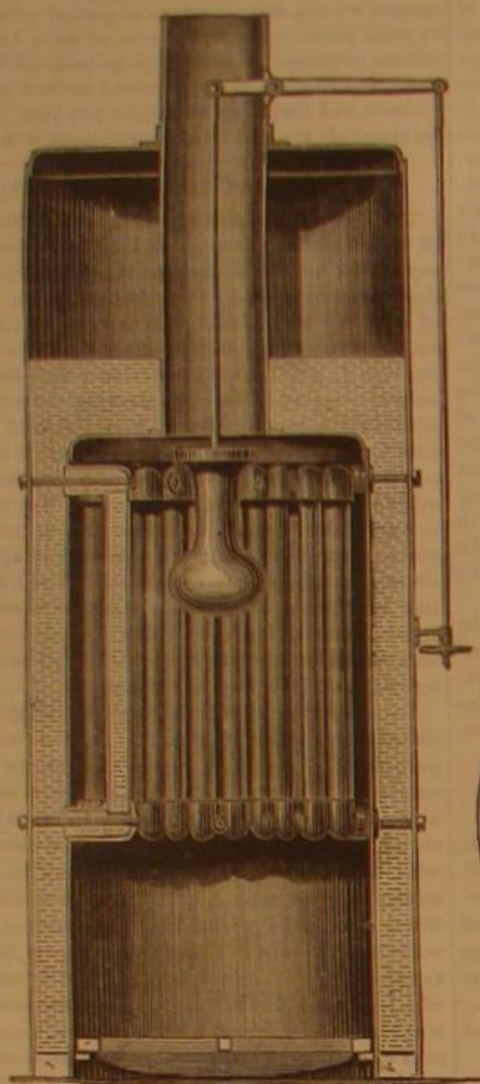


FIG. 2

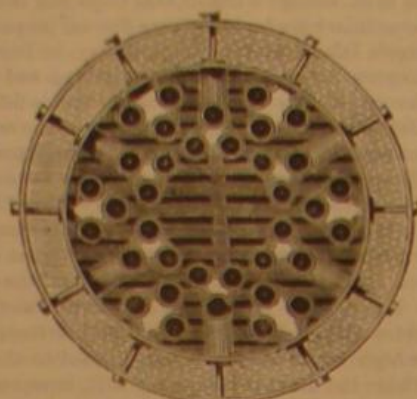
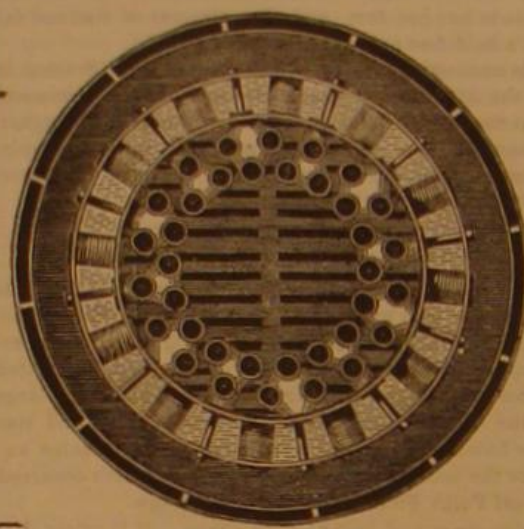
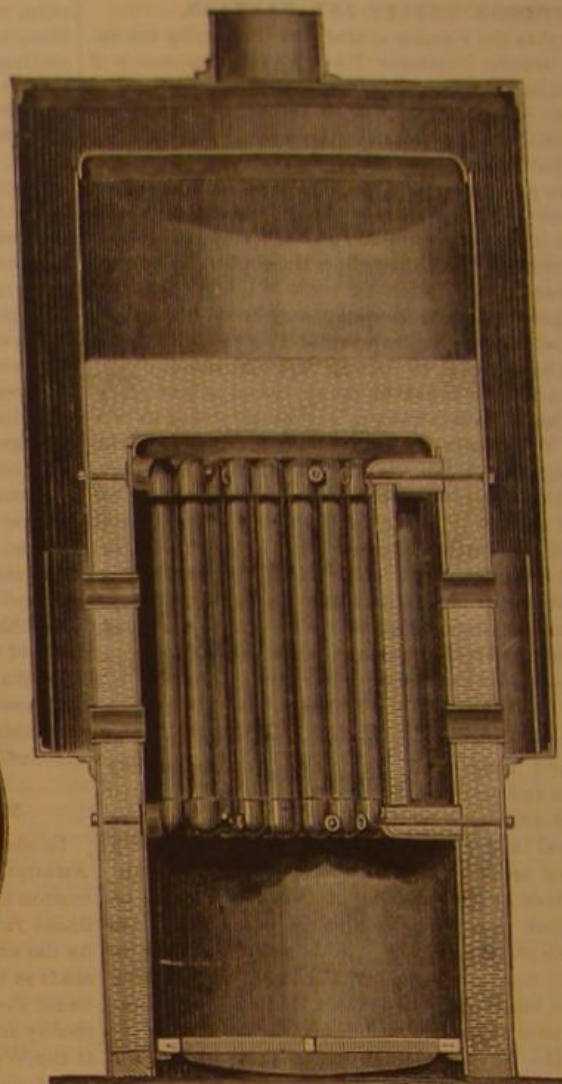
SECTIONAL PLAN OF
FIG. 2SECTIONAL PLAN OF
FIG. 1

FIG. 1

HILL'S VERTICAL BOILER.

are fitted into malleable castings, as shown, in groups. These castings are tapered and ground at the outer ends or legs, and these tapered ends are drawn into slightly conical holes in the fire box, by the bolts and nuts passing through the outer shell, as shown. Any tube, or rather any group of tubes, can be taken out by removing the nuts on the outside of the boiler, and, on withdrawing the bolts, allowing the group of tubes to descend into the fire box, whence it can be taken for repairs or renewal of tubes.

It will be seen that the arrangement is cheap and simple, and we understand that several of these boilers which are at work have given very satisfactory results. The malleable castings appear to stand very well, and give no trouble of any kind. The facilities for manufacture are obviously great, and the boiler deserves extended adoption.

English and American Railways Compared.

The French government some time ago directed M. Malézieux, chief engineer of roads and bridges, to prepare and submit a thorough report upon the condition, cost, operation, etc., of all the English railways. This work has lately been completed, and published in the official journal of the French Engineers, the *Annales des Ponts et Chaussées*. Its interest to American readers is enhanced from the fact that a couple of years ago M. Malézieux visited the United States, and compiled a report upon American engineering structures, and that in presenting this, his second report, he has drawn largely upon the knowledge gained across the Atlantic to institute comparisons between the railway systems of England and the United States. The results of his examination into the comparative cost of working shows that 57,040 miles of railroad in the United States produced, during the year 1872, an average gross receipt of \$5,160, which sum is just half that gained in England. This amount is divided between passengers and freight in the proportion of 28 to 72, in place of 44 to 56 in the latter mentioned country. It will be noticed that the passenger travel in England is as exceptionally large as is the freight transportation in the United States.

The working expenses, which in England may reach 50 per cent of the gross receipts, in the United States are 65 per cent. The net earnings then are but 35 per cent in the latter country against 50 per cent in the former. This, however, represents 5.20 per cent of the expense of construction in the United States and but 4.75 per cent in England, which the author ascribes to the fact that the cost per mile averages \$55,683 in the United States, while in England it is \$170,645.

siders that, without the aid of land subsidies and the contributions to loans to the roads by cities, the development of American railways would not have been so extraordinarily rapid.

IMPROVED CROW AND TAMPING BAR.

To workmen who, in the course of their labor, find it necessary to transport a kit of heavy tools from place



to place, the invention herewith illustrated will prove quite convenient, as its object is materially to reduce the weight of the implements, while, at the same time, causing them to be less expensive and to occupy less space. The

October 19 following, and has issued a circular containing the general regulations for exhibitors. Articles to be entered are divided into ten departments, as follows: 1. Raw materials, mineral, vegetable, and animal. 2. Materials and manufactures used for food, or in the arts, the result of extractive or combining processes. 3. Textile and felted fabrics—apparel, costumes and ornaments for the person. 4. Furniture and manufactures of general use in construction and in dwellings. 5. Tools, implements, machines and processes. 6. Motors and transportation. 7. Apparatus and methods for the increase and diffusion of knowledge. 8. Engineering, public works, architecture, etc. 9. Plastic and graphic arts. 10. Objects illustrating efforts for the improvement of the physical, intellectual, and moral condition of man.

Application for space must be made to the Director General. There will be no charge for the same, but exhibitors must provide their own show cases, shelving, counter shafts, etc. Transportation, etc., is at the expense of the exhibitor. Goods will be received from January 1, 1876, and none will be admitted after March 31, 1876. For heavy articles requiring foundations, arrangements should be made as soon as the buildings are begun. Patent medicines, empirical productions of any nature, and dangerous substances are excluded. Sketches, drawings, or photographs of entries will not be permitted, except by joint assent of the exhibitor and the Director General. Goods must remain until the close of the exposition, but subsequently must be removed before December 31, 1876. All communications should be addressed to the Director General, International Exhibition 1876, Philadelphia, Pa.

The New York State Agricultural Fair.

The New York State Agricultural Society announces that its thirty-fourth annual fair will be held at Rochester, N. Y., from September 14 to 18 next. Entries close on August 15. A very large number of premiums are offered, especially for fine cattle. Manufacturers of agricultural implements will doubtless find it to their advantage to exhibit, as the fair will attract a large gathering of farmers from all parts of New York, Ohio, and Canada. We notice that a gold medal is offered for a combination of machinery, driven by steam, for plowing or otherwise preparing the ground for sowing. The requirements are that such machinery shall do as good and as cheap work as is now commonly done by horse power, and shall be adapted for use in the State of New York.

A WATER BELT FOR TRANSMITTING MOTION.

A curious mode of transmitting motion by means of a water belt is represented in the annexed engraving, which we extract from the *Revue Industrielle*. The device is that of an English inventor, Mr. J. Robertson, and is said to work with perfect freedom from noise and vibrations. The piston of the engine is connected with the driving shaft, A, on one extremity of which is attached a large hollow pulley, B. The outer face of the latter is cut away from the center so as to leave only a flange of the width shown at *b*. Through the opening passes the shaft of a fan blower, D, on which, and inside the hollow pulley, is a pallet wheel, C. The pallets on the latter do not touch the inside of the hollow pulley.

In operation the water, *a*, of which a small quantity is placed in the pulley, B, is caused, by centrifugal force, to spread itself against the inner periphery, and to be carried around with the wheel. Into this water, as shown in the sectional view on the left, the pallets on wheel, C, dip, and are thereby acted upon by the force of the same, causing the wheel, C, to rotate. The hollow pulley is of sheet iron, and is revolved at the rate of 500 turns per minute. No water whatever, it is stated, is ejected from the apparatus, and it is only necessary to supply the small amount lost by evaporation to keep the device in working order.

American Inventive Genius.

In Switzerland no patent law exists, much to the disgust of native inventors, who are obliged to seek protection for their improvements in this and other countries. Mr. Adolph Ott, a native of Switzerland, but long resident in New York, is now at home, laboring to procure the passage of patent laws by the Diet, and has lately published at Zurich a pamphlet on the subject, in which he makes the following tribute to the inventive genius of America:

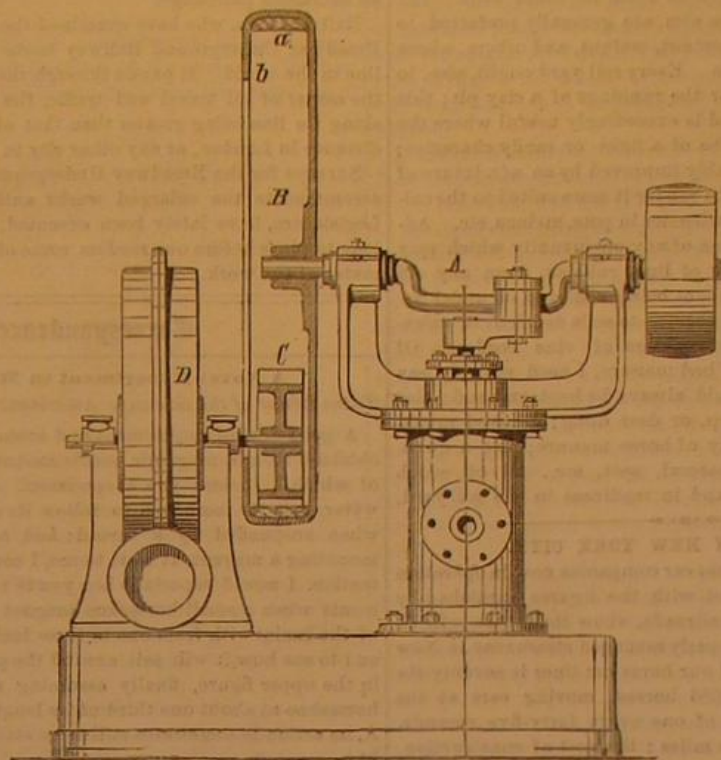
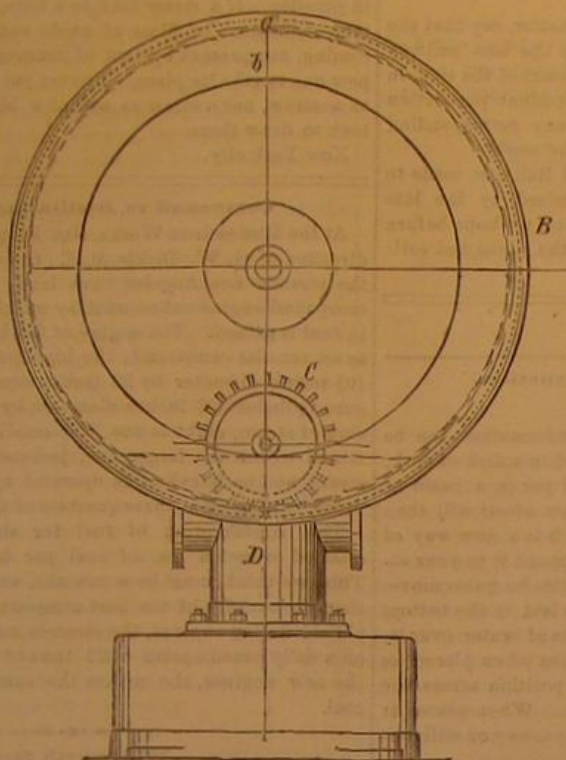
"No nation can boast of having accomplished so much towards the general progress of industry as the American. If you make inquiries about the origin of the most important improvements in any branch you please, you will find in five cases out of ten that it was made on the other side of the ocean. In our boasted watch industry the substitution of machines for manual labor took place only through the impulse given by Americans. The modern system of grain mills is of Yankee origin, and so is the whole india rubber industry. The present system of the construction of iron bridges is the result of American genius. Look at the boring machine that performs its work at the St. Gothard tunnel uninteruptedly; it came to us from the other side of the ocean, and so did the system of electric blasting. As to the printing telegraph, it is due to Professor Samuel F. B. Morse, an American who died recently. The system of railways like that on the Rigi Kulm, which promises to be of so much importance to Switzerland, was invented by Mr. Sylvester Marsh, a New England man. With regard to fire arms, the United States has presented us with the most important improvements. The best wood-working machinery is of American origin, this being also the case with numerous agricultural implements, not to speak of household machines. To a western man, Mr. Samuel Danks, we owe the mechanical puddler, an invention in the manufacture of iron which is only second in importance to that of Bessemer. In an article in the *Journal of the International Exposition*, the well known engineer Perels calls the American machines for making tools sent to the Vienna Exhibition "perfect instruments of precision," and according to him the hand saws are distinguished by a truly astonishing form and accuracy. In the making of scientific instruments, the United States are equally advanced. To Professor Jno. W. Draper we owe entirely new self-registering meteorological instruments, which, though more simple, are not less accurate than the best in use in Europe. The American watches compete already to a considerable extent with the Swiss and English. In view of this entirely unparalleled inventive activity, an American was not quite wrong in saying, in the International Patent Congress in Vienna: "It has been stated from the opposite side that a German had invented printing when there was no patent law. This is true, but it required three centuries thereafter to invent the printing machine. Surely in America, it would not have required over five years."

The Perils of Flying.

M. De Groof, the flying man, lost his life recently at London, England. He had ascended in a balloon, and his part of the performance was to fly down to the earth after the bal-

loon attained a great altitude. The unfortunate inventor had constructed a pair of wings made of cane and silk, each 37 feet long by 4 feet wide, and also a tail 18 by 3 feet in dimensions. The wings were inserted into two hinged frames, which were attached to a wooden stand, upon which the aeronaut stood and manipulated them by means of levers. The theory was that, when started from any high altitude, the machine would reach the earth by a very gentle incline, passing over a great distance and eventually landing without concussion. At a first trial of the device, on being

WATER BELT FOR TRANSMITTING MOTION.



dropped from a balloon, the earth was reached in safety, but on the present repetition of the experiment, De Groof seemed to lose control of his wings, and the apparatus collapsed and fell, dashing the man to pieces on the street pavement below.

A NEW SECTIONAL BALLOON.

Mr. James Hartness, of Detroit, Mich., has recently patented a novel form of balloon, the main object of which is to prevent accidents due to bursting while in the air. In

Fig. 1.

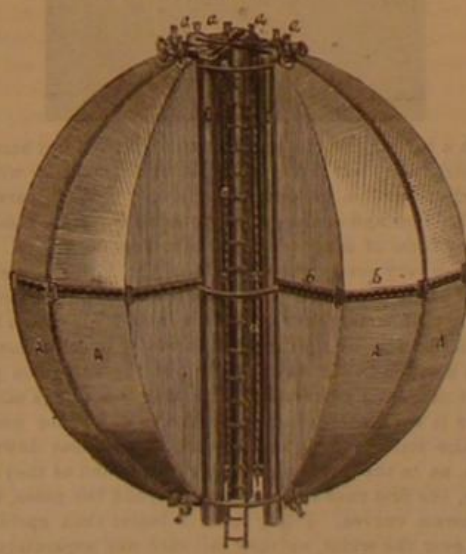


Fig. 2.



stead of making a single globe, he constructs the body of the balloon in sections, exactly similar to those of an orange, each one of which is inflated separately, and all joined together complete the sphere. A section is shown separately in Fig. 2, and several joined together in Fig. 1. An axial opening is left at the extremities, at the middle of which the sections, the inner edges of which are made of suitable shape for the purpose, are connected by straps, *b*. Through this opening a rope ladder extends, so that the aeronaut may have access to all the valves, one of which is arranged in each section. The poles shown passing up through the aperture are designed as a support for the balloon during the process of inflation.

It will be seen that, owing to the small amount of pressure which each section has to withstand, the fabric may be made much lighter than would be necessary in a balloon of corresponding size constructed in the usual way, while, as in compartment ships and sectional boilers, a rupture occurring at any point is confined to a single section, the others, remaining uninjured, retaining their buoyancy.

Patented Car Improvements.

There were one or two points in the proceedings of the Car Builders' Association, at its late meeting, in which a peculiar sensitiveness was developed about discussing the merits of patented devices. The impression seemed to prevail with many of the members that such devices were not only inadmissible as legitimate topics for discussion, but that committees, in making their reports, must not indorse or recommend any such devices for adoption, no matter what might be their actual merits. This, in our judgment, is a

mistake which cannot be too soon corrected: nor do we think that, in order to do so, any alteration of the constitution of the Association is necessary. That instrument, as it is now, merely forbids the admission of patentees or their agents to advocate their claims at any of the meetings of the society, but does not prevent the members from freely expressing their views in the regular course of discussion upon any invention or device, whether patented or not. To suppress all discussion with respect to patents would seriously hamper the Association in the exercise of its proper functions, and so far destroy its usefulness. It must necessarily be progressive, or disband. It is not the business of the Association to make or un-

make the fortunes of inventors or patentees, or to discriminate between rival claims, except on the score of actual merit, and as the interests of railroads may be affected thereby. If the Miller platform or the Westinghouse brake is a good device now, let it be indorsed and approved; but as soon as either is surpassed by something better, let it be condemned. There is no evading this obvious duty. The Association has got to recognize patented inventions and pronounce upon their respective merits, so far at least as they apply to railway cars, or be exposed to comment and criticism, such as may be found in the *SCIENTIFIC AMERICAN* of July 18.—*National Car Builder*.

Soils and Fertilizers.

Turfy loam, being rich in decomposing vegetable fiber, forms a soil acceptable to almost all families of plants, forming, as it were, the staple or ground work to which other soils or ingredients may be added. Some cultivators, says a correspondent of *The Garden*, prefer using turf loam as soon as it is taken from the field or pasture, to form the principal ingredient in the formation of vine borders, and for melon culture, etc., justly considering that many of its useful properties are wasted, by its retention, of perhaps years, in the soil yard, before it is supplied to growing plants. It is obvious, however, that it would be inconvenient for the cultivator to have to repair to the field or pasture supposing that he had permission to do so, whenever he might require even a small portion of this soil; and most plant grower will only be too glad to take an opportunity; when it offers itself, to lay in a stock of this soil to last them for several years.

When this is carted into the soil yard, it should be stacked up in the form of a ridge, and might, with advantage, be thatched with some littery material, so as to prevent it from becoming saturated with cold rains during winter, or from being desiccated during dry summer weather. If a portion of good farmyard manure can be secured simultaneously with this soil, a layer of the same might be made to alternate with a layer of the loam, and this would form a most useful compost for many purposes; as, when it had laid some six or more months, it would then be found to be in excellent condition, without further additions, to use for the potting of fruit trees of various sorts, strawberries, roses, and other kinds of plants requiring a rich and somewhat tenacious soil; while, to render it suitable for other varieties of plants, river or silver sand, leaf mold, peat, etc., could be added in the proportions required.

PEAT, LEAF MOLD, AND OTHER MATERIALS.

In establishments where collections of heaths and other hard-wooded plants are cultivated, "fibery peat" soil is indispensable; and, in many parts of the country, peat, of the desired quality, is exceedingly difficult to procure. The black bog soil, which is sometimes substituted for it, is absolutely worthless, and any attempt to cultivate hard-wooded plants in such material will be sure to end in failure. Where good peat cannot be found, it is always advisable to purchase it from nurserymen or others who may be in a position to supply it, and this can always be done for a trifling outlay. The best description of peat generally contains more or less silver sand; but, if found to be in any degree deficient in this respect, sand can then be added to

any desirable extent; and as regards silver sand of the best quality, there are only a few places in which it is to be found. It can, however, always be purchased, and is not expensive; while, for many purposes, sharp river sand, where it can be obtained, forms a good substitute. Leaf mold, or soil composed entirely of decayed tree leaves, is also an essential material in every garden establishment; and, generally speaking, there is little excuse for a gardener not having an abundant stock of this always on hand. It is seldom, however, in good condition for potting purposes until it is two or three years old; and, even then, it should seldom or never be used alone, but mixed with loam or other soils. The leaves of the oak and the elm are generally preferred to those of the ash, horse chestnut, walnut, and others, whose leaves are of a softer tissue. Every soil yard ought, also, to contain a portion of clay, or the runnings of a clay pit; this improves with keeping, and is exceedingly useful where the natural soil is inclined to be of a light or sandy character; the latter will be considerably improved by an admixture of clay, which will be found to render it more suited to the culture of fruit trees and strawberries in pots, melons, etc. Advantage should also be taken of any opportunity which may occur to secure a quantity of lime rubbish, from any old buildings which may be about being removed or under repair, as this material is of service to soils deficient in calcareous matter, and in the formation of vine borders. Of well rooted stable or hot bed manure, I need scarcely say a considerable portion should always be kept on hand; also a portion of dry cow, sheep, or deer dung; decayed mushroom beds, composed chiefly of horse manure; also a quantity of broken bones, charcoal, soot, etc., all of which should be kept separate, and in readiness in the soil yard.

RAILWAYS IN NEW YORK CITY.

"The statistics of the horse car companies now in operation in this city, when compared with the figures furnished by the London underground railroads, show that there will be immense profits from a properly managed steam road in New York. The total length of our horse car lines is seventy-six miles. They employ 11,086 horses, moving cars at the busiest hours at the rate of one every forty-five seconds. The speed per hour is five miles; the cost of construction, three eighths of a million dollars per mile. Last year, the passenger travel amounted to 192,000,000 persons, being two and a half millions per mile. One some roads the ratio was still larger. The Sixth Avenue road carried four millions per mile, and the Third Avenue line, below Central Park, carried five millions. The average fare on the different lines and their connections is 5½ cents, while the total expense per passenger is 4 15-100, leaving a net profit of 98-100 cent. The business of the horse roads has increased 255 per cent in ten years.

In London, there are 19 3-10 miles of underground roads. The motive power employed is 70 engines. Trains run every four minutes, during the busiest hours of the day, at an average speed of fifteen miles. The cost of construction per mile, after deducting sales of surplus real estate, is three and a half million dollars. Sixty-five million passengers were carried last year, at the rate of three and a half millions per mile. The average fare is five cents, and the total expense per passenger 2 31-100 cents, leaving a net profit of 2 69-100 cents for each passenger carried. In the underground roads, the increase of business in ten years has been 360 per cent.

A comparison of these statistics gives a most favorable showing to the steam railway. While the expense of construction and equipment is larger in the case of the latter the operating expenses are very much less. The expense of transportation per passenger by the steam engine is about one half of that reported by the horse roads, while the net profit is nearly trebled without any advance in the fares. At the same time the speed is fairly trebled. The steam road is popular, too. Rapidly as travel has increased on the surface lines in New York, the increase on the London underground railway has been half as large again. The people have had practical proof of the speed and safety of the latter, and patronize it accordingly.

This comparison shows the large profits which lie within the reach of any corporation that shall be the first to go to work and give New York the benefit of rapid transit. There are no estimates in the figures just presented. They exhibit work that has been done and profits that have been pocketed. According to these statistics, steam roads might acquire a net profit of over five million dollars, annually, by carrying the same number of passengers that now yield the horse roads a profit of less than two millions. A competent engineer, who has carefully studied the subject of rapid transit, estimates the gross revenue of a road to Forty-sixth street at \$4,319,400 per annum, with \$1,916,000 as the annual cost of operating, leaving a net income of 23 78-100 per cent on the calculated cost. There would also be added to this the extra fare for carrying first class passengers, baggage, express parcels, or the mails.

This exhibit appears as reasonable as it is gratifying. If it be also taken into consideration that the population in the city limits will be largely increased as soon as rapid transit becomes a fixed fact, the probability of large returns on investments in this direction becomes a certainty.

A golden harvest awaits the corporation that shall enter upon the work. Labor is ripe for it, and capital will not hesitate to lend a helping hand in due time. There is no such opportunity for enterprise and profit elsewhere in the land. It were a waste of time to enlarge upon the benefit of underground rapid transit to the community. The profit it promises is the argument of the hour."

The above is from the *Daily Graphic* of this city. It is gratifying to be able to add that the Legislature, at its recent

session, granted some additions to the charter of the Broadway Underground Railway Company, which it is expected will, before long, enable that corporation to begin the work in earnest. The authorized first section of the road is from the Battery, at the extreme southern end of the city, under Broadway to Central Park, with a side branch to the Grand Central Depot at 42d street. Considering that it now takes the passenger a dreary hour, by horse car, to traverse this distance, 4½ miles, and considering that by the underground railway it may be done in ten minutes, it requires no great stretch of the fancy to predict that the new road will enjoy an enormous patronage.

Railway men, who have examined the matter, say that the Broadway Underground Railway route is the best railway line in the world. It passes through the heart of the city, in the center of all travel and traffic, the resident population along its line being greater than that of any corresponding distance in London, or any other city in the world.

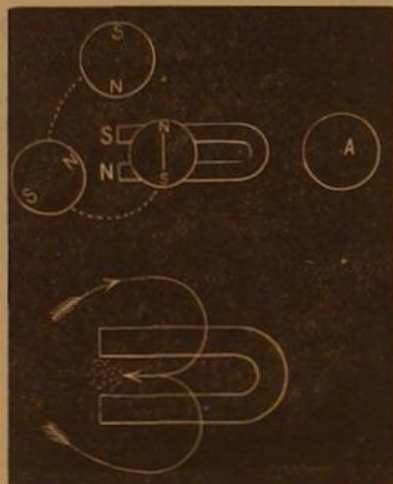
Surveys for the Broadway Underground Railway, made to accommodate the enlarged works authorized by the late Legislature, have lately been executed, and we hope before long to place before our readers some of the plans and estimates of the work.

Correspondence.

A Novel Experiment in Magnetism.

To the Editor of the Scientific American:

A good deal of amusement and some information can be obtained from a magnetic needle mounted in a disk of cork, of which I inclose you a specimen. If put in a basin of water, it is far more free to follow its own sweet will than when suspended by a thread; and as it is a new way of mounting a magnet, at least to me, I commend it to your attention. I would especially beg you to notice its queer movements when a small horseshoe magnet is laid in the bottom of the basin with from one to three inches of water over it, and to see how it will sail around the poles when placed as in the upper figure, finally assuming a position across the horseshoe at about one third of its length. When placed at A, its action is sometimes still more strange, as you will perhaps see.



With a bar magnet, its motions are different, but amusing and instructive; but in any mode of experimenting with it, its perfect freedom to assume its proper position serves to show the lines and centers of force with far more clearness than any form of magnetic toy I have ever seen.

Another very pretty experiment (see the lower figure) is to put one of the magnets in the basin with about one eighth of an inch of water over it; take a small file and a bit of iron, and let the filings drop on the water over the magnet. This is a much better way than to put the filings on paper and the magnet underneath. The way the filings sail into position is very interesting; they like to enter into position from the outside and near the center, and float down the middle, as in the direction of the arrows; and as they accumulate, the first ones are forced out beyond the poles, in the well known curves. Filing them is better than sprinkling filings over the water, as they fall each one separately. In sprinkling filings on the water, they fall in aggregations in which they are not as free as when each atom of iron is separate.

H. P. HENRY.

Pittsburgh, Pa.

REMARKS BY THE EDITOR: We have tried all these experiments, and, although the movements we observed are not precisely those described, they are still very amusing and interesting.

The Largest Locomotive in the World.

To the Editor of the Scientific American:

I see in a recent issue of your paper that a correspondent makes the statement that the largest locomotive is one on the Philadelphia and Reading railroad, which has two cylinders, 20 x 26, and twelve driving wheels; and that the whole weight is sixty tons. He probably has never heard of the "Janus," constructed by William Mason, of Taunton, Mass. It was built for the Union Pacific railroad, but could not be used there; and where it is now, I do not know.

Sandwich, Ill.

GEO. H. FRIZZELL.

REMARKS BY THE EDITOR.—We are much obliged to our correspondent for reminding us of the Janus, which, as he states, was built at the celebrated Mason Machine Works, Taunton, Mass. Mr. Mason informs us that the Janus has four cylinders, 15 x 22, and twelve drivers 3½ feet diameter, and no other wheels. Its weight, when the tanks and coal bunkers are full, is 84 tons. It is now working on a coal

road in Pennsylvania. If anybody can produce a larger locomotive, we hope they will trot it out.

Hardening and Tempering Tools.

To the Editor of the Scientific American:

You have been talking to us in your "Practical Mechanism," by Joshua Rose, in a way that we can understand, and upon subjects in which we are directly interested, and, as I think, to our benefit. But please keep out the oxides. We do not want them in the shop; we know of straw and blue colors as different tempers because we always find them so in practice. If a straw may be a blue, and a blue a straw, temper, because of films of oxide and the time they were coming, our present system of tempering is gone, with no new one to take its place. I never yet found a blue as hard as a straw, nor a straw as soft as a blue, whatever time it took to draw them.

New York city.

TOOLS.

Compound vs. Oscillating Engines.

At the Risdon Iron Works, San Francisco, Cal., under the direction of G. W. Dickie, M. E., the oscillating engines of the steamer Los Angeles have lately been removed, and a compound engine substituted, by which an important saving in fuel is gained. The engine, of 337 horse power, is known as an annular compound; the high pressure cylinder being 19½ inches diameter by 28 inches stroke, and the low pressure cylinder 43½ inches diameter by same stroke; expansion of steam, eight to one, the smaller cylinder being contained within the larger one, jacketed with high pressure steam, and both cylinders operated by one balanced slide valve, cutting off at three quarters of the stroke.

The consumption of fuel for the new machinery is claimed to be 1 6 lbs. of coal per hour per horse power. This, we think, must be a mistake, as it is considerably less than the average of the best compound engines. With the old oscillating engines, the steamer made nine knots an hour on a daily consumption of 22 tons of Sydney coal. With the new engines, she makes the same speed on 5 tons of coal.

Whitworth Steel.

Some idea of the solidity of compressed castings of Whitworth metal may be gleaned from the fact that, five minutes after the application of pressure,—about twenty tons to the square inch,—a column of fluid steel becomes shorter by 12.5 per cent, or 1½ inches to the foot. Sir Joseph Whitworth, as a writer in *Iron* states, holds the proportion that for certain purposes a metal must be used having a certain tensile strength and a certain percentage of ductility. Hence the metal cast at the Whitworth works is classified according to its possession of these qualities, and arranged for convenience in four groups, distinguished by colors, red, blue, brown, and yellow, and by numbers, No. 1 of each group representing the most ductile metal, and No. 3 the least so. Of Low Moor wrought iron, the tensile strength per square inch is 27 tons, and ductility or percentage of elongation, 38. In good cast iron the same qualities are represented by 10 and 0.75. Various samples of Whitworth steel similarly tested gave from 36 to 72 tons tensile strength, and from 33.3 to 14 per cent elongation. There is shown a singular relation between the tensile strength and ductility of the metal, the one generally increasing as the other decreases, a circumstance which, it is suggested, may possibly deserve investigation.

The Polyspheric Ship.

This is the name of a novel vessel, recently invented in England by Mr. Charles M. Barnes. The bottom is flat and fitted with three inclined planes with square ends, the effect being as though three teeth of a gigantic saw were moved through the water with the sloping portion of the teeth first.

The inventor has tested the device by means of small models impelled by rockets. A 7 pound model was driven, by a 3 pound 3 ounce rocket, a distance of 105 yards in 3 seconds, or at the rate of 63 knots per hour. The motion is said to resemble sliding over ice. There is scarcely any water disturbance, and the decks were apparently motionless. When drawn slowly over the water, the vessels offered more resistance than models of the ordinary shape; but when the equilibrium, between the horizontal pressure of the inclines forward and the pressure of the water in the contrary direction, is destroyed, the model at once rises in the water and passes over the mass of hitherto obstructing fluid.

Valve for Gases and Corrosive Liquids.

This valve is adapted to cases where liquids have to be forced into vessels under pressure. A piece of glass tube, about 3" long and ¾" internal diameter, has a bulb blown in the middle, and the ends are cut off square. A piece of india rubber tube 3" long, and of such a thickness that it will just pass into the bulb tube, has one end tied with string or platinum wire. Just below the ligature a transverse slit is made, so that the end is nearly cut off. The uncut part serves as a hinge. A small pellet of cork or india rubber is put into the end beyond the slit. The tube is then stretched on a piece of glass tube, and the whole forced into the bulb tube, till the valve occupies the interior of the bulb. Any pressure in the tube raises the valve on its hinge, while any back pressure closes it tightly. For pressures up to 30 lbs. on the square inch it is perfectly airtight. Beyond this the author has not tried it.—Roland H. Ridout, in the *Chemical News*.

A MOUTH without grinders is like a mill without a stone. A diamond is not so precious as a tooth.—Don Quixote.

PRACTICAL MECHANISM.

NUMBER VI.

BY JOSHUA BORE.

TAPS AND DIES.

Taps should be forged of hammered square bar steel, and forged to as near the finished size as possible (so that they are large enough to true up), for the reasons already given with reference to tool steel.

The threads of taps of the smaller sizes should be finished by a chaser, so as to insure correctness in the angles and in the depth of the thread.

The taper tap should not be given more taper than the depth of the thread in the length of the tap, or it is liable to be used upon holes that are too small, which places more duty upon it than is necessary and than it should be required to perform; rendering it, in consequence, liable to break from the excessive strain, and causing the square end of the tap, where the wrench fits, to twist and the corners to become rounded.

A tap which has clearance placed upon its thread, by the screw-cutting tool or by a chaser, will cut very freely, and will answer for rough work; but such a tap does not cut a really good thread, and generally leaves the diameter of the thread in the hole larger than the diameter of the tap itself, because the tap is liable to wobble, and the least excess of pressure, on one end of the tap wrench more than on the other, causes the tap to lean towards the end of the wrench receiving the most pressure, and hence to tap a hole larger than itself. Especially is this liable to occur if the tap wrench has more than one square hole in it so as to enable the same wrench to be used on more than one size of tap; for in such a case, the holes being not in the center of the wrench, the weight of the wrench and the pressure placed on the end of the wrench will exert more pressure on one side of the tap than the other, in consequence of their greater distance or longer leverage from the tap. The same effects (from the use of such wrenches) are experienced in using taps having no clearance in the thread; but the thread in this latter case is so much nearer a fit to the hole that it serves as a guide and keeps the tap steady.

The only clearance necessary is to ease off the tops of the teeth of the tap back from the cutting edge, which will give the teeth sufficient clearance to make them cut clean, and leave the sides of the thread to fit the thread being cut, and thus prevent the tap from moving laterally.

The plain part of a tap, that is, that part from the thread to the end of the square where the wrench fits, should be turned down a little smaller in diameter than the bottom of the thread (unless in the case of very small taps), so that the tap can pass right through the hole in all cases where the hole passes through the work, thus saving time by obviating the necessity of winding the tap back, and furthermore preserving the cutting edges of the tap teeth by avoiding the abrasion caused by their being rubbed backwards against the metal of the hole. For special work, where the holes to be tapped do not pass through the work, and it is therefore compulsory to wind the tap backwards to take it out of the hole, the plain part of the tap may be left larger than the diameter of the thread, the advantage being that the squares of several different sizes of taps may be made alike, and therefore to suit one tap wrench.

Taps for use in holes to be tapped deeply should be made slightly larger in diameter than those used to tap shallow ones, because in deep holes the tap is held steady by its depth in the hole, and because whatever variation there may be, in the pitch of the threads in the hole and those on the bolt, is, of course, experienced to an extent greater as the length of the thread (that is, the number of threads) increases.

It is an excellent plan to finish the threads of a tap by passing it through a sizing die, that is, a solid die kept for that special purpose; but very little metal must be left on the tap for the solid die to take off, or it will soon wear and get larger. In making such a solid die, let its thickness be rather more than the diameter of the tap it is intended to cut, and make allowance for its shrinkage in hardening, for all holes shrink in hardening, while taps swell or become larger from that process; an allowance for this must therefore be made both in the case of the tap and the die. In the case of the solid die, it will be found that not only does the hole become smaller, but the external dimensions of the entire die have become larger by reason of the hardening, so that while the term shrinkage is correct, as applied to the hole, it is incorrect as applied to the die, the fact being that the metal of the die (the same as the metal of the tap) has expanded, extending its dimensions in all directions, and therefore in the direction of the center of the hole, hence causing a decrease in its diameter or bore.

Three flutes are all that are necessary to small taps (that is, those up to an inch in diameter), which leave the tap stronger and less liable to wobble, especially in holes that are not round, than if it had four flutes. Taps of a larger size may have more flutes, but the number should always be an odd one, so that the tap will do its work steadily.

ADJUSTABLE DIES.

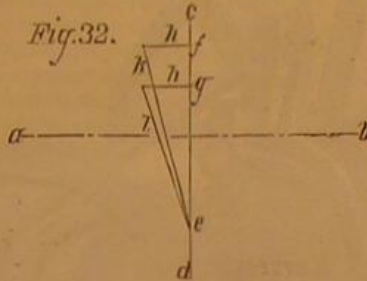
that is, those which take more than one cut to make a full thread, should never be used in cases where a solid die will answer the purpose, because adjustable dies take every cut at a different angle to the center line of the bolt, as explained by Figs. 31 and 32.

Fig. 31 represents an ordinary screw. It is evident that the pitch from *a* to *B* is the same as from *C* to *D*, the one being the top, the other the bottom, of the thread. It is also evident that a piece of cord wound once around the top of the thread will be longer than one wound once around the

bottom of the thread, and yet, in passing once around the



thread, the latter advanced as much forward as the former, that is, to the amount of the pitch of the thread. To illustrate this fact, let *a b*, in Fig. 32, represent the center line of



the bolt lengthwise, and *c d* a line at right angles to it; then let from the point, *e*, to the point, *f*, represent the circumference of the top of the thread, and from *e* to *g*, the circumference of the bottom of the thread, the lines, *h h*, representing their respective pitches; and we have the line, *k*, as representing the angle of the top of the thread to the center line, *a b*, of the bolt, and the line, *l*, as representing the angle of the bottom of the thread to the center line, *a b*, of the bolt, from which it becomes apparent that the top and the bottom of the thread are at different angles to the center line of the bolt.

The tops of the teeth of adjustable dies are themselves at the greatest angle, while they commence to cut the thread on the bolt at its largest diameter, where it possesses the least angle, so that the dies cut a wrong angle at first, and gradually approach the correct angle as they cut the depth of the thread.

From what has been already said, it will be perceived that the angle of thread, cut by the first cuts taken by adjustable dies, is neither that of the teeth of the dies nor that required by the bolt, so that the dies cannot cut clean because the teeth do not fit the grooves they cut, and drag in consequence.

DIES FOR USE IN HAND STOCKS

are cut from hubs of a larger diameter than the size of bolt the dies are intended to cut; this being done to cause the dies to cut at the cutting edges of the teeth which are at or near the center of each die, so that the threads on each side of each die act as guides to steady the dies and prevent them from wobbling as they otherwise would do; the result of this is that the angle of the thread in the dies is not the correct angle for the thread of the bolt, even when the dies are the closest together, and hence taking the finishing cuts on the thread, although the dies are nearer the correct angle when in that position than in any other. A very little practice at cutting threads with stocks and dies will demonstrate that the tops of the threads on a bolt, cut by them, are larger than was the diameter of the bolt before the thread was commenced to be cut, which arises from the pressure, placed on the sides of the thread of the bolt, by the sides of the thread on the dies, in consequence of the difference in their angles; which pressure compresses the sides of the bolt thread (the metal being softer than that of the dies) and causes a corresponding increase in its diameter. It is in consequence of the variation of angle in adjustable dies that a square thread cannot be cut by them, and that they do not cut a good V thread.

In the case of a solid die, the teeth or threads are cut by a hub the correct size, and they therefore stand at the proper angle; furthermore, each diameter in the depth of the teeth of the die cuts the corresponding diameter on the bolt, so that there is no strain upon the sides of the thread save that due to the force necessary to cut the metal of the bolt thread.

Recent Researches on Flame.

M. G. Hirn has been experimenting upon the optical properties of flame, and theorizing upon the incandescent bodies of the sun's atmosphere. (*Ann. Chim. Phys.*, xxx, p. 319.) In considering these researches we must remind the reader of Davy's theory of the luminosity of flame. It is that, if any solid substance be ignited to a sufficiently high point, let us say 1,000° Fah., it becomes luminous, while gaseous matter requires a much higher temperature. But if solid particles be introduced into a gas of a high temperature, they instantly begin to throw off light in all directions; and as the temperature of the particles rises so does the color vary through all the gradations of the colors of the spectrum. Thus, commencing with a red heat, it passes through yellow and what is termed a white heat, while a very intense heat produces violet rays. Such is Davy's theory, which, to a certain extent, is accepted at the present day. It has, however, been qualified by the researches of Dr. Frankland, who was first to point out that we can have highly luminous flames which do not, or would not, probably, contain solid particles. As examples, let us take the pretty familiar experiments of the combustion of phosphorus or bisulphide of carbon in oxygen. Most of our readers who have attended a course of lectures upon chemistry will remember the dazzling light given off in these experiments. So rich are the lights obtained in this manner in actinism that they have been used very successfully in taken instantaneous photographs.

The researches of Dr. Frankland may be generalized as follows: That gaseous substances have a point of incandescence which depends chiefly upon the density of the gas, and it follows that gases of low density become luminous much more readily than those of a high density; also, that gases which are not luminous at all at our ordinary atmospheric pressure (let us say hydrogen, for instance), when submitted to increased pressure become luminous. Thus a jet of hydrogen, burning in a vessel in which the pressure was increased, gave a light, by which a newspaper could be read two feet from the flame, on producing a pressure of two atmospheres.

Some connection may be observed, between the theory of Davy and the experiments of Frankland, from the experiments of Dr. Andrews, who has lately demonstrated the continuity of the liquid and gaseous state; or in other words, that, when operating upon gases capable of taking the liquid form with great pressure, a certain stage is at last reached where there is no perceptible physical difference between the liquid and gaseous conditions. Dr. Draper, of New York, in experimenting upon Davy's theory, has, however, found that, if, on heating a strip of platinum to a temperature of 1,280° by the voltaic current, a red heat was obtained which extended up to the line F (yellow) in the solar spectrum, at 1,325° the spectrum was prolonged into the bluish green; at 1,440°, beyond the line G; and at 2,190° a pure and intense spectrum, reaching as far as H in the violet, was obtained. These high temperatures were measured by the expansion of platinum wire itself.

Now, it is extremely easy "in the mind's eye" to conceive the intense actinic power of the rays emanating from the incandescent vapors of the sun, whose beams are the storehouse of actinic power which actuates, we may safely say, this world of ours. We may extend these theories on luminosity to the sun itself without a great stretch of imagination; for it would seem to be merely one gigantic mass of incandescent elements, similar in every respect to those we meet with in our earthly experience. But here the temperatures which we would consider intense are only to be compared to the color spaces observed upon the face of the sun; the red and white heats of our forges would appear black by contrast to the intensely ignited mass beyond if placed upon the face of the sun. What were some few years since thought to be breaks in the photosphere of the sun are now known to be incandescent clouds of vapor of a lower temperature than the brilliant background. There is hardly a gaseous element, even at a low pressure, which is not capable of becoming intensely luminous; in fact, we can conceive no limit to the phenomenon.

M. Hirn accepts the theory of Davy, and believes that the greater part of the luminosity of flame is due to solid particles being formed or precipitated into the incandescent flame. If there were opaque solid particles in flame, light would be reflected and would become polarized. Arago, years ago, observed that light from a flame is not polarized, and M. Hirn has confirmed these observations. Therefore, the latter named experimenter comes to the conclusion that the solid particles, as they became incandescent, become perfectly transparent; and the rather curious observation that a flat flame, such as we meet with in a fishtail gas burner, radiates light quickly in all directions, although so irregular in shape, is thus explained. The real shadows produced by particles of carbon, says M. Hirn, which have escaped combustion, or the fumes of burning phosphorus, when compared with the striated and feebly colored shadows given by flames of very considerable solidity, show that the precipitated particles do not affect the transparency of flame, and, consequently that, when they become incandescent, they become at the same time diaphanous (transparent).

A slight contradiction is noticed in connection with the magnesium light, which projects a real, and not simply a striated, shadow. Were this radical change in the optical properties of the solid particles not to take place—that is to say, the change from opacity to transparency—it is obvious that not only would such particles hinder the transparency of flame, but they would only illuminate from a very thin envelope.

It is easy to perceive the importance which these facts acquire when the temperature of an incandescent body, such as the sun, is studied. If the particles were opaque, they would serve as screens, one for another, of all those situated in a straight line. Only the nearest to us would send out light; and these, besides being under less pressure, would be really less luminous.

It must also be recollected that other investigations than those referred to above tend to show that the upper layers of the sun's atmosphere are the coolest, and consist of hydrogen, sodium, and magnesium; that we have layers of iron and calcium at a higher temperature; and again, layers of nickel, cobalt, copper, and zinc at a higher temperature still. M. Hirn's observation about magnesium is curious, and hardly seems to agree with the observation of Mr. Lockyer in the examination of one of the bright stripes called "facule." In this bright surface upon the sun's disk, Mr. Lockyer observed a cloud which his spectroscopic determined to consist of magnesium vapor. We, however, see at once how the different layers of vapors pass rays through their diaphanous or transparent brethren, and thus we get the full effect of the incandescence of those metals which are so rich in chemical force.

—*British Journal of Photography.*

IMPROVED METAL CUTTING AND PUNCHING MACHINE.

The novel apparatus which forms the subject of the annexed illustration differs from machines designed or like employment in that, instead of consisting of a single movable jaw (the upper one), which acts in connection with a rigid bed, it is virtually a huge pair of shears, in which both of the blades partake of the motion. In order to communicate power to the arms of the shears, there is an ingenious and quite novel mechanical combination which, together with a solidly built frame, completes the device.

Power is applied to a belt pulley on the opposite end of the shaft which carries the fly wheel, A. Also on said shaft is a pinion, which engages with the large gear wheel, B, and thus, rotating the crank at C, moves back and forth the connecting rod, D. The latter is pivoted in the upper end of a double curved bar, E. The lower extremity of said bar is also pivoted to the lower shear arm, F. The upper shear arm passes through the bar, and within the latter and immediately below the arm is a roller upon which the curved portion of the arm rests. The pivot pin which secures the roller also holds the upper end of the bar, G, the lower extremity of which is pivoted to the frame.

The arms of the shears do not cross, but are provided with projections, which lap, and through which the pin, H, passes. By this arrangement, opening the arms forces the cutting edges together.

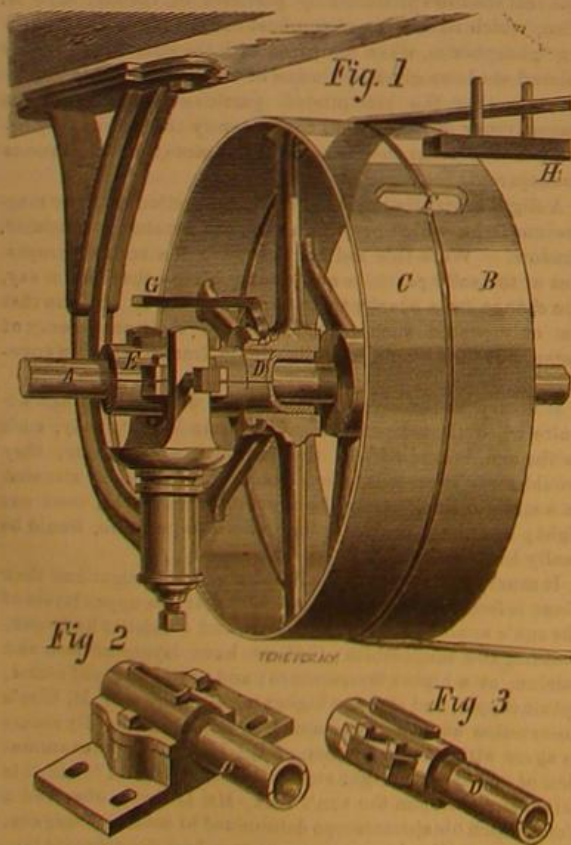
In operation the to-and-fro motion of rod, D, is communicated to curved bar, E. When the latter is thrown outward or to the right, its roller, acting against the curved portion of the upper shear arm, raises the same, while the lower end of the bar necessarily forces downward the lower shear arm, F. It is hardly necessary to explain that the combination of bars, E and G, with the shear arms, is calculated to admit of the application of very strong and uniform force to the jaws of the shears.

But little power is required to operate the machine, and its work is rapidly accomplished. It is stated that an apparatus weighing 1,700 pounds will cut bar iron one inch thick by three inches wide. The jaws, instead of carrying cutter blades, may be constructed to hold a punch and die, thus rendering the machine available for punching, as well as cutting, purposes. The device is also constructed to be operated by hand power, in which case the gearing as described is suitably modified.

For further particulars regarding rights, purchase of machines, etc., address Mr. H. C. Richardson, 59 and 61 Grand street, Brooklyn (E. D.), N. Y. Patent allowed through the Scientific American Patent Agency.

HOLDEN'S IMPROVED LOOSE PULLEY.

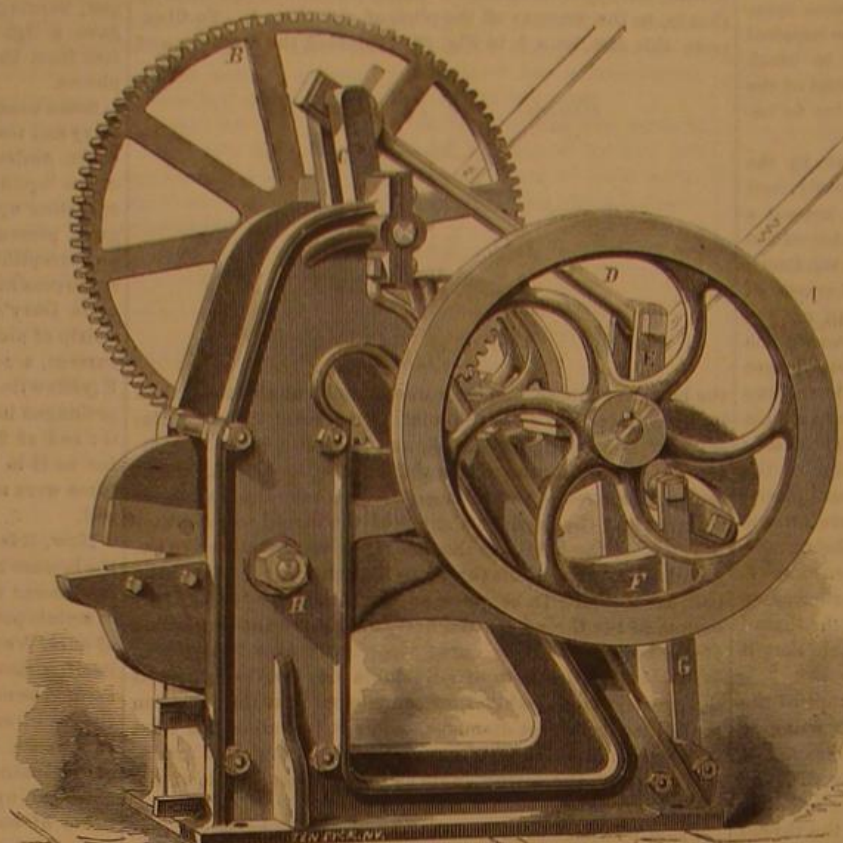
The essential feature of the improved loose pulley represented in the annexed engraving is that it, with the belt, remains in a state of rest except during the few seconds when the belt is shifted from loose to fast pulley. By this arrangement the belt revolves only when actually in use, and hence the wear of the same, together with the expenditure of lubricating material, otherwise required for the bearing, is saved.



A, Fig. 1, is the driving shaft, and B, the fast pulley. The loose pulley, C, is mounted on a bearing, D, projecting from a box, E, supported by the hanger. Through this bearing and box, the driving shaft passes. As shown through the portion broken away at F, the adjacent edges of the periph-

ries of the two pulleys are beveled, so that, when it is desired to shift the belt from loose to fast pulley, both pulleys may be caused to revolve together by forcing the pulley, C, slightly toward the pulley, B, by means of the shipper, G. After the belt is shifted, pulley, C, is drawn back on its bearing, and again comes to a state of rest. In shifting the belt from fast to loose pulley, the latter is not moved, as the belt is carried over by means of the ordinary shipper, H. The bearing and hub of the loose pulley are clearly shown in section in Fig. 1. Fig. 2 is a pillow block with a projection to receive the loose pulley, and Fig. 3 is a box and bearing, the same as in Fig. 1, shown removed from the hanger.

Patented May 5, 1874, by Messrs. W. H. Holden and T.

**REYNOLDS' METAL CUTTING AND PUNCHING MACHINE.**

C. Sheldon. For further particulars address W. H. Holden & Co., Box 327, Fitchburg, Mass.

The Music Stool Battery.

Land and Water publishes the following item, but declines responsibility for its truth by vaguely ascribing it to "a local paper."

"A valuable invention has just been patented by a post office official. It is an improvement in turret ships, the principal feature being that the battery rises and falls. Like many other inventions and discoveries, this one had its origin in accident. The inventor was out shooting one day, and both barrels of his gun went off simultaneously, the rebound causing him to spin round with considerable velocity. When he turned home he happened to sit on the music stool, and this piece of furniture also spun round in the well known manner. The movement reminded this clever official of his earlier spin. He was a gentleman capable of putting two and two together. Therefore he fastened his double barreled gun to his rotary piano stool, and banged away in his back garden, obtaining eventually a result which places him in the enviable position of being able to treat with two governments for the sale of his patent, for both England and Russia are anxious to become possessed of the rising and falling battery of this sharp post office official."

This invention bears a striking resemblance to the revolving cannon mentioned by Mr. Orpheus C. Kerr. That valuable weapon was pivoted in the middle and loaded at both ends, and, when fired, revolved with astonishing rapidity, causing promiscuous slaughter in both armies. It was intended to test the gun before a congressional committee; but as the individual deputed to fire it mentioned that he had a large family dependent upon him for support, the trial was indefinitely postponed.

Action of Earth and other Substances on Organic Matter.

At a recent meeting of the Chemical Society, a paper on the action of earth on organic nitrogen, by E. C. Stanford, was read, in which the author gave details of his experiments on mixtures of earth and decomposing animal matter. From these it appears that the earth is but an indifferent dryer, the mixture continuously losing nitrogen, which is evolved as ammonia principally; the earth also does not act as an oxidizer, and no nitrification takes place. Dr. Frankland stated that when decomposition was in the direction of putrefaction, ammonia was always produced from the nitrogenous matter, but much nitrogen also escapes in the elemental form. The action of charcoal is very different; seaweed charcoal mixed with excrementitious matters and allowed to dry is found to retain almost the whole of the nitrogen. These facts are of interest to sewage economists and the advocates of the dry earth system.

Four Hundred Miles in a Balloon.

Professor Donaldson, the aeronaut, recently accomplished a very successful voyage in his new balloon "Barnum."

Starting from the Hippodrome in this city, in the afternoon at 4 o'clock, the final landing was made the next day at 6 p. m., near Saratoga, N. Y. The party consisted of five persons, Donaldson and four reporters of the daily journals. Stops were made at various places on the route. The journey lasted 26 hours, during which time about 400 miles was traveled. The highest altitude reached was 9,000 feet.

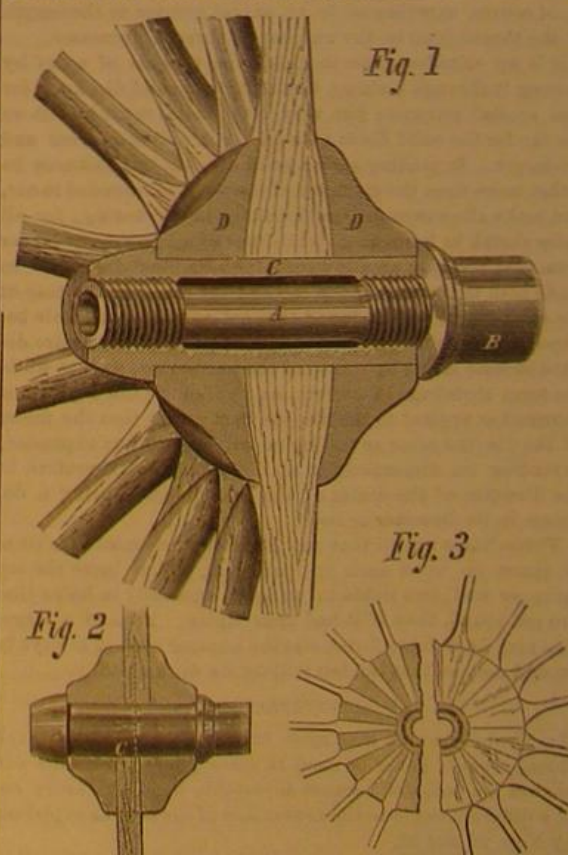
The Requisites for Good Mortar.

To obtain a good mortar, says Graham Smith, as much depends on the character of the ingredients and the manner of mixing them as on the goodness of the lime itself. It does not necessarily follow that, because a lime is good, the quality of the mortar will be good also. The best lime ever burnt would be spoiled by the custom, common among some builders, to mix with it alluvial soil and rubbish taken from the foundation pits of intended buildings. The sand should be hard, sharp, gritty, and, for engineering purposes, not too fine; it should be perfectly free from all organic matter, and with no particular smell. Good sand for mortar may be rubbed between the hands without soiling them. The water should also be free from all organic matter, and on this account should never be taken from stagnant ponds. The presence of salt in sand and water is not found to impair the ultimate strength of most mortars; nevertheless, it causes the work to "nitrate," or, as it is commonly termed, "salt-peter," which consists of white frothy blotches appearing on the face of the structure. It also renders the mortar liable to moisture, and for these reasons should never be present in mortar intended for architectural purposes, although for dock walls and sea works it may generally be used with advantage and economy.

Sand is used to increase the resistance of mortar to crushing, to lessen the amount of shrinking, and to reduce the bulk of the more costly material, lime. Water is the agent by which a combination is effected, and, as sand does not increase in volume by moisture, it necessarily follows that no more of the aqueous element should be employed than is absolutely necessary to fill the interstices between the sand, and render the whole into a paste convenient for use; and the greater strictness with which this is adhered to the more compact and durable will be the mortar.

DAVIS' IMPROVED HUB.

The invention, engravings of which in section we herewith present, is a simple and novel form of hub, composed of few parts, which may be quickly adjusted together so as firmly to retain the spokes. In Fig. 1, A is an inner metal tube forming the axle box and having a head at B. C is a larger and outer tube, into which tube A is screwed, as clearly shown. The middle portion of the hub consists of two collars, D, fitted on the tube head, at B, and binding the spokes between them. The spokes may be made large at the parts clamped between the collars, so as to fill the whole intermediate space, as shown to the right of Fig. 3, or the ends may be constructed smaller to enter grooves or mortises formed in the faces of the collars, as indicated at the left of



the same figure and in Fig. 2. The tube, A, is cored out on its middle portion to form an oil space, and the ends which form the axle bearings are cast in chills to render them hard, smooth, and durable.

The plain form of collar, the inventor states, will prefera

bly be used when the spokes are to be adjusted in a single plane, and the slotted faced when the wheel is to be built staggered. Patented through the Scientific American Patent Agency, June 30, 1874. For further particulars regarding sale of rights, etc., address the inventor, Mr. John W. Davis, Newton, Catawba county, N. C.

THE CHILIAN EXPOSITION.

The second International Exposition of the Republic of Chili, a brief mention of which has already appeared in these columns, opens at Santiago on September 16, 1875. The large South American trade which yet remains undeveloped, and the constantly increasing demand which the progressive republics of that continent are making for American productions and inventions, will, we think, offer great inducements for our manufacturers and inventors to contribute to this enterprise. Special arrangements have been made for the transportation of articles for exhibition, at low rates; and the passage of mechanics and special workmen, in charge of goods, will be in part defrayed by the Exposition Committee. No rent is charged for space, and storage and power

ence of the magnetic telegraph, and brings into bold view the feeble beginning of the marvelous progress of this peculiarly American work. After the patient but persistent efforts of Professor Morse for several years, Congress in 1843 made an appropriation of \$30,000 for an experiment with the Morse telegraph between Washington City and Baltimore, and it was this line that was completed in the spring of the following year. The money, grudgingly granted in the midst of scoffs and jeers and references to "animal magnetism," etc., has been frequently referred to as a munificent gift in the interest of Science and the diffusion of intelligence. Perhaps it was, but it may serve at once to illustrate the magnitude of the growth of the telegraph, and how greatly the government profited by its generosity, to say that quite recently, within a period of five years, the Western Union Telegraph Company alone paid to the Treasury in taxes \$850,000, and in gold duties, on imports of telegraphic wire, \$28,000 more. Thus the investment of that \$30,000 repaid itself in those two items alone, in those five years alone, and from one company alone, more than thirtyfold.

Going back to the forty miles of wire between Washington and Baltimore, which measured the whole dimensions of the

marvelous change and the vast and wonderful system that has brought it about is, as the decease of the builder of the pioneer line sharply reminds us, the growth of but thirty years.—*Public Ledger.*

A Wonderful Oil Well.

The Titusville (Pa.) *Herald* thus describes a wonderful oil well that has been opened recently in that vicinity.

The road leading to the Parker well from Petrolia is in moderately good condition; and soon after leaving Central Point, the traveler observes the words "no smoking permitted here" in conspicuous places. After about two and a half miles a ride, the top of a hill is reached, where a loud, roaring noise is distinctly heard, and eighty rods further on brings us in sight of the well. A dense fog or mist envelopes the derrick, engine house and tanks, while fully one thousand persons are there, gazing on the wonder of Armstrong county. The derrick has conspicuously placed upon it, in large letters, "Boss Well," and "Creswell City." There are two 250 barrel tanks full of oil; also two 1,200 barrel tanks, one of which is full. Three dams, one below the other, catch the dripping; and the rivulet beyond, we are told, for ten miles



BUILDING FOR THE GREAT EXPOSITION AT SANTIAGO, CHILI, 1875.

are offered free. The Exposition closes December 31, 1875. The condition and number of general premiums have not, as yet, been determined, but three liberal special prizes are to be awarded as follows:

First. One thousand dollars, in gold, for the best style of narrow gage railroad, not exceeding three feet, shown by fixed and rolling stock, including locomotive and tenders sufficient to accommodate and carry 6 to 100 tons up gradients of 1 in 50, with curves of 164 feet radius.

Second. One thousand dollars, in gold, for the best system of measuring and distributing water for purposes of irrigation, in specified or proportional quantities. The invention must be accompanied by the necessary apparatus to demonstrate its applicability to the requirements of Chili.

Third. Five hundred dollars, in gold, for the best exploring drill, adapted to mining operations of coal, iron, copper, silver, gold, etc.

The city of Santiago in Chili is situated in a most picturesque valley at the foot of the Andes, and is adorned with beautiful parks containing lakes, gardens, fountains, theaters, libraries, amusements of all kinds, observatories, etc. In one of these parks, the size of which is two square miles, the Exposition will be held. The structures include several buildings, the main one of which covers over 60,000 square feet of ground. It is over eighty feet in height, is constructed of stone, brick, and iron, and contains many spacious galleries. An efficient fire brigade will be constantly in attendance during the Exposition. The street railways which pass round the park have branches extending within the edifice in order to facilitate the conveyance of heavy machinery and other cumbersome goods.

Full particulars can be obtained of the Chilean consuls at New York, Baltimore, Washington, and Philadelphia. We give herewith an engraving of the main exposition building, which is of considerable architectural beauty.

The Builder of the First Telegraph.

A few days ago a telegraphic despatch from Maine announced the decease in that State of Mr. G. E. Smith, who constructed for Professor Morse the forty miles of magnetic telegraph from Washington city to Baltimore, which constituted the original of the vast system of telegraphs now extended throughout the world. That line was completed for use in the last week in May, 1844, the first news despatch having been sent over the wire on the 29th of May. The quite recent death of the constructor of that line naturally carries the mind backward over the thirty years of the exist-

magnetic telegraph this day thirty years ago, we are better able to appreciate the two hundred thousand miles of wire which form the immense network of the telegraph over the United States to day. Of these two hundred thousand miles of American wires, which would encircle the globe more than eight times, about one hundred and seventy thousand belong to one company. In June, 1844, there were two operators at work; in June, 1873, there were nine thousand nine hundred and thirty persons employed by one American company, and about twelve thousand by all the American companies. In this exhibit of the growth of thirty years, we limit the figures to the statistics of our own country, leaving the Old World out of view altogether.

In some other respects, the change wrought by the telegraph in less than the period of one generation is still more striking. It requires no strain upon the memories of even the junior partners of some of our old business houses and offices to recall the anxious times when they were more or less at the mercy of shrewd and active men who used carrier pigeons, relays of fast horses with their hardy express riders, semaphore signals from hill top to hill top and along the coast, and other similar expedients for getting advances of important events, with all the resulting disadvantages. In those days fluctuations in the prices of commodities in the great markets of the world were frequently secrets known only to a few, who sold their knowledge to another few, and thus a small knot of men in every commercial center were enabled to buy the property of their uninformed neighbors for far less than its value, or sell their own for far more than its value. Now all business men get their information simultaneously, and, if they wish it, they can get it from all the markets and money centres of the world. The merchant at our Commercial Exchange is in immediate communication with corn, cattle, cotton, produce, shipping, and commercial exchanges everywhere in our own country and abroad. The banker on Third street has his wire extending from his office to New York, Chicago, San Francisco, New Orleans, London, Paris, Frankfurt, Berlin, Amsterdam, Constantinople, Bombay, Calcutta, Rio Janeiro and Shanghai, and all cities and countries between. He sits there with instant knowledge of the financial, commercial, political, and other important current events of Europe, Asia, Africa, Australia, the East and West Indies, and South America, as well as of his own country. The telegraph, the Associated Press, and the newspapers within that organization concentrate this universal intelligence, and lay it before the whole public simultaneously at least twice every day; and all this

of a circuitous route to the Allegheny River, is covered with oil.

There are two 2 inch pipes connected with the well, one of which is shut completely off, and out of the other flows a steady stream of oil with immense force. There is no perceptible intermission in the flow; and as it gushes into one of the 1,200 barrel tanks, the foam and spray envelop the whole surrounding atmosphere in a dense mist.

"A trustworthy gager informed us that he had gaged the well three times since the stream was turned into the 1,200 barrel tank, and he found it doing 1,750 barrels, and he estimated the leakage to be at least 50 barrels per day. He further stated that in his opinion the well started off out of the two 2 inch pipes at the rate of 2,500 barrels per day. He also claimed that, although this was almost incredible, he believed that, if the full stream were turned on now, it would do at least 5,000 barrels.

"The well is claimed to be the largest ever struck in the lower region. A farmer walked up to us and offered to sell his adjoining farm of 100 acres for \$100,000, which ten days ago, for farming purposes, would not have brought \$1,000. The surveyors are at work laying out Creswell City.

"The Parker well stands two and one eighth miles due east of the most eastern well of the fourth sand development, and about two and three quarter miles east of Petrolia. The number of wells drilling on this belt, east of the most easterly well on the McGarvey farm, are six, namely: Two on the Snow farm; one on the Steel farm; the Gushford well, 1,000 feet deep; the Crawford well, 300 feet deep, and the Prentice well, 1,450 feet deep. The latter is half a mile due west of the Parker well, and is due next week."

The Reason Why.

It is always desirable that facts should be supported by a reason. The editor of Arthur's *Home Magazine* give the following questions and answers, which are pertinent to this season of the year:

Why is fruit most wholesome when eaten on an empty stomach?

Because it contains a large amount of fixed air, which requires great power to disengage and expel it before it begins to digest.

Why is boiled or roast fruit more wholesome than raw?

Because, in the process of boiling or roasting, fruit parts with its fixed air, and is thus rendered easier of digestion.

Why are cherries recommended in cases of scurvy, putrid fever, and similar diseases?

On account of their cooling and antiseptic properties, and because they correct the condition of the blood and other fluids of the body when there is any tendency to putrescence; at the same time, like all fresh fruits, they possess a mild aperient property, very beneficial to persons of a bilious habit.

What effect have vegetable acids upon the blood?

They cool and dilute the blood, and generally refresh the system. All fruits contain acids and salts, which exercise a cooling and invigorating influence. Apricots, peaches, apples, pears, gooseberries, and currants contain malic acid. Lemons, raspberries, grapes, and pine-apples contain citric acid. The skins of grapes, plums, sloes, etc., contain tannic acid, which has a bitter taste.

Why should salt be applied to vegetables intended for pickling, previously to putting them in the vinegar?

Because all vegetables abound in watery juices, which, if mixed with the vinegar, would dilute it so much as to destroy its preservative property. Salt absorbs a portion of this water, and indirectly contributes to the strength of the vinegar.

Why is bread made from wheat flour more strengthening than that made from barley or oats?

Because, as gluten, albumen and caseine are the only substances in the bread capable of forming blood, and consequently of sustaining the strength and vigor of the body, they have been appropriately called the food of nutrition, as a distinction from those which merely support respiration. Wheat contains eight hundred and twenty-five parts of starch, three hundred and fifteen of gluten, albumen, and caseine, and sixty of sugar and gum; while barley contains twelve hundred of starch, one hundred and twenty of gluten, albumen and caseine, and one hundred and sixty of sugar and gum; hence wheat is much richer than barley in the food of nutrition.

The Discovery of Oxygen—Celebration of the One Hundredth Anniversary.

There was a large gathering of American scientists at Northumberland, Pa., on July 31, to celebrate the one hundredth anniversary of the discovery of oxygen by Joseph Priestley. The proceedings commenced in the main hall of the village academy with an address of welcome by Colonel Taggart, of Northumberland. Professor Charles F. Chandler, of Columbia College, New York, was called to the chair, and Professor A. R. Leeds, of the Stevens Institute, Hoboken, N. J., was appointed secretary; telegrams were exchanged with Birmingham, England, where a statue of Priestley was at the time being unveiled by Professor Huxley, and Professor H. H. Croft introduced the business of the day by reading a paper on "The Life and Labors of Joseph Priestley," in which he rapidly but clearly traced Priestley's great life and works. His fondness for chemical dabbling was pursued, like all his work, on a plan of his own, regardless of the schools; his wonderful discoveries, embracing at least two thirds of the now known gases, showed conclusively the compound structure of the air. He traced also the theological wars in which Priestley's controversial propensity kept him constantly engaged. Like Ishmael, his hand was against every man, and every man's hand was against him; and, though his powerful intellect vanquished one enemy after another, and the volumes hurled against his foes numbered more than a hundred, new opponents constantly arose. The Church banned him, society thrust him out, until at the age of sixty-one, feeble, worn out, his house burned from over his head, his books and papers destroyed by howling mobs, injustice and opprobrium heaped upon him, he fled to America, where he met a joyous welcome, which must have sounded passing strange to his ears, accustomed to years of constant strife. Some of his family having settled at the Forks of the Susquehanna, he followed them here, and found a land of peace and restfulness. The third and fourth generations of the great chemist's descendants still reside in the town.

Professor J. Lawrence Smith, of Louisville, Ky., offered and had adopted the following resolution:

Resolved, That a committee be appointed to confer with the committee of the Centennial Exhibition, to correspond with the chemists and professors of cognate sciences in Europe, in order to induce a large representation of them to visit this country in 1876.

Professor T. Sterry Hunt, of Boston, read a paper on "The Century's Progress in Theoretical Chemistry." The lecturer traced the progress of the art from its earliest stages, and defined Stahl's phlogistic hypothesis, in which Priestley placed such unwavering faith. The three great chemists of the century just expired were Scheele, Priestley, and Lavoisier. Of these the two first were great experimenters, but failed to interpret their discoveries properly. Priestley, though the founder of a new school himself, adhered firmly to the old philosophy, and died the last defender of phlogiston. Lavoisier seized, with a marvelous comprehension, the true significance of the facts made known by his contemporaries, greatly enlarged the field by his own researches, and like another Newton, showed the great harmonies which govern all the changes of matter in the mineral, animal, and vegetable kingdoms. Lavoisier justified by the aid of the balance the old doctrine of Hermes, that in the changes of matter nothing is lost and nothing is gained. With Wenzel, he made chemistry a quantitative science, and the great laws of definite and multiple proportion made known by Dalton showed that all things were ordered by weight, by number, and by measure.

A second session was held in the evening of the day, at which Professor Joseph Henry was to have presided; but being prevented by ill health, Dr. Henry Copple, President of the Lehigh University, filled the chair, and delivered in

the open air an eloquent and glowing tribute to the chemist in whose honor the gathering was held. In the lecture hall, Dr. J. Lawrence Smith reviewed the whole progress of chemical science during the past 100 years.

On the following day, August 1, Professor Silliman read an essay on American contributions to chemistry; and various other papers on the history of the subject were given, and many interesting letters and other relics of Priestley were exhibited.

Another New Comet.

Now that Coggia has passed for ever from our view, it is gratifying to know that a new comet has just made its appearance. It was discovered at Marseilles, France, July 26, and first observed in this country by Professor Swift, Rochester, N. Y., July 30. He says: "It is quite large and bright for a telescopic comet, and has a strong central condensation, but, as far as I could judge by observation, both in the solar and lunar twilight, it has no nucleus or tail. It is in the fourth coil of *Draco*, and moves at the rate of about one degree a day."

IMPORTANCE OF ADVERTISING.

The value of advertising is so well understood by old established business firms that a hint to them is unnecessary; but to persons establishing a new business, or having for sale a new article, or wishing to sell a patent, or find a manufacturer to work it: upon such a class, we would impress the importance of advertising. The next thing to be considered is the medium through which to do it.

In this matter, discretion is to be used at first; but experience will soon determine that papers or magazines having the largest circulation, among the class of persons most likely to be interested in the article for sale, will be the cheapest, and bring the quickest returns. To the manufacturer of all kinds of machinery, and to the vendors of any new article in the mechanical line, we believe there is no other source from which the advertiser can get as speedy returns as through the advertising columns of the SCIENTIFIC AMERICAN.

We do not make these suggestions merely to increase our advertising patronage, but to direct persons how to increase their own business.

The SCIENTIFIC AMERICAN has a circulation of more than 42,000 copies per week, which is probably greater than the combined circulation of all the other papers of its kind published in the world.

DECISIONS OF THE COURTS.

United States Circuit Court—Eastern District of Pennsylvania.

PATENT FIRE EXTINGUISHER.—THE NORTHWESTERN FIRE EXTINGUISHER COMPANY, ET AL. vs. THE PHILADELPHIA FIRE EXTINGUISHER COMPANY. [In equity.—Before Judge McKennan.—Decided April, 1874.]

Suit brought on letters patent relating to Dawson Miles, administrator of P. F. Carlier, deceased, and Alphonse A. C. Vignon, No. 4,994, dated July 16, 1872 (original patent No. 83,344, dated April 13, 1869), for improvement in extinguishing fires.

The claims of the patented patent are as follows:

1. The improvement in the art of extinguishing fires, hereinbefore described, by throwing upon the fire or conflagration a properly directed stream of mingled carbonic acid gas and water by means of the pressure or expansive force exerted by the mass of mingled gas and water from which the stream is directed.

2. We claim a strong vessel provided with a proper plug or lid, by which an orifice in it can be closed, and a stopcock, through which its contents can be ejected, and a flexible tubing or hose for directing the stream as ejected at the will of the operator, these parts being substantially such as described, and capable of operating as specified.

3. We claim a strong vessel provided with a proper plug or lid for closing an orifice in it, and also with a stopcock, in combination with another vessel or tube, the combination being substantially such as specified, and the construction being substantially such as described, so that the vessels may keep separately the ingredients for making carbonic acid gas, and that when their contents are mingled they may be discharged in a stream of carbonic acid gas and water.

4. We claim, in combination with the vessel's lid or plug and stopcock combined, and capable of operating as in the above third claim, a hose and nozzle, so applied, as described, that the mingled stream of carbonic acid gas and water may be suitably directed, as hereinbefore set forth.

5. As we claim a strong vessel provided with a lid or plug and a stopcock, in combination with a vessel or tube arranged in the interior thereof, the arrangement being substantially as described.

6. We claim a strong vessel provided with a lid or plug and a stopcock, in combination with a vessel or tube arranged in the interior thereof, and a rod passing through the wall of the outer vessel, and capable of operating substantially as described.

7. We claim a strong vessel provided with a lid or plug and a stopcock, in combination with the vessel or tube arranged in the interior thereof, and a rod and cock or valve, the whole being and operating substantially as described.

8. We claim the elements or parts of a whole apparatus specified in the fifth claim, and arranged as therein specified, in combination with a flexible hose and nozzle, and with handles or loops, whereby the apparatus may be supported and the stream directed, substantially as specified.

9. We claim, in combination, a strong vessel, a lid or plug for closing the same, a stopcock near the bottom of the vessel, a hose and nozzle, and handles or loops, whereby a volume of water charged with carbonic acid gas may be confined and transported, and a stream thereof directed, in the manner and for the purposes described.

10. The keeping of the acid and alkali or alkaline solution in separate and distinct vessels, but in such proximity to each other that they may be immediately brought into contact when the apparatus is required for use, one mode of accomplishing which we have above set forth.

11. A closed receptacle, made of suitable material, containing one of the gas-generating ingredients, placed within the main reservoir containing the other gas-generating ingredient, to be discharged of its contents in the manner herein set forth, or by other equivalent means.

This bill is founded upon a reference patent to Dawson Miles, administrator of the estate of Philippe F. Carlier, deceased, and Alphonse A. C. Vignon, as joint inventors of an "improvement in extinguishing fires." They are described as residents of the city of Paris, and subjects of the Emperor of France at the time of the invention. The answer denies that there was any person named Philippe F. Carlier, and avers that François Philippe Carlier was the name of Vignon's associate in the alleged invention; and for this misnomer it is urged that the patent is void.

Assuming, then, that the Christian name of Carlier was François P., he is demonstrated to be the same as Philippe F., by conclusive proof of his connection with the subject of the patent, and of the impossible capability of the additional description to any other than Vignon's associate. There is, therefore, no doubt of the personal identity of the patentee, and the most that can be said is that, by a transposition of his double Christian name, he is not thereby accurately designated. But this will not void the patent, where it supplies upon its face an added description, by which the patentee may be certainly identified. The patent must, therefore, be treated as valid.

The main inquiry in the cause relates to the novelty of the invention claimed by Carlier and Vignon. I have no doubt they were original inventors; but were they the first?

The earliest date to which their invention is carried back is June, 1862. Although there is no evidence in the cause fixing this date, yet, from what incidentally appears and for the purpose of determining the priority of their invention, it may fairly be taken as the time when invention was completed.

What, then, did they claim to have invented? This is very clearly described in the reference patent in controversy.

"It consists," says the specification, "first, in the process or method of extinguishing fires by means of a jet or stream of mingled water and carbonic acid gas ejected from a closed vessel in a suitable direction by means of the pressure or expansive force of the mixture contained in the vessel; and, secondly, in the construction of apparatus for containing and delivering this extinguishing medium, which apparatus may be made of an exceedingly portable nature, and kept always charged and ready for use at a moment's notice at the particular locality which it is desired to protect."

To show that the invention thus claimed is not novel, the defendants have exhibited in evidence a rejected application of Dr. William A. Graham.

It appears that on the 23d of November, 1867, Dr. Graham applied for a patent for a method of extinguishing fire, by projecting upon it a stream of mingled carbonic acid gas and water, and filed a specification, in which he fully described the mechanical devices to be used in effectuating this method, and the process of operating them. On the 25th of November, 1867, his application was rejected, for reasons stated by the Examiner, which now seem strange enough. This decision was reaffirmed on the 16th of December following. On the 26th of December, 1867, an amended specification was filed, and thus the case stood until December, 1869, when a model and drawing and a third specification were filed, and the application

was renewed and finally rejected. These several specifications and the drawings are all in evidence in the cause, and it is urged that they, of themselves, are effective proof of prior invention by Graham.

But it does not follow that a rejected specification and drawings are, under all circumstances, inadmissible as evidence. By themselves they are inconsequential, but when the inventor's idea is perfected by a practical adaptation of it, in the form of mechanism, they are valuable as guides in ascertaining the date of the invention, the design of the inventor, and the principle, intended functions, and mode of operation of his mechanism, and they must, therefore, necessarily be considered in connection with it.

So, in the present case, Dr. Graham embodied what he supposed he had discovered in a practical form: for the proof establish beyond question that as early, at least, as 1863 he constructed apparatus which he then exhibited.

As early, at least, as 1861, a model and drawings of the apparatus described in the specification were filed by Dr. Graham in the Patent Office. With the aid of all these there certainly could be no difficulty in constructing the necessary apparatus for the practical application of the invention. Indeed such apparatus was constructed by Dr. Graham as early as 1863, and it was produced at the hearing, with the immaterial substitution of a piece of new hose for the old piece originally attached to it, its identity having been indisputably established.

It appears that, in 1862 or 1863, Dr. Graham made a trial of his apparatus near Lexington, Va., in the presence of a large number of witnesses, by setting fire to a large pile of straw, and then throwing upon it a stream of mingled water and carbonic acid gas projected from his extinguisher by the expansive force of the gas. That this trial was successful is apparent from the fact that the progress of combustion was promptly arrested, and the failure to extinguish the fire entirely was manifestly due solely to the insufficient capacity of the extinguisher, as compared with the magnitude of the ignited material. The incompatibility of carbonic acid gas with fire needed no proof, because it was an indisputable fact; the problem to be demonstrated was the practicability of the proposed method of discharging and directing carbonic acid gas in combination with water upon an ignited mass, whereby the well known properties of both these substances could be made usefully available. So far as this result was concerned the trial made must be considered as having proved the utility and efficiency of the invention.

But equally if not more satisfactory proof on this point was furnished at the hearing of this case. The same appliances, used by Dr. Graham on the occasion referred to, had been made exhibit in the case, were produced in court, and were subjected again to the test of trial. They consisted of a metallic fountain, or closed vessel, charged with carbonic acid gas and water, to which was attached leather hose ending in a bunch of nozzles, and a single nozzle. When the stopcock opening into the hose was turned, a stream of mingled gas and water at once issued from the nozzle, and, by means of the expansive force of the contents of the vessel, was projected to a distance exceeding that stated by Dr. Graham in his specifications, until the vessel was emptied.

Against the pressure of all these proofs I cannot resist the conclusion that Dr. Graham devised an original method of extinguishing fires by the combined agency of carbonic acid gas and water, and that he "perfected and adapted" his invention by embodying it in the form of mechanical appliances capable of operative and successful use.

It was urged, however, that the efforts of Dr. Graham are to be treated as abandoned experiments. An experiment may be a trial, either of an incomplete mechanical structure, to ascertain what changes or additions may be necessary to make it accomplish the design of its projector, or of a completed machine to illustrate or test its efficiency. Obviously, in the first case, the incompleteness of the inventor's efforts, if they were then abandoned, would have no effect upon the rights of a subsequent inventor.

But if the experiment proves the capacity of the machine to effect what its inventor proposed, the law assigns to him the merit of having produced a complete invention.

It is heretofore shown that the theory of Dr. Graham attained this practical condition, and there, apparently, his efforts ceased. But why? Repelled from the Patent Office by the arbitrary assumption that his enterprise was impracticable with the employment of any mechanical auxiliaries whatever, without pecuniary resources, his "poverty, not his will, consented" to an abandonment of further effort to secure the full benefit of his invention to himself and to the public. But this will not help the complainants. The most that can be predicated of his inaction is that he abandoned his invention to the public, although I do not believe that hypothesis. But if he did, it will not reduce his matured invention to the grade of a mere experiment, and open the way to the complainants to appropriate the title of first inventor.

From what has been already said, the first claim of the patent cannot be sustained. Graham was prior to Carlier and Vignon in devising the "improvement in the art of extinguishing fires" embraced in this claim, and the merit of novelty cannot, therefore, be accorded to the latter.

The other claims are for mechanical combinations. The ninth is for a combination of a strong vessel, a lid or plug, a stopcock near the bottom of the vessel, a hose and nozzle, and handles or loops, "whereby a volume of water charged with carbonic acid gas may be transported and a stream thereby directed, in the manner and for the purposes described."

The tenth is for "the keeping of the acid and alkali or alkaline solution in separate and distinct vessels, but in such proximity to each other that they may be immediately brought into contact when the apparatus is required for use."

All these claims, except the last, are for combinations of devices, none of which devices are alleged to be new, and while the efficiency of all of them is necessary to effectuate the ulterior design of the patentees, they are subdivided into groups and claimed as several inventions. Indeed the specification is a notable example of ingenious multiplication of claims, so as, it must be presumed, to embrace and protect the invention in every possible aspect of it.

It is not to be doubted, however, that a valid combination may consist of old elements, which have not been before similarly arranged, or, if they have, that a novel result is produced by their conjunction. Either the instrumentalities employed or the effect caused by their operation must be new to constitute a patentable combination. If substantially the same devices have been used before for a like purpose, or if they are applied merely to effectuate a method known and practiced before, such employment of them will not be protected by a patent.

Were these elements, then, similarly combined before and used for an analogous purpose? I am convinced that an inspection and analysis of some of the defendants' exhibit, and especially of Nichols' "nozzle," would lead to a negative answer to this question. The devices which compose the combinations claimed in the complainants' patent are substantially embodied in Nichols' apparatus, and it is in they are arranged and operated in substantially the same way as in the complainants.

The object of Nichols was to construct apparatus in which acid and an alkali could be kept in separate vessels, but in such proximity to each other that they could, at the will of the operator, be brought into immediate contact; carbonic acid gas thereby generated and a body of water contained in an enclosing vessel impregnated with it, and that the acidulous water could be discharged through a suitable opening by the elastic pressure of the gas and used as a beverage.

And, as essential elements of his apparatus are a strong metallic vessel of portable dimensions, to be filled with water, with an opening in its top; a plug to be screwed into this opening; another vessel enclosed within the strong one to contain diluted acid, and connected with it by an exterior pipe which extends into and to the bottom of it; a tube or smaller vessel, for holding an alkali within the acid chamber, which is provided with a tight-fitting lid attached to a rod extending up through the top of the vessel, by which the bottom can be opened and closed at pleasure; and a stopcock to permit and direct the discharge of the contents of the strong vessel in a mingled stream of carbonic acid gas and water. To operate this apparatus the strong metallic vessel is nearly filled with water through the opening in its top, the alkali chamber is taken out of its place within the acid chamber, into which latter is poured a quantity of diluted acid, an alkaline substance is put into the alkali chamber, against the bottom of which its metal covering is tightly drawn by means of the rod attached to it, and it is then replaced and tightly screwed into the acid chamber. By a revolution and slight pressure of the rod, the bottom of the alkali chamber is brought into contact with the acid in the chamber below. Carbonic acid gas is at once generated and is conducted through the pipe provided for that purpose to the bottom of the water vessel, where it is intermixed with the water and from which it is driven, as desired, through the discharge pipe by the expansive force of the gas.

It is plain to my mind that it is not necessary to add a hose and nozzle to the discharging stopcock in the Nichols fountain to make it as effective a fire extinguisher as the complainants'. The obvious addition of so simple an element to the devices which coexisted in the old machine and perform all the fundamental functions of the subsequent one, cannot constitute the combination of a new and patentable one.

But it is urged that the prior construction of structures of this class cannot affect the question of novelty here, because they were not applied to the extinguishment of fires, and their use and that of a fire extinguisher are entirely diverse. It must be observed that there is a marked analogy in the means employed and the result produced by both machines up to the divergent application. The action of both is the prompt generation of carbonic acid gas and the impregnation of water with it, and the same projectile force is employed to expel the acidulous water from the vessel containing it. In the one case, a stream of this water is directed into a vessel, where it may be used as a beverage, and, in the other, it is directed upon a mass of ignited matter. This difference, then, in the ultimate application of the same agencies, marks the line of distinction between them.

Now, the art of extinguishing fires by means of carbonic acid gas and water intermingled was not new, for it had previously been practiced by Graham; and the real question, therefore, is: Does the application of old mechanical devices, without material change, to a use in which they were not employed before, but which was known and had been practiced, constitute a patentable invention? A decisive answer to this question is furnished by Mr. Justice Story, in *Bean vs. Smallwood* (2 Story, 408), where he thus states the law:

"Now, I take it to be clear that a machine, or apparatus, or other mechanical contrivance, in order to give the party a patent therefor, must in itself be substantially new. It is old and well known, and applicable only to a new purpose, that does not make it patentable."

And, in *Curtis on Patents* (3d ed., sec. 56), the result of the authorities is thus accurately stated:

"Of course, if any new contrivances, combinations, or arrangements are made use of, although the principal agents are well known, these contrivances, combinations, or arrangements may constitute a new principle, and the application or practice will necessarily be new also. But where there is no novelty in the preparation or arrangement of the agent employed, and the novelty professionally consists in the application of that agent, being a well known thing, or, in other terms, where the contrivance in the practice only, the novelty of that practice is to be determined, according to the circumstances, by applying the test of whether the result or effect produced is a new effect or result not produced before."

It is apparent, therefore, that where an effect or result has been before produced, the mechanical agencies by which it is reproduced, if they are not themselves new, are not the subject of a patent.

This rule is decisively applicable to the present case, both as to the result achieved and the means employed to effectuate it; and the claims for both being thus invalid for want of novelty, the bill must be dismissed with costs.

[Edmund Burke and Keller & Blake, for complainants; Chas. B. Collier and D. L. Collier, for defendants.]

Recent American and Foreign Patents.

Improved Railway Rail Joint.

Bartholomew C. Crowley and John D. Kelley, Renovo, Pa.—The chair plates, clips, and fish plates, are made of wrought metal, in one piece, the plates being long enough for extending across two ties and resting at the ends on them, while the clips are of the usual length, and located at the middle, where the rails meet in them, thus combining the chair and fish plates. The knee-shaped guard chairs, of cast metal, are bolted up to the fish plate on one side by one of the bolts used for fastening them, and also bolted or spiked to the tie. The end bearing against the fish plate, and also the shoulders bearing against the flange of the rail and edges of the chair, are rounded, to allow the chair to be closely bound to the several parts, and at the same time allowed to move forward and back, as the rail expands and contracts, without cramping unduly.

Improved Steam Pump.

William Atkinson, Gardner, Ill.—This invention relates to means whereby greater simplicity, less liability to stoppage, and greater economy in the operation of pumps, may be secured. This is considered by experts to be a very noticeable improvement.

Improved Lint Cotton Opener, Cleaner, and Straightener.

James B. Wendel, Memphis, Tenn.—This invention relates to and consists in means whereby lint cotton may be opened, cleaned, and straightened by a single continuous operation.

Improved Gas Machine.

Robert L. Cohen, Philadelphia, Pa.—This invention relates particularly to the construction of the blower or device for forcing air through the carbureting liquid, whereby such uniformity of pressure is produced as ensures a steady, unwavering flame, in place of a flickering one, as in most other machines.

Improved Leather Glazing Machine.

Wright Walter, Yonkers, N. Y.—This invention consists of a rotary wheel, carrying the agate glazing rolls on its face, to revolve against the morocco, leather, or other substance to be dressed, lying below the wheel on a spring bed or platform. The glazing rolls are mounted on a spring band of metal at the middle of the spaces between the arms of the wheel on which the band is stretched. Under each roll is an adjustable spring bearer, to regulate the pressure of the glazing roll on the leather. These bearers are adjusted a little short of the band, so that when the rolls first strike the leather on the table the band will yield more readily, and thus not deliver blows as heavy as if directly supported by the beams. The beams are also provided with adjusting screws by which to cause the agates to bear evenly on the leather throughout the whole length.

Improved Gate Hinge.

William S. Whitting, Jr., of Seymour, assignor to Frederick L. Allen and William H. Richardson, Waterbury, Conn.—By this improved gate hinge, the gate may be readily swung to either side without difficulty, and closed or shut by its own weight. The invention consists of a supporting bracket fastened to the gate post, and provided with curved V or wing-shaped slot for guiding the pintle of the bracket plate of the gate, and preventing the gate from getting out of place. The pintle plate swings by side recesses around fixed pins of the supporting plate. When the gate is in closed position, the pintle is in the vertex of the slot, and both recesses are in contact with the guide pins. By swinging the gate to either side, the side recesses and pintle swing around the corresponding and slotted part until the extreme limit of motion is obtained.

Improvement in Laying Cement Pipes.

Jacob Loewler, New York city.—By this invention, a continuous and solid pipe may be constructed directly on the ground, dispensing with special pieces of production, loss of breakage by shipment, and other difficulties. The invention consists of a molding flask, constructed of detachable exterior sections, suitably supported on the ground, and eccentrically adjustable core sections, which are flanged in such a manner that an overlapping joint of the pipe sections is produced as they are formed consecutively, one after the other. The core sections are withdrawn from the finished pipe sections, by contracting them, by means of a central shaft and cam eccentrics.

Improved Ventilator Cap.

Gerald Kavanagh, New York city.—This invention relates to the construction of caps for ventilator pipes or flues, and consists of pyramidal shaped and overhanging sections connected with the top of the flue, combined with a central section consisting of two pyramids, the bases of which are connected, the sections being supported by means of straps or stays. It is claimed that this cap will allow a current of heated impure air to escape, while admitting a current of cold fresh air to enter.

Improved Self-Adjusting Dam for Dental Use.

Jacob L. Chevalier, Newark, N. J.—The frame of the device is formed of wire bent into a coil, and with its ends bent outward. To the ends are attached U-shaped frames of such a length as to embrace two or three teeth. The inner arm of the upper frame is made the shorter, on account of the curvature of the roof of the mouth. The outer arm of the upper frame is made with an extension bow, that it may be extended or contracted. The arms of the frame are covered with rubber bags, stuffed, to form pads, which stuffing may be readily adjusted. To the inner arm of the lower frame of the side dams is attached a rubber flap to rest upon and prevent the tongue from coming in contact with the tooth being operated upon. Five of the dams constitute a set—two for each side, and one for the front.

Improved Washing Machine.

John Contrell, New York city.—In a box of rectangular form are placed on edge three movable ribbed plates, to which is given a horizontal longitudinal motion. The clothes to be washed are placed between the reciprocating plates. The proper quantity of water being in the machine, the clothes will be forced between the ribs of the plates, and, being thus held, will receive an alternate back and forward motion nearly identical with hand motion. The reciprocating ribbed plates are connected at their ends by perforated flexible diaphragms, to prevent the clothes from getting between the box and the ends of the plates. Tubes are attached to sections, arranged near the bottom of the machine, which extend to a steam generator, by means of which a circulation of water is maintained.

Improved Iron Truss Bridge.

Edward Hemberle, Chicago, Ill.—The top chord of a bridge truss is made of π -shaped rolled beams, jointed together at the ends and straight in the middle of the truss, from a point one and a half panel lengths from the end of the truss; from this point to the end, the chord is bent in a circular arc down to the shoe. The arc is held in shape by two or more tie rods entering at the bottom chord pin, to distribute and transmit the load from the point to the arc. The top chord is spliced and connected over the pin by a wrought iron plate, bent in double angle form to fit the web of the beams, bolted on the ends of the two beams so that its flanges project outward to receive the pin, for connection of the tie rods and struts of the truss. This plate is bolted to the under side of the chords by two short bolts, making a temporary connection to the top chord. On top of the chords, at the joint of the sections, there is a cast block, fitting into the trough of the π -beam, which is bolted down, by two bolts, passing through the block to the web of the beam and the wrought iron connecting piece. The block has lugs cast on the top, in which the top lateral ties are secured.

Improved Earth Auger.

William Sandlin, Minden, La.—This invention consists of a spirally flanged auger of the usual construction, provided with a pivoted and exchangeable bit for producing wells of different diameters, and connected with a cylindrical sand box, having band springs applied at the outer side for retaining the box stationary in the well. Small rollers at the upper curved ends of the band springs are carried through slots of the box between two disk-shaped collars of the auger shaft, on which the collars turn, while also raising and lowering the box with the auger. The ends of the band springs are attached by ropes or chains to the auger shaft to prevent the escaping on projecting parts of the well during the raising of the auger and sand box.

Improved Glass Melting Pot.

Robert Richardson, Brooklyn, N. Y.—The pot is made with a cover about the same as the ordinary covered pots, but with two or more large openings at the junction of the cover with the sides of the pot, and with raised portions of the cover projecting over said openings, so as to prevent the falling of any matters from the top of the furnace and the flue into the pot. A small opening is made through the top of the wall surrounding the mouth of the pot, to permit of the escape back into the furnace of any portion of the heat currents that may, in consequence of draft through openings, tend to come out at the opening in the furnace wall through which the glass is taken from the pot.

Improved Medical Compound.

Benjamin F. Ulmer, Savannah, Ga.—This invention consists of a composition composed of ground dandelion, ground butterbur bark, ground senna, ground serpentaria, ground star aniseed, ground fennel seed, and ground coriander seed, mixed together and moistened with pure glycerin, water, cologne spirits, and sirup prepared from the domestic black root of the Southern States. The remedy is administered as a liver corrector or vegetable aperient, and is found useful in all bilious complaints.

Improved Tyre Tightener.

Abraham Hollingsworth, Alba, Mo.—This invention is an improvement in the class of tyre tighteners in which a wedge is employed to draw the two ends of the tyre together. The improvement relates, first, to providing both ends of the tyre with lengthwise slots and the felly with radial slots, one to receive the wedge and the other to permit adjustment of a screw clamping bolt; second, to a U-shaped bar or staple applied to the slotted end of the felly, to operate in conjunction with the tightening wedge.

Improved Manufacture of Enamelled Dial and other Plates.

Joseph H. Robinson, Liverpool, England.—The foundation of the dial is made of thin sheet iron, which is stamped out by means of a press and suitable dies, with the edges turned up all round, so as to form a kind of shallow tray to hold the enamel on the face of the plate. The necessary holes are punched at the same time. The plate, having been made chemically clean, receives an enamel composed of white lead, arsenic, flint glass, salt-peter, borax, and ground flint. These substances, having been all reduced to powder, are mixed together, melted in a crucible, and run into cakes, which are afterwards pulverized. A sufficient quantity of the dry pulverized enamel is sprinkled on the face of the plate, which is then placed in a muffle. When the enamel is fused, the plate is withdrawn from the muffle and allowed to cool; and when cold, it will have a hard, white, glazed surface, and is then ready for receiving the lettering and figuring.

Improved Vehicle Seat.

James A. Curtis, Greencastle, Ind., assignor to himself, Robert Rentek, and Gasper Rentek, same place.—This invention consists of a sliding back seat on ways on the top of the buggy body, with spring clamping levers to fasten it at any point. The levers extend from each side to the middle of the seat, where a locking bolt is contrived for binding them against the ways by turning it so as to cause a cam to press down on the levers. The front or jump seat is provided with short swiveled legs connected with longer legs of the same, so that, when the seat is thrown forward, the shorter legs will be detached from their sockets and turned on their pivots to adapt them to support the seat in its changed position.

Improved Pocket Book.

Alexander M. Le Vins, New York city.—This invention relates to an improvement in pocket books, by which they may be manufactured without stitching, in a neater or more durable manner; and it consists in the connection of the partitions, which are made of a continuous blank, with sector-shaped extension side flaps or tongues, arranged symmetrically at each section thereof, with the outer side flaps or gussets. The main advantage of a pocket book constructed in this manner consists in the extension of the partitions across the full width of the same, and its exposure to wear and tear at the outer edges of the partition, being the points of greatest resistance, while the sections of the side flaps or gussets are folded or cramped to the inside, and thereby fully protected.

Improved Rotary Engine.

Edward Myers, New York city.—The cylinder is provided with heads in the ordinary manner, and with a central partition. The shaft passes through the centers of the three heads. In the inner sides of the two outer heads, and in the opposite sides of the central head, are formed circular cavities, concentric with respect to each other, eccentric with respect to the heads, and tangent to the inner surface of the cylinder between the ports. Hollow drums are made to fit into the cavities and abut against the heads. In the ring ends of the drums, close to the circumference of said ends, and extended longitudinally through said shell, are formed round holes, in which are placed cylinders which are slotted longitudinally to receive the shafts of the pistons, which receive the shaft and carry the same with them in their revolution. The outer end of the pistons is made with flanges upon its opposite sides, fitting into a recess in the face of the drums, and its outer surface is curved to correspond with the inner surface of the cylinder. The steam chest has two branch ports leading into the cylinder upon the opposite sides of the central head. As the steam is admitted through one of the ports, it forces the piston around the inner surface of the cylinder, the steam in front of said piston all the time exhausting through the other port. The movement of the piston will rotate the shaft and drum about their separate axes. The eccentricity of the drum and shaft with respect to each other, and the location of the ports with respect to said axes, gives space for the steam as it expands. To avoid this useless weight, the head of the piston may be made separate from its stem, and secured to it by screws, so that the head may be detached and the stem inserted and withdrawn through the interior of the drum; or a portion of one end of the drum, around the hole for the slotted cylinder, may be cut out and replaced by a piece secured by screws, so as to be readily detached and replaced. This allows the piston and cylinder to be removed together from the drum, the piston stem passing out edgewise.

Improved Plow.

Moses F. White, Douglassville, Texas.—This invention relates to turn plows, and consists in several features of improvement, by which the preparation and tillage of the soil may be done at less than the usual expense, and with more than the usual convenience to the farmer. By this invention, the cutter may be easily changed in depth or inclination and securely held at any point of adjustment.

Improved Plow.

Moses F. White, Douglassville, Texas.—The object of this invention is to provide an improved plow for cultivating cotton or other crops which are grown in rows or drills of the requisite distance apart. The improvement consists in the arrangement of a plate or share with an adjustable bar which forms what is commonly designated the point, and a grooved standard having lateral flanges having a broad flat foot to which the share is attached.

Improved Windmill.

John A. Jelley and Josiah N. B. Farris, Atalissa, Iowa.—This invention relates to that class of windmills which automatically adjust themselves to the wind. It consists of a set of vanes journaled upon a revolving plate, to which is pivoted a large main tail having a smaller supplemental tail at or nearly at right angles to it. When the wind blows too hard, it forces around the smaller tail, which, by means of a projecting arm, changes the direction of the main tail, and causes the revolving plate to turn and present the vanes more obliquely to the wind, thereby correspondingly reducing their velocity. Said tails are also controlled in their position by means of separate independent gearings of ropes, which are fastened to the same and pass around sheaves, contained within arms attached to the revolving plate, and are fastened within reach of the workmen below.

Improved Screw and Pivot Chair.

William T. Doremus, New York city.—The chair seat rests upon the rubber springs, which are seated on a cross bar and bolted thereto. In the center of the cross bar is formed a long socket, in which fits a screw which passes through a plate and into the pedestal. By suitable construction this screw is securely connected with the base, so that it will be firmly held. This construction also enables the pedestal to be made low, to better adapt the chair for being upholstered; and also enables it to be made lighter than is possible when the screw is attached to said base.

Improved Corn Planter.

John Claridge, Mount Sterling, O.—To the free end of a lever which governs the dropping valve, and to the projecting side of the distributor, are pivoted the rear ends of two rods, the forward ends of which are attached to a slide. By suitable construction, as the slide moves forward the distributor is operated to drop the seed into the cavity of a standard, and the valve is closed to receive the seed. As the slide moves to the rearward, the distributor is turned to receive seed for another hill, and the valve is opened to drop the seed previously removed to the ground. The slide moves forward and back between four friction rollers pivoted to a plate attached to the front cross bar of the frame. To the end parts of the plate are attached two blocks as thick as the slide for the cross slide to work upon. The cross slide is held down upon the blocks by keepers. In the lower side of the cross slide is formed a cam groove to receive a pin attached to the slide, so that the latter may be moved back and forth longitudinally by the transverse movement of the cross slide.

Improved Cooking Stove.

James R. Williamson and John L. Williams, Jessup, Ga.—The stove is divided, by vertical partition plates, into compartments, of which the outer ones are arranged as fireplaces, with grates, ash boxes, front dampers, and doors constructed in the usual manner. The inner compartments are divided into the lower and upper sections, the lower sections being used as ovens, and provided with a door, hinged so as to swing in horizontal position, to be supported therein by chains of sufficient strength to support the bake pans thereon. The upper sections connect recesses of the partition plates with the fireplaces, and draw the flames through the same. The upper sections are cleaned from soot by a front opening and door above the door of the ovens. A chamber extends below the ovens, connecting by slotted apertures with the fireplaces and with the chimney. Pivoted dampers serve to open or close apertures, and admit thereby the fire to heat the ovens or exclude the same, as desired. The chamber may easily be cleaned by taking off the door. The rear wall is provided with draft openings near the top plate, which are opened or closed by dampers, so that cooking may be carried on in all the pots and ovens, or in any part thereof.

Improved Can for Cooling Milk During Transportation.

George W. Fluke, Mount Pleasant, Iowa.—The object of this improvement in cans for cooling milk during transportation is to utilize the cooling capacity of the ice or water which was allowed to run off in the milk can as in the improvements patented by same inventor under dates of March 3 and May 19, 1874. The present invention consists of an ice water receptacle, placed circumferentially around the milk can, and below and in connection with the bottom of the ice chamber or receptacle at the side of the can, for conducting the ice water around the lower part of the can, and discharge by an exit perforation at the upper part and near the end or partition of the water chamber.

Improved Horse Power.

Andrew Jackson Pierce, Cherryvale, Kan.—This is an improved horse power so constructed that it can be conveniently taken down, set up, and carried from place to place, and which will allow as many horses to be attached to it as the work to be done may require. This consists of a polygonal center block fastened to the ground, from which radiate a number of sills. Each sill carries a standard, and the standards support a frame in which are a number of vertical flanged pulleys. An endless chain passes around all the pulleys and also around a large gear wheel. From the latter motion is imparted to the mechanism to be driven. The draft bars are attached to the endless chain in any required number.

Improved Car Coupling.

John Pendergast, Spring Grove, Minn.—This invention consists of a drawhead with curved jaws which are fulcrumed to a slot of the drawhead back of the link cavity, so that the overlapping ends of the jaws pass through side slots of the mouth of the drawhead into the same, and couple thereby the link. The rear arms of the jaws are attached to a strong elliptic band spring, which is again applied at its rear part to a connecting bar sliding in a longitudinal guide perforation of the drawhead, and projecting beyond the front part above the mouth, so as to close the jaws when being carried back by the concussion of the drawheads, and be locked in this position by a pivoted spring lever catching into a notch of the sliding bar. On releasing the lever or treadle the link is instantly uncoupled by the spreading of the spring jaws.

Improved Clover Separator.

Zephaniah Miller, Canal Fulton, O.—In operating this machine, the clover is thrown on a stationary toothed feeding apron, whence it is carried on and over a cylinder to the teeth of the stemmer concave, when the stems are torn from the heads, and both are carried to a stationary conducting apron, and then to the separator, the broad teeth of the apron preventing any stems or pods from falling into the cylinder case. The feed bottom catches the heads which have fallen through between the slats of the separating belt, whence they are carried by the slats of said belt into the cylinder case, and then to the hulling teeth, by which the seeds are thrashed from the heads, when both are thrown over into the seed and pod conveyor. They fall thence into the seed separator, and are prevented from rising on the cylinder above the stationary toothed apron by its broad teeth. Thus the two operations, that of stemming and hulling clover, are performed by one beater cylinder. The pods and seeds pass from the conveyor to the platform and belt, by which they are delivered to the winnowing mechanism located under the platform.

Improved Sewing Machine Table.

James M. Baird, Wheeling, W. Va.—The object of this invention is to utilize the available space in the cover of the sewing machine, and to furnish an improved fastening of the same to the table; also to extend the table in such a manner that the cover may be placed in the rim like a leaf, and thereby out of the way. Beveled lugs slide into grooves at the inside of the cover, and lock in connection with a beveled cam, which is pivoted to the table and fits into a corresponding groove of the cover, securing the box firmly to the table. In the direction of the arm and needle bar are arranged parallel drawers. The top of the cover projects sufficiently to have the width of the table, and rest thereby on extension pieces, like the leaf of a folding table.

Improved Cotton Cultivator.

Theodore C. Burham, Waco, Texas.—To the axle is attached a cone chain wheel, around which passes an endless chain, which also passes around a chain wheel, the journals of which revolve in the frame. To the front cross bar of the frame is secured a rod, which is hinged to the end of a block that rides upon the axle in a cavity formed in the side of the cone chain wheel, the said rod having a bend formed in it to pass around the rim of the said wheel. To the chain wheel are attached bevel gear wheels, which gear with vertical shafts. To the lower ends of the latter are attached circular cutters, made slightly convex upon their upper side and slightly concave upon their lower side, and in one side of each of which is formed a semicircular notch about six inches in diameter. The cutters are so arranged that the notches of the two cutters may be directly opposite each other, so as to leave an uncut space about six inches in diameter every time the notches of the cutters come together as the machine is drawn forward. Plows are attached to the forward part of the frame, in proper position to bar off the plants in front of the cutters, which cutters will thus have to cut only through the ridge of soil left between the furrows made by the plows. Guards are supported at the inner sides of the plows to guard the plants from being injured by rubbish or stones thrown against them. Suitable means support the cutters and plows of the said frame away from the ground, for convenience in turning and passing from place to place.

Improved Railroad Track.

Henri A. Corbin, Paris, France.—The ties by which the rails are connected are composed of a rod and tube, the former passing through the latter, and also through the rails, and having screw nuts applied to its ends. The ends of the tube abut against the inner side of the rails and thus hold them rigidly apart, while the screw rod equally prevents their separation. The rails are made of angle iron, one side or flange of which forms the base that rests on the ground. They are connected in sections by fish plates which are riveted or bolted to the ends of one pair of rails, and pivoted to the contiguous ends of the next pair.

Business and Personal.

Charge for insertion under this head is \$1 a line.

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Manufacturers of small steel wares, wishing to estimate on a new article, address W. E. Case, Newark, N. J.

To Engine Builders and Boiler Makers—A practical Boiler Maker desires a location for a small shop, or would purchase an interest in one already established. Address J. C. P. O. Box 2728, St. Louis, Mo.

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Lyman's Universal Screw Cutting Table, with rule for Compound Gearing, Price 10 cts. Address E. Lyman, C. E. New Haven, Conn.

A Situation wanted as Foreman of a Boiler Shop, by a man of 12 years' experience. Address John McMahon, 175 Hamilton Avenue, Brooklyn, N. Y.

H. Beloe, Sacramento, Cal., wishes to communicate with makers of knife sharpeners and other small articles of ready sale.

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For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

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E. T. C. can remove rust stains from calico by the process described on p. 148, vol. 27.—G. F. can find his ale by the recipe given on p. 75, vol. 31.—G. W. P. will find directions for making a good black ink on p. 203, vol. 29.—M. will find details of a millstone cement on p. 246, vol. 30.—S. will find directions for making gutta percha varnish on p. 279, vol. 30.—J. M. W. does not forward any description of the invention on which he asks an opinion, but merely testimonials as to its merits.—W. P. B. and many others will find booksellers' addresses in our advertising columns.—J. S. B. will find full directions for tinning cast iron on p. 76, vol. 30.

S. T. B. says: A French chemist says: "By fabricating coke, nitrogen can be made." What is the meaning of fabricating coke? A. It means the making of coke by expelling from coal the principal gaseous and liquid matters that it contains. In the manufacture of gas, the coal is placed in retorts and heated; and when the gas passes out of the coal, the residue remaining in the retorts is called coke.

F. B. C. asks: What are ocher and amber? A. Ocher is a variety of fine clay containing iron. The common colors are yellow and red, the latter being colored by sesquioxide of iron, and the yellow variety by the hydrated sesquioxide. Amber is an ochreous ore of iron, of a brown or blackish brown color, consisting of oxide of iron, oxide of manganese, silica, alumina, and water. They are found principally in Europe, although they are widely distributed. The ocher is found in beds some feet in thickness, which lie generally above the oolite, and are covered by sandstone or quartzite sands, more or less ferruginous, and are accompanied by gray plastic clays, of a yellow or brownish color; all of them substances which contribute more or less to its formation. There are many large mines of it in this country, at Bennington, Vt., and in various other places. Amber is found in Europe, especially in the island of Cyprus, and also in this country in large quantities. They are used as pigments, and as dyes in varnish; also, sometimes, in coloring porcelain.

J. C. W. asks: 1. When a person is writing several hours every day, inhaling the air from ink which is drying so near him, does he receive into the lungs and the blood anything from the ink which may have a deleterious effect upon the heart or any other organ? A. Not from any of the common inks. 2. If only pure water evaporates from ink, would that moisture be likely to affect the lungs of any person bending over the drying paper from morning till night? A. No. 3. According to the sense of smell, when ink is freely used, the indications are that something more than pure water rises from ink in drying. Is injurious to health, what would be its specific effect? A. Not injurious to health any more than minute particles of dust and saline matters, or traces of organic matters received from other sources.

P. H. S. asks: Can a calcium light be made so as to be carried in the hand on a foggy day? A. It has not, nor ever can be until some simpler form of apparatus is invented, which will combine the advantage of compactness with the ability to furnish cheaply the continuous flow of gases necessary.

How can a pattern of a pot be drawn, the bottom to be 7 inches in diameter, the top 3 1/2 inches across, and the pot 7 inches high? A. This question is somewhat confused. See Warner's "Sheet Metal Worker's Assistant."

Can colored candles be made to burn with a flame of the same color? For instance, for red, nitrate of strontium might be dissolved in boiling alcohol and the wick soaked in it. Boracic acid might be used for green. Can the colors be intensified in any way? A. We doubt very much as to whether the object desired can be accomplished, for various reasons, and certainly not in the way you speak of, from the fact that strontium nitrate is nearly insoluble in alcohol, consequently very little effect would be produced by wick steeped in so weak a solution. So also, with boracic acid, which, even in the most concentrated solutions, only tinges the edge or border of the flame.

How can I deposit a thin coat of platinum on metal by a plating process? Can I put it on as a wash, after dissolving in nitro-muriatic acid? A. Your best method would be that of electroplating; the best solution to employ is the nitro-muriatic, to which sufficient soda is added to render it neutral. The object to be coated should be cleaned by potash before the process is commenced. A fine platinum wire connected with the

positive pole of the battery is placed so as to dip into the solution; the object to be plated is placed by a wire in connection with the zinc or negative pole, and also placed in the solution. If the battery be not too strong, in a few minutes the object will be coated with platinum.

W. H. C. Sr. says: There is a man in our neighborhood who says that, if a boiler with both heads out were set up on end in a body of water (it matters not of what depth, provided the upper end is above water and the lower end sunk in the mud deep enough to prevent water from leaking in), when the boiler is pumped clear of water, the boiler will rise from the mud immediately after being pumped out and refilled. I contend the contrary. Who is right? A. We incline to your opinion. It is an experiment that we very readily be made with a piece of tin pipe.

D. K. S. says, in answer to J. J. K.'s question in regard to the British man of war sunk at Hell Gate about 1747: I would state that it has been visited by divers for several successive years; with what success as to money obtained, I cannot tell. It is buried deep in the mud and difficult to get at, and can only be visited in good weather and at certain times of tide. I have several relics in my possession which were taken from her.

J. O'D. asks: I have often felt the want of ventilation in railway cars, and I have wondered why the companies did not do something towards remedying the evil. But I am not surprised now, having read your article on the subject in a recent number. I was not aware that so many methods had been tried without success. Would it not be well for the companies to offer a prize for a successful invention, that would bring all the inventive talent to bear on the subject? We should then, I believe, soon have a good method of ventilation. A. The suggestion of our correspondent is an excellent one. Let the railway companies unite in offering a prize say of fifty thousand dollars, and doubtless the desired invention would be forthcoming.

J. H. McD. asks: The follower on a steam engine of 32 inches diameter (of a condensing engine on a steam boat), pulled off the follower bolts, nuts, and fastenings with it, and broke the cylinder, as the piston was coming up with the steam under it, and a vacuum of 26 inches over it (on the follower). It is a disputed question whether the vacuum on the top of the follower had any tendency to pull the follower, or in any way remove it off its seat. A. It did not have any tendency to pull the follower, but did render it easier for the follower to be pushed by the pressure on the other side.

S. F. R. asks: If there is a certain quantity of water in a boiler, and that amount of water be converted into steam, would there be the same amount of water when condensed if there were no means of escape? Is there any decrease in water by boiling it? A. There would be the same amount afterwards as before, under the given circumstances.

H. L. K. asks: 1. Is an artesian well sunk in the same way and by the same apparatus as a common drive well? A. Not generally. Artesian wells are usually of such depth as to require the hole to be bored by a boring designed for the purpose; whereas the hole of a drive well is commonly made by driving the tube into the ground. 2. Is the same kind of piping used in both? A. No, the pipe for artesian wells is put together in sections, in consequence of the extreme length; the pipe for a drive well, being short, is usually in one piece, one end being closed and pointed so as to enable it to drive. 3. What is the diameter of the pipe used in sinking an artesian well? A. The size varies from 2 to 5 inches, as a rule.

W. H. K. Jr. asks: What ought to be the thickness at top and at bottom of two square brick stacks, respectively 100 feet and 140 feet high, each having an 8 inch square flue for the entire height? A. For the 100 feet stack, make the walls 8 feet thick at bottom and 16 inches thick at top, the brickwork being of hard brick and cement mortar.

A. L. D. M. asks: I have a boiler 56 inches long and 28 inches diameter, with 20 tubes of two inches diameter; the dome is 16x20 inches, of iron 3/4 inch thick. How many pounds steam will be safe to work at highest rate? A. About 50 lbs. per square inch.

M. H. R. says: To become a surveyor, is it necessary to study at a university? If not, what should I do to become one? A. It would be better for you to obtain some instruction at a good engineering school. But many surveyors learn their profession by actual practice in the field (which, of course, would be necessary after leaving school) without the preliminary education of which you speak. If you are determined to become a good surveyor, you are pretty certain to succeed, whichever course you take.

H. C. T. asks: I wish to supply a tank, situated on top of a levee, with water from a river, the tank being 100 feet from the river, the levee sloping at an angle of 45°. What will be the cheapest way of supplying the tank, by machinery? A. An ordinary steam pump, if the quantity of water required is small, and a centrifugal pump, or well designed pumping engine, for small quantities.

F. G. H. asks: If a toy balloon were cut loose to go whither it would be blown, what would be the result? Will balloons burst if they rise as high as possible? A. Yes; but they seldom reach a sufficiently high altitude, because of the loss of gas.

R. K. asks: The lightning rod on my house runs underground several feet. Would it be an advantage to put a wheelbarrow full of wrought or cast iron turnings at the end of the rod, letting it bed itself in them? A. It would undoubtedly increase the safety of your house if you place a mass of conducting material, as you propose, into connection with the lower end of your lightning rod. Better dig a trench and spread the iron along in it.

J. J. S. asks: Is magnetic iron sand worked practically at any place in the United States? In Vermont we could obtain large quantities daily. Being very pure, it would be an inducement to establish works. A. Not to any extent. Much iron sand is titaniferous, and it would be necessary before mining to see whether it was all magnetite, or contained an injurious amount of titaniferous iron.

E. C. M. asks: Would a boiler be subject to damage by having a slight blast underneath? If so, to what extent? The blast is to be used for the purpose of smelting ore. A. It is not usual to employ a blast in this manner; generally the blast is employed to clean off the bottom of the boilers. Two probabilities present themselves. First, that the blast would increase the rapidity with which the boiler would burn out. Second, that if your blast were mixed with the products of combustion, it would be injured so far as its further employment in the smelting of ores was concerned.

You again write to us without giving your name and address.

M. P. S. says: Your repeated cautions in regard to lightning rods lead me to ask your advice through your columns upon the following points: I have erected at my country residence a water tank and fixtures of rather novel construction. At one corner of the house, I have placed an old cylinder boiler, about 30 feet long and 3 feet diameter, standing on end, resting on brick foundation. The upper head has been removed, making a huge water tank. The top projects above the eaves of the roof, but not higher than the peak. It is encased in an ornamental frame tower connecting with the main building. I propose to keep this tank filled with water by force pump from the well. It is now empty, however. From this tower, iron water pipes lead to the kitchen and bedrooms, and also to the cast iron force pump in the well, and probably 10 feet down into the water. The house has two ordinary lightning rods on chimneys, leading to the ground on the opposite side of the house. 1. Is this arrangement dangerous? A. The arrangement as described is not to be called exactly dangerous, but might be made much better by a little change. 2. Would lightning be attracted by the large mass of iron of the boiler, rather than by the lightning rods, which are higher? A. If, as would appear, the iron tank is in excellent connection with the ground, it is quite possible that lightning might strike it or some of the pipes running from it in the house in preference to the lightning rods. 3. If struck, would the lightning follow the mass of iron to the ground, or pass through the pipes into the well, or enter the chambers through the discharge pipes? A. If the tank or its connections were struck, the lightning would, without doubt, go to the earth and not into the house. 4. Would it be advisable to put a lightning rod on the outside of the tower leading to the ground? A. A lightning rod on the tower should be put into perfect metallic connection with the tank, and need not extend below its upper edge. Let the tank and water pipes, in other words, be the lower part of the rod. 5. Would not this last tend to attract the lightning, and in such case would not the electricity be likely to leave the rod and enter the boiler with same effect as if no rod were there? A. Both your suppositions in this paragraph are correct. 6. Will not this large mass of iron resting on the ground and this indirect water connection answer the purpose of a conductor? A. This question is already answered in No. 4, assuming that the pipe into the well is in perfect metallic connection throughout, with no rust or cement joints. Red lead is an admirable insulator. In the way of advice we would say: Connect all your lightning rods together, and also to your iron tank and water, gas, or other pipes, not by separate connections, but so that there is some connection between all as high as possible. If you have a metal roof connect all rods with it. If not, connect them by a good sized conductor running along the ridge of the roof. Bear in mind that, to carry off the heaviest lightning flash known, a copper rod one inch in diameter is not considered too large, and, though of course such flashes are of very rare occurrence, they may come. Hence the great value of uniting your different rods high up. Read our article in vol. 29, p. 26, and our editorial remarks upon a letter, p. 144 of the same volume.

J. E. J. asks: Will acid dissolve resin without destroying its natural qualities? If so, what kind of acid? If not, what will? A. Rosin, or colophony, is a mixture of several resinous acids, namely, phenic, sylic, colophonic, and sometimes also pinic acid. It is soluble in nitric acid, but in dissolving suffers decomposition. It is soluble in alcohol and may in this state be used as a varnish. It is soluble also in the alkalis.

S. C. J. asks: In your book of instructions for obtaining patents, there is a recipe for making marine glue: Take 3 parts gum shellac, 1 part caoutchouc, dissolve in separate vessels in ether free from alcohol, applying a gentle heat. I have been reading that if the odor of ether is inhaled, it will produce insensibility, etc., and great care should be taken not to pour it out with a flame below it, otherwise an explosion of a dangerous character might ensue. "Mixed with certain proportions of air, it forms a highly explosive compound."—(Zell's Encyclopedia). I wish to make some marine glue, but must confess I am afraid to use ether if it is so dangerous, and would be greatly obliged to hear from you further about it. A. There is no necessity in this experiment of pouring the ether out over a flame, or of inhaling it in large enough quantities to produce any effect. Place the ether in bottles, into which drop, respectively, the requisite quantities of shellac and caoutchouc.

C. D. F. asks: 1. Why is it that, when I adjust a telegraph sounder so that, when the circuit is closed, the armature touches the magnet, it (the armature) will still stick to the magnet when I break the circuit? A. Because of the residuary magnetism in the soft iron cores. The armature should never be allowed to touch the poles of the magnet. In ordinary telegraph sounders, set screws are used, to limit the movement of the armature in both upward and downward motion. 2. If, as you say in a late number of your paper, short, thick cores in electro-magnets give greater attractive power, why are such cores used in telegraph instruments? A. They are used for the very reason stated, namely, because of the better results obtained. 3. In making a blue vitriol solution for a Daniell's battery, how much vitriol should I use to a quart of water? A. As much as it will dissolve. 4. Will a leather cup instead of a clay porous cup in Daniell's battery make more electricity? A. The porous cup is only an accessory in the battery, and takes no part in the generating of the current. A cell in which the cup is of unglazed leather is said to have less internal resistance than one in which an ordinary earthenware cup is used.

S. F. says: I wish to suggest a form of balloon which may be worth experimenting on, and which I believe has not yet been proposed. I have frequently observed that metallic shell ware, and all descriptions of sheet metal work constructed with a view to lightness and strength are dependent upon the use of curved, fluted, or corrugated surfaces for their power to sustain pressure. It is wonderful what an enormous pressure a simple convex lid or covering for any light tin vessel will sustain. It is of course possible to estimate how much weight it must bear—a convex shell of a given thickness, and proportion of are of circle—and to ascertain the relative resisting powers of various metallic shells. Now this appears to me to be a feasible suggestion to make: That a balloon be constructed in the globular or oval form, from sheet metal as thin as possible; this vessel to have but one aperture, connected by a pipe to an air pump. Pump out the air to a degree of rarity such that the specific gravity of the balloon and its contents be less than that of the surrounding air; and if the shell be strong enough not

collapse, it will of course rise from the ground. This is, in other words, the same thing as saying: Cannot a hollow globe be constructed of sheet metal, of uniform thickness, elliptical, or of proportional thickness if elliptical, sufficiently strong to resist upon its outside or convex surface, a pressure of not more than fifteen pounds to every square inch? If the answer to this proposition be an affirmative one, in actual practice demonstrated by experiment, then the greatest difficulty in aeronautic science is removed. After this point of aerial ascension is practically settled, and the balloon constructed on some such plan as to be easy to manage at any altitude, I believe we shall go ahead with aeronautics, and not before. A. One of the earliest flying machines ever made had four sheet copper balloons attached to the corners.

D. M. asks: What can I coat sheet zinc with (that will not be dissolved by water) to take away the smell and taste which it gives to water and other things in a refrigerator? Can the taste of the zinc be got rid of in some other way? A. Use paraffin varnish. A solution of paraffin may also be used.

N. L. T. asks: 1. I have a horizontal boiler of copper 1 foot long by 10 inches diameter, the copper being 2 1/2 inches thick. How much pressure will it stand? A. About 100 lbs. per square inch, if the joints are brazed. 2. The safety valve has a hole of 3/16 inch in diameter, and with the weight at the end of the lever it takes 21 ozs. (avoirdupois) upward pressure to raise it. How many lbs. pressure are there? A. More data are required, namely, the weight and dimensions of the lever, the weight of the valve and ball, and the distance of each from the fulcrum.

J. H. B. asks: How can I clean off the rust from a revolver, and prevent it rusting hereafter? A. Clean the rusty parts with brick dust, then brown the parts that have become brightened in cleaning by rubbing them with a rag wetted with nitric acid. To prevent future rusting, have the parts lacquered.

H. G. L. asks: 1. In a recent issue, I have seen that correspondents ask how to estimate the horse power of an engine, and in some cases you answer that sufficient data are not given. On p. 314 of your vol. 30, a correspondent asks what would be the horse power of an engine that has 36 inches stroke and 16 inches diameter of cylinder, running 65 revolutions per minute with 70 lbs. steam. What is lacking to enable you to estimate the horse power of the same? A. The mean effective pressure of the steam on the piston. 2. Will you please give us the formula and work out the following example for the benefit of your readers: What would be the nominal horse power of an engine of 17 inches bore of cylinder, 17 inches stroke of piston, with 65 lbs. steam pressure, running at 85 revolutions per minute, using common slide valve? What have we omitted in this example, to supply the necessary data? A. The ordinary rule for finding the nominal horse power of a non-condensing engine is as follows: Nominal horse power = $\frac{1}{2} \text{ stroke in feet} \times (\text{diameter in inches})^2$. Hence sufficient data are given. The actual horse power, however, depends upon initial pressure, point of cut-off, amount of wire drawing, back pressure and compression, none of which data are furnished by you. 3. In a recent issue you say that an engine with 24 inches stroke running 90 revolutions per minute has a piston speed of 240 feet per minute. In this reply I differ with you. Then $24 \times 90 = 2160$ inches = 180 feet. Am I right? A. You are right.

Suppose a steam hammer has a cylinder 18 inches bore x 22 inches stroke, with lifting block (attached to piston rod) weighing 1,500 lbs. What would be the force of the blow in lbs. struck? If a weight weighing 800 lbs. be elevated 25 feet and let fall (of its own weight), what would be the force of the blow struck in lbs.? Will you give us the formula for these examples? A. We do not know of any formula by which you can solve these examples.

G. M. asks: Does clearance between piston head and cylinder, more than sufficient for the safe working of the engine, help to keep the engine from knocking when it passes the ends, or does it do any good in any way? A. No.

S. D. Jr. asks: What are the rules for proportioning engines? Will a boiler of 3 1/2 inches diameter x 15 inches length be of sufficient capacity to drive an engine of 1 1/2 inches bore x 3 1/2 inches stroke? The boiler is heated with 3 or 4 gas burners. A. It is difficult to give definite rules for such small boilers, as a great deal depends upon the manner in which they are constructed and set. Allow from 15 to 20 square feet of efficient heating surface for each horse power of the engine.

W. T. W. asks: If a pendulum 39 inches long strikes once in a second, how long would the pendulum have to be to strike once in a minute? A. 11,700 feet.

C. D. asks: Please give me a simple rule for calculating the pressure on safety valves of steam boilers. For instance, what would be the pressure of valve with weight of lever 4 lbs., length of lever from fulcrum to weight 22 1/2 inches, from fulcrum to center of valve 7 1/2 inches and weight on lever 20 lbs.? A. You do not send enough data, the weight of the valve and stem and the position of the center of gravity of the lever being required. But neglecting the weight of the valve, and supposing the center of gravity of lever to be midway between the fulcrum and weight: Pressure on valve $\times 2 1/2 = 4 \times 11 1/2 + 20 \times 22 1/2$. Whence pressure on valve = 195 lbs.

E. S. W. says: All books say that an artificial horizon, to be used with the sextant on land, should be made of mercury, or some other fluid. Would it not be equally well to use a mirror or looking glass placed on the ground and leveled by a small spirit level? A. When one considers the error caused by even a very slight divergence from the proper level in measuring the altitude of an object millions of miles away, and remembers that it is very probable some inaccuracy of adjustment will occur, he will be very likely to agree with a friend of ours, who said that the method reminded him of the farmer who guessed at the weight of a stone, after using it to ascertain the weight of his pig.

J. A. H. Jr. asks: Is it necessary that parties running a steam launch or small steamboat (for their own pleasure or convenience, and not as public carriers) should comply with the steamboat law requiring the employment of a captain, pilot, and licensed engineer? A. We think not.

G. R. C. asks: What would be the effect on a volume of steam going through a pipe if it came to a place where the pipe turned a right angle? A. The pressure would be reduced, on account of the resistance due to the bend, and some of the steam would, in general, be condensed.

H. P. C. says: I have made a very nice kind of black ink with extract of logwood, bichromate of potash, and prussiate of potash, and for a while it works well. But now it has grown thick as mud, and molds. What can I put in it to keep it thin and liquid, to prevent its molding? A. The thickening is probably due to evaporation. Your bottles should be kept well stoppered. Try a little carbolic acid.

H. B. T. asks: What power of engine will it take to force a stream of water 4 inches in diameter to a distance of 35 feet through a pipe, the first 60 feet to be forced at an angle of 45°, and the remainder, 25 feet, to be forced perpendicularly into a tank? A. It depends entirely upon the quantity of water required to be forced up the pipe in a given time, which quantity will always be answerable to the capacity of the pump and its number of strokes per minute; this latter will be regulated by the proportion between the area of the pump piston or plunger as compared to the area of the steam piston. The more the area of the latter exceeds the area of the former (the lengths of their strokes being equal), the faster the pump will run; the area of steam piston is commonly the same as that of the pump piston; if the water requires lifting only for forcing, the steam area may be made twice or three times the pump area. Your first element is therefore the quantity of water per minute required to be forced up the pipe.

I. D. McC. says: Suppose that a boat is floating on perfectly still water, and that the boat has a sail in the fore part and a large bellows in the back part. Now if air is forced upon the sail from the bellows, would it cause the boat to move? A. The boat would not move by forcing the air against the sail. But by removing the sail and discharging the air from the bellows against the atmosphere, then the boat will move.

C. W. J. asks: In the case of mill rocks, when the lower rock is stationary, the upper doing the work, is the attraction of gravitation diminished when the rock is in motion? Does it require a greater strength of support to sustain the weight of the upper rock when in motion than at rest? It is contended by some that the weight is less; and they endeavor to maintain their argument by citing, as an illustration, the governor balls of a steam engine, stating that the centrifugal motion destroys, to some degree, the weight of the governor. A. The weight is the same, whether the stone is at rest or in motion.

G. A. N. asks: 1. Would a boiler made from 3/16 iron, 10 1/2 inches in diameter and 25 inches high, with 36 tubes 12 inches long and of 1 inch diameter, with tube sheets 1/2 inch thick, be of sufficient power to drive an engine of 3 inches bore and 7 inches stroke? A. No. 2. What will be the fire surface of such a boiler? A. It will depend upon the manner in which it is set. The fire surface may be the surface of the tubes and one end of the boiler, and may have the surface in the shell of the boiler, in addition.

E. V. asks: Is it possible to compress steam at a low temperature, say 220° Fah., by any of the known means (for example, by a pump) to a pressure of say 90 lbs. per square inch, without increasing the temperature, and have any such experiments ever been made? A. It can be done by making provision for removing the heat of compression by some method of refrigeration. We do not know of any experiment on the subject.

P. R. asks: In case of shutting down for 1 or 2 weeks, is it injurious to the boiler not to blow off, but to let the water stand till starting up again? A. If the water is pure, it may be left in the boiler; but if it contains minerals in solution, it is better to blow off and clean the boiler. 2. Which is the best time to blow off, with a pressure of steam or not? A. The best plan, if the water will run out without pressure, is to let it stand for 12 hours after hauling the fire. 3. What effect does oil going in with the feed water have on the boiler? A. It frequently causes priming.

What is meerschaum? A. It is a hydrous silicate of magnesia, occurring chiefly in Asia Minor. I have suffered for the last eight years with a bunion or something of the kind on my foot. How can I get relief? A. Shoes made by a man who understands the anatomy of the foot are sometimes efficacious in cases of this kind.

A. V. asks: Would a sewing machine making a stitch similar to hand sewing be more popular than the present kind? A. Some people might prefer it.

Suppose I had a hollow iron ball, 1 foot diameter with the shell 1/2 inch thick, what force would it require to hold it 3 feet under water? A. You can readily make the calculation. The weight of the ball tends to keep it down. The weight of an equal volume of water tends to force it up.

I am an amateur mechanic, and wish to make a cupola on a small scale for casting small articles. Could I do it economically? A. Not unless you have had some practical experience in the matter.

Is there a reward offered for an apparatus for detecting cheating on the part of conductors on railways and street cars? If so, by whom, and how much is it? A. There is no reward publicly offered; but the managers of railway companies will doubtless be willing to compensate any one who brings them a useful invention for the purpose set forth in your question.

Would it not be a good idea to use molds for castings made out of wood and saturated with silicate of soda? A. No.

Where can I get a book on chemistry for beginners? A. You will find notices of publishers of such works in our advertising columns.

J. S. S. asks: Is it economy to keep 60 lbs. pressure of steam in boiler when 40 lbs. will do the work required? I am running a steam grist mill and 40 lbs. steam in boiler will drive the rock; but I contend that it is economy to keep 60 lbs. in boiler. A. You do not send sufficient data. If you have an automatic cut-off engine, it would be more economical to maintain the higher boiler pressure.

S. R. says: A man was killed in a well last summer by gas. The well was completed, being laid in brick and waterlime mortar; the plank curbing and pump were fixed in the same, and the well was probably airtight, with the exception of a very small crack between two planks. The first cold snap that came, a sharp whistling sound could be heard. Our neighbors are superstitious. We thought the air contracted in the well and the outside air rushed in through the crack. We placed straws across the crack, and they sucked down. Can you explain it? A. The crack probably connects with some crevice in the earth, which communicates again with some larger chambers or caves in the ground; and there being other openings in other localities, opportunity is given for the wind to blow through them.

M. S. C. Jr. asks: 1. Of what horse power do they usually make narrow gauge railroad engines? A. One hundred horse power, and over. 2. How much more can a railway engine draw than a road engine of the same horse power? A. From 8 to 10 times as much. 3. What is the average cost of a narrow gauge railroad engine, and how much does it cost, more or less, than a road engine? A. It is about the same as the cost of one of the larger sizes of road engines.

B. G. says: I have a pump barrel, 3-16 inch thick by 5 inches diameter, length 10 inches. Will it be strong enough to make a cylinder for a small engine, and about how many pounds of steam to the square inch will be safe for it? A. You can use it for pressures of from 20 to 25 lbs.

T. S. S. asks: Do the drive wheels of some locomotives have a lining of wood underneath the tyre? If so, what is the idea? A. Some passenger car wheels are made in this way, but we are not sure whether the plan is employed in the case of locomotive drivers. The object is to deaden the shock and noise.

L. G. K. says: I am running a twenty-five horse engine, and we have to use hard limestone water, which is so hard that we cannot run more than three or four days without blowing out dry and filling up the boiler again. Will a little lime in the tank from which I feed the boiler be of any use in checking the boiler from foaming? If not, what will prevent it? A. A feed water heater, arranged to deposit the mineral substances of the water before it entered the boiler, would be serviceable in this case.

W. R. asks: Will an iron wire 1/2 inch in diameter and 500 feet long be strong enough to draw a load which would require the strength of one horse to pull? The wire is to be supported on rollers 100 feet apart, each roller to be removed as the load reaches it; the wire to be wound around a large stationary wheel turned by water power. If the 1/2 wire will not answer, what size will? A. It would be better to use a wire rope 3/4 inch in diameter.

C. F. D. asks: Will you give me a rule for lining up propeller shafts? A. We copy the following rule from the "Cadet Engineer," by Long and Buel: Put two straight edges on the slides, one at each end; run a line through their center points, and continue it beyond the shaft. Set a T square on one of the straight edges, making one edge of the blade cut the center point. Then erect a perpendicular, at the center of the shaft, to the line previously run, by locking it out of wind with the edge of the T square (or arranging it so that, when viewed from a distance, it covers the edge of the T square for the whole length). Then swing the crank, disconnected from the rod, on the centers and half centers, and measure the distances of its face from the two lines. If they vary at different points, the shaft is not in line, and must be adjusted until the distances are the same for all points of the revolution.

I have heard engineers speak of working up indicator cards. What working up is there to do after the card has been taken? A. It is usually desirable to ascertain the mean pressure, back pressure, point of cut-off, etc.

H. B. asks: Is there such a thing as a pickle or solution, capable of removing the sand that adheres to iron castings? A. Place your castings in equal parts of oil of vitriol and water; and after they have remained there two days, wash them with clean water, and the sand will be removed.

A. C. says: I have now in use a steam boiler, 24 feet long by 4 inches diameter, with two 16 inch flues; and I want to put in its place a boiler 10 feet long by 4 inches diameter, with 75 flues 2 1/2 inches in diameter, with a dome 24 inches diameter by 25 inches high. I wish to know if, with equal draft and setting, the 10 feet boiler will make much more steam than the long one, with less fuel. I drive now 2 engines with my present boiler, 10 1/2 inches, making 100 revolutions, cutting off at 3/4 stroke; but I have to burn too much fuel. One boiler maker tells me that the short tubular boiler will make more steam than the old one, with a great deal less fuel, and another boiler maker says that the short boiler is too small and will have to be crowded too much to do the same work as the long two foot boiler. Please give me your opinion. A. We advise you to continue to use the old boiler as long as it is serviceable. We incline to the opinion of "another" boiler maker.

G. L. D. L. asks: What would be the proper speed of an emery wheel, 13 inches in diameter, with 2 inches face, to do the most efficient service with safety? A. About 1,200 revolutions a minute.

J. E. P. asks: Would not a single cylinder engine of such proportions as to allow the admitted steam to expand to atmospheric pressure be as economical and effective, other things being equal, as one of the compound system? A. Yes.

J. A. says: I have at my house a large underground brick cistern. Water comes from a French roof, with the upper part tiled, sides slated, conductors (bright tin) inside to the ground, and glazed earthen pipe in the ground. The water is drawn out of a tight brick box, serving as a filter, through a block tin pipe. When the cistern was built, the top of the roof had had several coats of lead paint. I then had all the painted tin and painted eaves troughs covered with one of the patented slate paints, which covers well and appears to be a solid coating. The cistern has now been in use 1 year. The water is somewhat yellow and still tastes slightly of cement; but is odorless and soft. Am I safe in using the water for drinking without fear of poison from the roof? A. The water is probably affected by particles disintegrated from the brick and cement mortar; probably the sand used in the mortar was loamy. We do not think that the lead paint, if covered with a coat of slate paint, since become hard and firm, can much affect the water. An additional filter at the discharging end of the pipe might be used to advantage, and the present filter cleaned out and supplied with new material.

J. T. J. asks: What is the percentage of power or fuel lost by wire-drawing steam from 100 lbs. pressure per square inch to 60 lbs.? A friend contends that there is no loss, providing the engine is large enough for its work. A. If you suppose steam of 100 lbs. pressure: (1). To be expanded in the cylinder, so as to make the mean pressure 60 lbs., and (2) to be wire-drawn, before admission, to 60 lbs., and to be used in the cylinder without expansion: The loss from wire-drawing will be the difference in the amounts of steam required in the two cases, which you can readily calculate for any given case. In such a case the loss from wire-drawing would be excessive. In general, however, the steam is expanded as well as wire-drawn, which modifies the loss, though it is always more economical to expand the steam than to reduce the pressure by wire-drawing.

I. E. W. asks: How many square feet are there in a spiral screw, winding 5 times around a shaft 15 feet long and 3 1/2 inches diameter? The depth or width of the screw is 3 inches, and the diameter of screw and shaft together 19 1/4 inches. About 101 square feet.

L. & J. ask: Should an architect charge for extra work on a building ordered by owners but entirely outside of specifications, and not superintended by the architect? We have a case in hand on our new office, and think there is no justice in the attempt of the architect to charge for such service, not having rendered any. The work disputed on is such as the digging of cistern, catch basin, ceiling around elevator, overhead in basement, laying brick flooring, etc. The verbal agreement was a certain percentage on contract prices. There were no changes in plans or specifications to architect. We feel that, having ordered and superintended the work ourselves, we should not pay commission on it. Your answer will settle the question satisfactorily to both of us. A. You do not say whether the architect superintended the building generally. An architect's commission is divided usually into compensation for office work and for superintendence, from 2 1/2 to 3 1/2 per cent for the former and 5 per cent for the whole. Office work is considered the furnishing of plans and specifications, and sometimes working drawings; the percentage for this should be taken on the whole cost of the building, unless so great an addition is made to it as to involve the necessity for an additional plan and specification for said addition from other parties. But in respect to superintendence, the case is different; that part only should be taxed which is actually superintended by the architect.

J. S. W. asks: I am constructing a bath house in a running stream of fresh water; can I build the foundation walls and the bottom with bricks and common mortar, providing that I allow the mortar in the walls to thoroughly dry before tamping in the water, so that it will be sound and substantial? I know that there is a cement used for walls which are to be in undated, but I desire to use common mortar if it is practicable. A. It will not be safe to use common lime mortar for brick work under water. You should use a good hydraulic cement and clean, sharp sand, free from loam. It will be the most economical in the end.

If a hole of an inch in diameter be drilled through a fresh, green 1/2 inch plank, will its edges shrink? In other words, will the hole become larger, or remain of the same size? A. The board will shrink without reference to the hole, and the result will be that the hole will become after the shrinkage somewhat narrower but of the same length as at first.

D. & W. P. E. say: Our houses are supplied with water through a 3 inch iron pipe coated on the inside with gas tar; but although the pipe has been laid 2 years, the water, having little or no mineral deposits in solution, continues to taste very disagreeably of the tar. Can we place any chemical solution in the tank supplying the water, which will remove the taste yet not be injurious? A. It is doubtful whether you can do anything that will be successful with the present pipes.

We have a frame building, roofed with shingles which have been opened by the sun in large cracks; as our mill is close enough to be burnt if this building was, we would like to ask if there is any cement or composition with which to fill the cracks, which will be fire-proof and at the same time not be dislodged by rain or frost? A. There are several patent compounds in the market, which are said to be efficacious in such cases.

We have an elliptical reservoir, 2x50 feet and about 4 feet deep; the sides are composed of ordinary 18 inch mortar wall, banked on outside with dirt and covered on inside and top with Rosendale cement (2 parts cement to 1 of sand); but last winter the frost cracked the cement on the top and sides, making the reservoir leak like a sieve. What would be best to do to make it tight? A. It will probably be necessary to draw off the water and relay the stones.

G. W. C. says: G. N. S. can straighten a gun barrel by constructing an apparatus something like a bow for shooting an arrow. The cord is to be made of silk thread and quite fine. Put the cord through the barrel and strain it with the bow. The barrel must be smooth and clean. Hold it up, and let the bow hang under the barrel; and you can easily see where the crook is, and with a blacksmith's hand hammer, on an anvil or the end of a hard wood block, can straighten your barrel.

G. M. says, in answer to H. E. K., who asks for the best way to make putty of the colors of different woods, walnut, ash, etc.: In my experience, I have found that the best way was to soften up white putty with linseed oil, and then work in dry color or colors until the desired shade is reached. It can be done in small quantities as it is needed, with very little trouble.

B. W. says, in reply to H. P.: If a mixture in the proportion of a quarter of a pound of lime, made into a paste and added to a spoonful of powdered alum, be put into 300 gallons of water, it will soften the water, and precipitate vegetable and other matter.

J. H. says, in reply to C. L., who asks how to can green corn: The following method cannot be excelled: Dissolve 2 1/2 ozs. tartaric acid in a pint of water. Of this solution, use one tablespoonful to every pint of corn while the corn is at boiling heat. When opened for use, add one teaspoonful soda to every three pints of corn.

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

J. S. McC.—No. 1 is a readily fusible amphibole, with a specific gravity of 3.16. No. 2 is specular iron ore. No. 3 is specular iron ore imbedded in quartz.—L. S. P.—The powder contains common salt and a number of other substances in small quantities. It is utterly useless for the purpose for which it is sold. As it does not prevent in the slightest degree the explosion of these light oils, its sale should be regarded as criminal.—H. M. S.—We are unable, without having the entire plant, to identify it, to see whether any notice of its possessing a sber had been taken hitherto.—G. H. G.—It is galena, arseniophide of lead.—F. W.—It consists principally of hydrated sesquioxide of iron, with a small amount of silica and clay.

A. F. P. C. says: I have not succeeded in preserving fish which is oily, on account of the oil becoming rancid in a short time. If this difficulty could be overcome, a very large business might be done in drying salmon in California. It would hardly do to extract the oil, but it might perhaps be neutralized without destroying the flavor of the salmon.—J. T. P. asks: 1. What kind of sealing wax is best to use in sealing glass jars? I have lost much fruit by the wax not adhering to the glass. 2. Why will tomatoes not keep

wellington glass?—J. A. T. asks: 1. Is the disease called pip among chickens on the tongue? 2. Will it produce death unless cured? 3. What is the remedy therefor?

COMMUNICATIONS RECEIVED.

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

- On Tempering Steel and Copper. By J.S.M.
- On the Nickel Plating Patents. By A. D.
- On the Atmosphere. By H. W.
- On Moles. By W. S. N.
- On Hardening and Tempering Tools. By J. P.

Also enquiries and answers from the following:

A. D. H.—W. E. K.—F. L.—F. A. R.—W. D. P.—A. J. Q.—N. M.—A. D.—R. Y.

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 mullage? 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

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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:

30,396.—BUREAU PROOF SAFES.—J. R. Floyd. Sept. 30

30,394.—DOOR LATCH.—T. Slight. October 21.

EXTENSIONS GRANTED.

29,137.—CAN COUCH.—W. A. Brown.

29,142.—FLOW.—L. Green.

29,180.—HOISTING APPARATUS.—I. Lemman.

29,200.—STEERING VESSELS.—F. E. Sickels.

29,212.—SPRING HINGE.—A. Acker.

DISCLAIMER.

29,180.—HOISTING APPARATUS.—J. Lemman.

DESIGNS PATENTED.

7,535.—BAG RELIEF.—T. Kappeler, Cambridge, Mass.

7,536 & 7,537.—MUFFS.—G. H. Prindle, Philadelphia, Pa.

7,538 to 7,540.—LAMP BRACKETS.—F. R. Seldensticker, West Meriden, Conn.

7,541 to 7,546.—CARPETS.—R. R. Campbell, Lowell, Mass.

7,547.—CARPET.—C. S. Lilley, Lowell, Mass.

7,548 & 7,549.—CARPETS.—D. McNair, Lowell, Mass.

7,550 & 7,551.—GLASSWARE.—D. Bennett, Baldwin township, Allegheny county, Pa.

7,552 to 7,557.—CARPETS.—R. R. Campbell, Lowell, Mass.

7,558 & 7,559.—CARPETS.—D. McNair, Lowell, Mass.

7,560 to 7,563.—CENTER PIECES.—J. O'Neil, San Francisco, Cal.

TRADE MARKS REGISTERED.

1,872.—HATS AND CAPS.—J. B. Fayerweather & Co., Danbury, Conn.

1,873.—ALE.—C. P. Hawkins, New York city.

1,874.—BEVERAGE.—G. N. Irish, Brooklyn, N. Y.

1,875.—FLOUR.—Metzger & Co., Platte City, Mo.

1,876.—GREEN PAINT.—Woods, Son & Co., N. Y. city.

1,877.—CIGARS.—C. Brewer & Sons, Boston, Mass.

1,878.—CHEWING GUM.—Curtis & Son, Portland, Me.

1,879.—FLOUR.—Bain et al., St. Louis, Mo.

1,880.—CUTLERY.—Hermann & Co., New York city.

1,881.—TOBACCO.—Beck et al., Chicago, Ill.

1,882.—BOOKS.—McNair et al., Philadelphia, 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 Release.....	\$30
On granting the Extension.....	\$50
On filing a Disclaimer.....	\$10
On an application for Design (34 years).....	\$15
On application for Design (7 years).....	\$10
On application for Design (14 years).....	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA JULY 16 TO 20, 1874.

3,603.—D. M. King, Mantua Station, Portage county, O., U. S. Improvements on potato diggers, called "King's Potato Digger." July 16, 1874.	
3,604.—L. Daurie, Montreal, Montreal Dist., P. Q. Improvements on cooking stove, called "Mechanic Stove." July 16, 1874.	
3,605.—D. Zeigler, Lewistown, Mifflin county, Pa., U. S. Improvements in Mechanical movements, called "Zeigler's Improved Mechanical Movement." July 16, 1874.	
3,606.—W. G. Dunn, Greensburgh, Decatur county, Ind., U. S. Improvements on joints of rails for railways, called "Dunn's Adjustable Combination Railway Joint." July 16, 1874.	

3,607.—E. E. Bean, Boston, Suffolk county, Mass., U. S. Improvements in gas lighting apparatus, called "Bean's Pneumatic Electric Gas Lighting Apparatus." July 16, 1874.

3,608.—J. C. Todd, Toronto, Ont. Improvements in toy guns, called "Todd's Improved Dog Gun." July 16, 1874.

3,609.—W. Briggs, Montreal, Montreal Dist., P. Q., and L. Senecal, Coteau St. Augustin, Hochelaga county, P. Q. Improvement on manure and hay forks, called "Briggs' Combined Manure and Hay Fork." July 20, 1874.

3,610.—E. A. C. Pew, Welland, Welland county, Ont. Improvements on pest machines, called "Pew's Pest Coal Machine." July 20, 1874.

3,611.—G. Stacy, Montreal, Montreal Dist., P. Q. Improvements on chisel pointed cut nails and machines for making the same, called "Stacy's Chisel Pointed Nail." July 20, 1874.

3,612.—T. W. Shaler, Brooklyn, Kings county, N. Y., U. S. Improvements on signal lanterns, called "Shaler's Signal Lantern." July 20, 1874.

3,613.—W. Baxter, Jr., Newark, Essex county, N. J., U. S. Improvements on compound engines, called "Baxter's Improved Compound Engine." July 20, 1874.

3,614.—W. E. Kelly, New Brunswick, Middlesex county, N. J., U. S. Improvements on steam generators, called "Kelly's Sectional Boiler." July 20, 1874.

3,615.—G. Forsyth, Seaford, Huron county, Ont. Improvements in the manufacture of picket fences, called "Forsyth's Improved Wire Picket Fence." July 20, 1874.

3,616.—R. Dunlop, St. Thomas, Elgin county, Ont. Improvements on steam and gas fitting wrenches, called "Dunlop's Improved Steam and Gas Fitting Wrench." July 26, 1874.

3,617.—J. E. Harriman, Bangor, Penobscot county, Me., U. S. assignee of M. L. Norton, same place. Improvements on lath machines, called "Norton's Improved Lath Machine." July 20, 1874.

3,618.—A. Palmer, Westminster, Middlesex county, Ont. Improvements on a machine for destroying potato bugs, called "Palmer's Potato Bug Killer." July 20, 1874.

3,619.—C. E. Patric, Springfield, Clark county, O., U. S. Improvements on a machine for sowing grain broadcast, called "Patric Broadcast Seeding Machine." July 20, 1874.

3,620.—R. Benner, Hamilton, Wentworth county, Ont. Improvements on the art or process of veneering, called "Benner's New Process of Veneering." July 20, 1874.

3,621.—A. McCannel, Caledon, Peel county, Ont. Improvements in self-opening gates for railway crossings, called "McCannel's Self-Operating Railway Gate." July 20, 1874.

3,622.—L. O. Cantin, Montreal, P. Q. Improvements in machine for burnishing photographs, called "Cantin's Photograph Burnisher." July 20, 1874.

3,623.—J. Bourk, Kingston, Frontenac county, Ont. Improvements in atmospheric engines, called "Bourk's Automatic Atmospheric Engine." July 20, 1874.

3,624.—J. F. Stairs, Halifax, N. S. Improvements in material for calking, called "Stairs' New Stock Oakum." July 20, 1874.

3,625.—T. J. Blake, Pittsburgh, Allegheny county, Pa., U. S. Improvements in the manufacture of smooth back shovels, called "Blake's Smooth Back Shovel." July 20, 1874.

3,626.—G. B. Cornell, Chicago, Cook county, Ill., U. S. Improvements in wrenches for inserting bung bush, called "Cornell's Bung Wrench." July 20, 1874.

3,627.—C. C. Jerome, Chicago, Cook county, Ill., U. S. Improvements in moth proof fur cases, called "Jerome's Moth Proof Fur Cases." July 20, 1874.

3,628.—R. P. Colton, Gansanogue, Leeds county, Ont. Improvements on harrows, cultivators, and analogous implements, called "Gansanogue Improved Harrow." July 20, 1874.

3,629.—J. M. Foss, St. Albans, Franklin county, Vt., U. S. Improvements on railway locomotive engines, called "Locomotive Draft Regulator." July 20, 1874.

3,630.—T. Ford, Platteville, Oxford county, Ont. Machine for cutting the tapering plug end of well tube joints, called "Ford's Pump Tube Jointer." July 20, 1874.

3,631.—J. D. Richardson, Houston, Harris county, Texas, U. S. Improvements on springs, called "Richardson's Tensile Spring." July 20, 1874.

3,632.—J. Ruthven, Levis, Levis county, P. Q. Improvements on carbureters, called "Ruthven's Improved Gas Machine." July 20,



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ASSETS.	
Real estate owned by the company	\$ 75,212 24
Cash in bank and hands of agents	123,619 50
Loans on first mortgages real estate	1,202,281 50
Deferred premiums	62,509 79
Accrued interest	47,538 14
Bills receivable	45,509 87
United States government bonds	280,420 00
State and municipal bonds	121,600 00
Railroad stocks and bonds	182,440 00
Bank and insurance stocks	498,320 00
Total Assets	\$2,937,176 26

LIABILITIES.	
Claims unpaid at date of audit	\$182,412 77
Reserve, N. Y. Standard Life department	1,416,292 70
Reserve, for re-insurance, acc. department	17,000 00
	\$1,615,705 47
Surplus as regards policy-holders	\$965,422 68

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28 Current

SCIENTIFIC AMERICAN

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

Vol. XXXI.—No. 8.
[NEW SERIES.]

NEW YORK, AUGUST 22, 1874.

\$3 per Annum
IN ADVANCE.

IMPROVED MACHINE FOR UNLOADING GRAIN.

The apparatus illustrated in the annexed engraving is designed for use in connection with grain elevators or warehouses, and its object is to afford a speedy means of removing the grain from the cars in which the staple is transported. The device is claimed to effect a saving of from three to four fifths of the labor incident to unloading. The large scoop or shovel shown in the hands of the workmen in the car is provided near its lower edge with hooks, to which is attached the rope leading from the machine. The rope passes between the sheaves of a fair leader, A, the arms of which are hinged to a beam on the floor of the warehouse, so that, when the apparatus is not in use, the portion, A, may be placed in a vertical position or turned back out of the way. When the car comes alongside, the fair leader is turned down horizontally, as shown in the illustration.

B is a drum to which are connected the barrels on which wind the cord, C, and chain, D, and also the tappet disk, E, the whole being loose on the shaft to which power is applied by means of the belt pulley. To the right of the drum is a clutch, F, feathered to and revolving with the shaft. G is a pivoted bell crank lever, one arm of which embraces the clutch, F, while to the other arm the chain, D, and a rope, H, are secured; the latter passes over a pulley and down through the floor, and carries a weight. The cord, C, is also similarly arranged. As represented in the illustration, the operator is drawing back the shovel, the clutch, F, is now disengaged, the drum, B, revolves freely on the shaft so as to pay out the rope thereon, and the cord, C, is thus wound around its barrel; the chain, D, by the same motion is unwound, while the tappets on the disk, E, striking from below against the pallet, I, on the latch, J, lift the former as each tappet passes. When the workman has drawn the shovel back to any desired distance, he pushes the edge of the shovel into the grain and slightly slackens the drag rope; this

allows the drum immediately to be rotated in the opposite direction by the action of the weight on the cord, C. The result is that, as the tappets on the disk, E, strike the pallet, I, from above, the latter no longer yields, but is carried down, thereby lifting the pivoted latch, J, and freeing the end of the lever, G; at the same time the chain, D, being unwound from its barrel, allows the weight attached to rope, H, to pull the end of the lever, G, outward, thus, as is evident, throwing the clutch, F, into gear with the drum, B. The drum now rotated by the belt wheel winds up its rope, and, in so doing, drags the scoop, guided by the workman, toward the edge of the car, and thus hauls a large quantity of grain out through the door. Meanwhile the chain, D, is being wound up, and its length is so adjusted that, when the shovel has reached the door of the car, the tightening of the chain pulls the end of the lever, G, inward, thus throwing the clutch out of gear; at the same time the latch, J, falls over the lever, as before, holding it in place, when the parts are once more in the position noted in the beginning of the description, and the same operation is repeated.

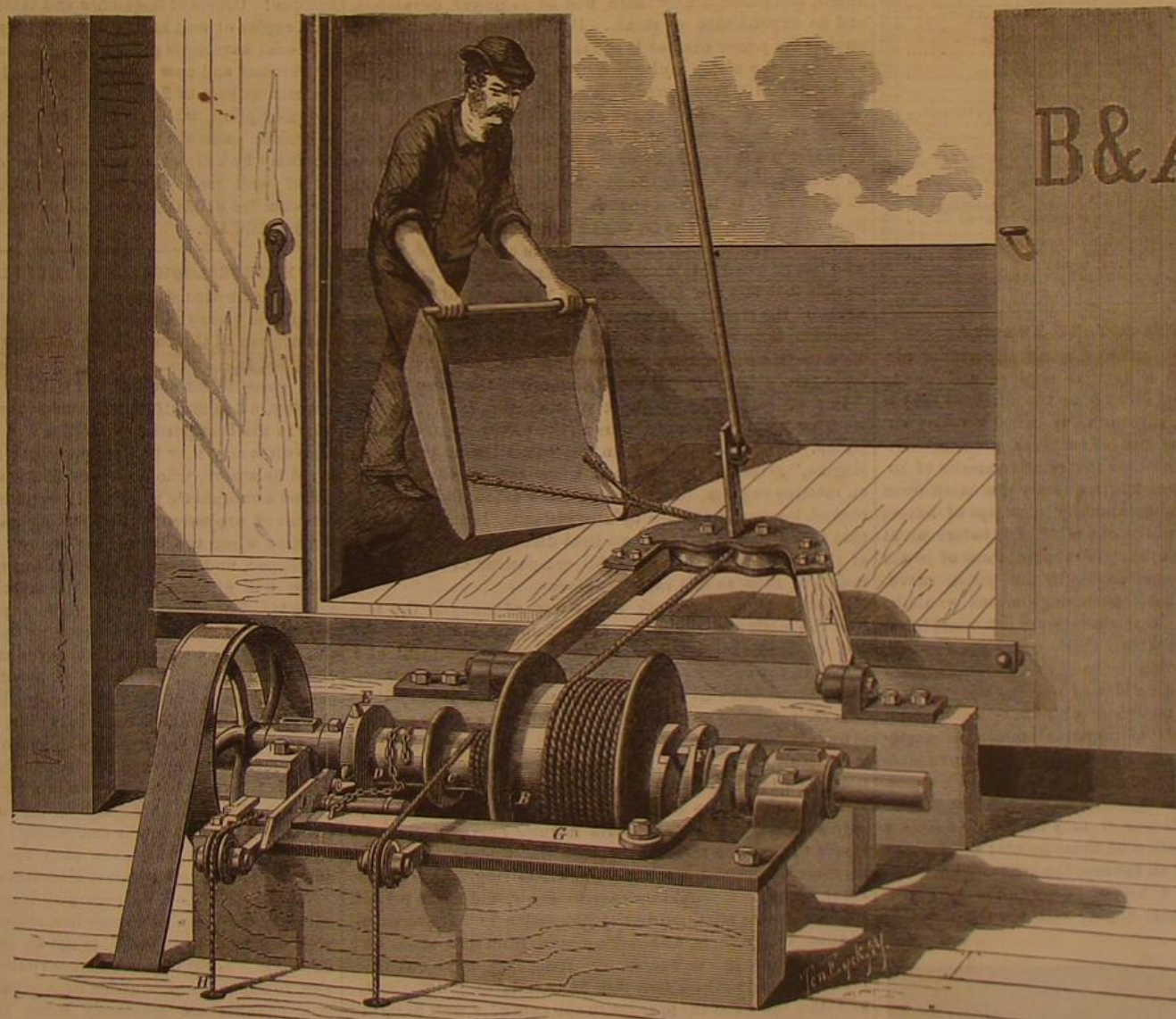
The main drum makes, we are informed, about fifty-five

revolutions and winds up one hundred and forty-five feet of rope per minute, so that the unloading is accomplished very rapidly and with no other labor than that of the single hand guiding the scoop.

In large grain houses several machines may be employed upon one line shaft extending past a number of elevators, and, where necessary, the apparatus may be arranged overhead. Single machines, like the one illustrated, may be used, or double machines, enabling two workmen to operate in one car at the same time, as circumstances may require.

The device is in use in many of the largest elevators of the West, and, judging from the many commendatory testimonials submitted by the inventor, is a valuable labor-saving invention.

It was originally patented by Mr. E. M. Clark, in 1864, and has since had combined with it improvements patented by Mr. John Beattie, July 6, 1869.



MACHINE FOR UNLOADING GRAIN.

For further particulars, address Mr. T. L. Clark, Newark, Licking county, Ohio.

Electrical Gas Lighting.

One mode of lighting numerous gas jets is by the electric spark, which is the sudden passage of an electric current through an aeriform body, producing heat, light, and sound. The electricity that produces a spark is of very high tension—that is, it moves with much greater velocity than the ordinary current from a galvanic battery, and hence possesses peculiar powers. This high tension electricity is generated chiefly by friction and by "induction," or the influence from a passing current in an adjacent conductor. It has little quantity, but great penetrating power, and might be compared to a bullet shot from a rifle, if a galvanic current were likened to a large stone thrown by hand. In igniting coal gas by this means, the sparks leap between the points of two wires that are brought together, but do not touch, at the orifice of the burner. The heat of the spark is sufficient to cause the ignition of the gas when this is combined with the air, but if the spark points be entirely immersed in the pure

gas, unmixed with atmospheric air, no inflammation will ensue when the spark passes, because pure coal gas is not an explosive compound, and a lighted candle introduced into an inverted jar full of such gas, is as effectually extinguished as if dipped into water. When the gas is mingled with a certain proportion of atmospheric air, or oxygen, it is readily and powerfully explosive.

The Late Sir Charles Fox.

During the forty-five years of his professional life, Sir Charles Fox was engaged upon works of magnitude in all parts of the world. As a manufacturer and contractor his works include the bridge over the Medway at Rochester; three bridges over the Thames at Barnes, Richmond, and Staines; the Shannon swing bridge; a bridge over the Saone at Lyons, and the Great Western Railway bridges. In roofs he executed those at the Paddington station, at the Waterloo station, and at the New street station, Birmingham, and slip

roofs for several of the royal dockyards. In railways we find him engaged upon the Cork and Bandon, the Thames and Medway, the Portadown and Dungannon, the East Kent, the Lyons and Geneva (eastern section), the Macon and Geneva (eastern section), the Wiesbaden and the Zealand (Denmark) lines. He also constructed the Berlin water works, in conjunction with others. During his practice under the firm of Sir Charles Fox & Sons, he was engineer to the Queensland railways, the Cape Town railways, the Wynberg railway (Cape of Good Hope), the Toronto narrow gauge railway, Canada, and, in conjunction with Mr. Berkley, to the Indian Tramway Company. In addition to these Sir Charles Fox & Sons were engineers to the comprehensive scheme of high level lines at Battersea for the London and Brighton, the London, Chatham, and Dover and the London and Southwestern railways, with the approach to the Victoria Station, Pim-

lico, including the widening of the Victoria railway bridge over the Thames. His two elder sons, Mr. Charles Douglas and Mr. Francis Fox, continue to carry on the firm of Sir Charles Fox & Sons, civil and consulting engineers, London. In personal character, Sir Charles was of a most urbane and generous disposition, and to few were these qualities better known, and by none were they better appreciated, than by those—now to be found in all parts of the world—who have been at one time or other in his employ. Sir Charles was highly esteemed by a large circle of friends, by whom the sad news of his decease, which took place on the 14th of last June, was received with no ordinary sentiment of regret.—*Engineering.*

A CORRESPONDENT, Mr. E. P. S., writes from Pskow, Russia, to inform our readers that the Mennonites, who are coming to this country in such large numbers, are not leaving home on account of any religious intolerance, but merely to avoid compulsory military service, from which they were exempt till the emancipation of the serfs abolished the inequality.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
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TERMS.

One copy, ONE YEAR	\$3 00
One copy, SIX MONTHS	1 50
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CLUB RATES: (Ten copies, one year, each \$2 50)	25 00
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VOLUME XXXI, No. 8. [NEW SERIES.] Twenty-ninth Year.

NEW YORK, SATURDAY, AUGUST 22, 1874.

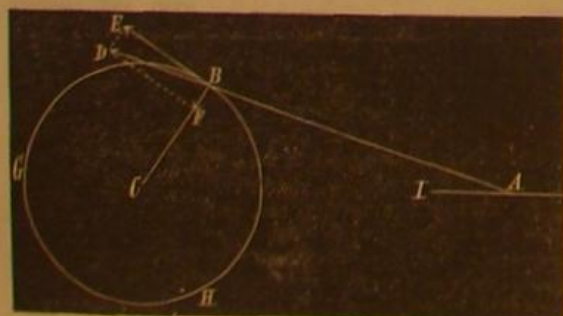
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ROTATIVE VERSUS ROTARY ENGINES.

An engine having a crank actuated by a reciprocating piston is commonly known as a rotative engine; and one in which the piston is attached directly to the shaft, so that it always moves in the same direction, is called a rotary engine. Each style of engine has advantages peculiar to itself, but the controversy between the relative merits of rotative and rotary engines is not infrequently discussed upon improper grounds. We are continually in receipt of letters of the same general tenor as the one which lies before us at present, in which the writer asks: "What percentage of power is claimed to be lost in a steam engine by the piston movement, and what is the probable percentage which would be gained by rotary motion?" Our readers are doubtless ignorant of the frequency with which these queries are sent to us. Our object, in this article, is to give a general answer on this subject. We have no idea of opening our columns to discussion on the supposed loss of power in the crank, any more than to arguments of perpetual motion or methods of squaring the circle. But there are numerous points of interest in the theory of the crank, and thorough explanations are only to be found in works which are inaccessible to many of our readers. Hence it may be well to devote a little space to the consideration of these points; and first we will endeavor to state with all fairness the argument of those who contend that there is a loss of power in the use of the crank as applied to the steam engine with the reciprocating piston.



Let the circle, B G H, represent the path described by the center of the crank pin, in one revolution of the engine; let C B be the direction of the crank, and A B, the direction of the connecting rod, at some given point of the stroke. The pressure on the piston is transmitted through the connecting rod to the crank pin at B, and may be represented in quantity and direction by the line, B D. But the only part of this force which can produce motion in the crank is that which acts tangentially to the circle at B, or perpendicularly to the crank, B C. This can be represented graphically by resolving the force, B D, into its components perpendicular and parallel to B C, by the principle of the parallelogram of forces; and this being done, it appears that B E, less than

B D, represents the part of the force on the piston that tends to move the crank, while the component, B F, acting in the direction of the crank, is apparently lost, as it has no effect in causing motion. Suppose, for instance, that the angle, B A I, between the connecting rod and the guides, is 30°, and that the pressure on the piston is 100 pounds. Then the force tending to move the crank is found (by multiplying the pressure on the piston by the cosine of 30°) to be only 86.6 pounds. At other points of the stroke, the effective pressure on the crank pin will be much less, being reduced to nothing when the direction of the connecting rod passes through the point, C, or when the crank is on the center; and the only point in which the effective pressure on the crank pin is equal to the pressure on the piston is that for which the connecting rod is perpendicular to the crank. Taking the mean of the effective pressures on the crank for successive points, it will be found that, if the mean pressure on the piston during a stroke is 100 pounds, the mean effective pressure on the crank pin will be 63.66 pounds. Hence, say those who insist that there is a loss of power in the crank, we have a loss of 36.34 per cent in a rotative engine, as compared with a rotary engine of the same dimensions. This, we believe, is a fair statement of the argument usually advanced by opponents of the crank, and as far as the facts are concerned they are correct; it is only the conclusion to which we demur. We will now present our argument, based on these same facts. An examination of the connecting rod, of an engine in motion, will show that the two ends pass over different spaces in a given time. If, for instance, in one stroke, the end of the connecting rod that is attached to the crosshead moves through one foot, the end which is attached to the crank pin, and makes half a revolution in the same time, passes through 1.5708 feet. Now power is something more than mere force or pressure; it is force acting through space. Suppose that an engine is placed with its crank on the center, and steam is admitted: no motion will be produced, and consequently there will be no power developed, and no expenditure of steam. But let the piston make a stroke: the power exerted is equal to the force or pressure acting on the piston multiplied by the space passed through, or it will be 100 foot pounds, assuming the data of the preceding instance. During the same time, the crank pin has passed through a space of 1.5708 feet, and the force or pressure exerted has been 63.66 pounds, so that the power exerted during this time, or the product of 1.5708 multiplied by 63.66 pounds, is 100 foot pounds. Hence there is no loss of power in the use of the crank, in theory, all the power exerted on the piston being imparted to the crank. The reader who has pursued this discussion attentively will probably be able to detect the fallacy in the argument of the opponents of the crank. It consists in confounding power and pressure, forgetting that a small force exerted over a great distance in a given time may develop as much power as a large force exerted over a small distance in the same time.

In practice, it is to be expected that the friction of the working parts will absorb some of the power exerted by the piston. Mr. Scott Russell, in his "Treatise on the Steam Engine," gives, as the result of some careful experiments on rotative engines, that the work done amounted to 90 per cent of the power exerted by the pistons. It may be added that this book contains an excellent discussion of the theory of the crank, as well as a careful comparison of the relative merits of rotative and rotary engines.

Another stumbling block in the way of many is the fact that the motion of the piston is continually stopped at the end of a stroke, preparatory to the commencement of a stroke in the opposite direction. But it should be remembered that while one end of the connecting rod is subject to this reciprocating motion, the other end has a rotary motion, always in the same direction. Now it will be found by observation that all single rotative engines are provided with heavy parts, such as fly wheel, disk cranks, and counterweights, which also have a rotary motion when the piston is in action. These heavy parts acquire energy during the stroke to continue the motion past the centers, where the pressure on the piston produces no effective pressure on the crank pin; and it would be easy to show, did space permit, that, by proper attention to the proportion and arrangement of these heavy parts, all trouble arising from what are known as dead points can be overcome. Indeed, most of our readers must have noticed that this trouble is only imaginary, and does not exist in practice in the case of a well designed rotative engine.

Our readers must not conclude from the foregoing remarks that we intend to induce inventors to give up designing rotative engines; we only wish to place the matter in its true light. If a practical rotary engine can be produced, one that can compete successfully with our best rotative engines in regard to economy and durability, the advantages of lightness, compactness, and capability of high piston speed are so important as to render its success almost certain. We only wish to dissent from the opinion that, other things being equal, the rotary engine is better than the rotative because the latter applies the power by means of a crank, thereby occasioning a loss, since this is not a fact.

THE FABRICATION OF ANTIQUES.

Apparently the most thriving branch of manufacture in the East is the production of pretended relics of the past, gems, coins, statues, ornaments, arms, written documents, everything that archaeologists can desire being turned out in quantity to meet the liveliest demand, and so skillfully done that the expertest judges find it difficult to detect the fraud. One of the most successful manufactories in Constantinople is devoted entirely to the fabrication of coins of the time of Constantine and his mother, to be palmed off on collectors

and tourists by confederate dealers who profess to obtain them from workmen engaged in pulling down old houses. A Greek monk in Athens drives a busy trade in spurious Greek coins, their composition regulated by such profound numismatic knowledge that much learning and great technical experience are required to distinguish them from genuine antiques. Equal adroitness is displayed in getting rid of his productions, which are never offered for sale in Athens, though it is known that they are sent by special emissaries to Constantinople and others of the larger capitals of Europe. The most successful agents, however, are herdsmen and shepherds of the provinces, who find a ready market among tourists and scientific explorers.

Spurious Mahomedan coins and gems are manufactured throughout the East, particularly in Persia, with surprising skill and boldness. A coppersmith in Shiraz is said to be able to supply anything of the sort—genuine, of course—that the traveling connoisseur may desire, as much as forty ducats having been paid him for a silver coin made in his own manufactory to represent one struck for the Khalif Ali. Bagdad sends forth gems on which Sassanian busts and Pehlevi inscriptions are reproduced with masterly skill; their only drawback is the fact that the characters, though admirably done, never admit of being reduced to legible words, much less to sense. The Byzantine coins made at Constantinople have the same failing. Dr. Mordtmann, who exposes these nefarious practices at great length in communications to a German paper, asserts—as evidence of the grave dimensions of the evil and the skill with which even experts are defrauded—that the great part of a large collection recently purchased in the East by no less a connoisseur than the Count de Gobineau, and described by him in the *Revue Archéologique*, consists of modern and spurious stones and medals. One of the stones bears an inscription of two words in Pehlevi characters, in which modern Persian, modern Greek, and Mohammedan elements are blended to form a pretended antique! Others of the stones and tablets are flagrantly evident copies of well known rock carvings in Asia Minor.

Special warning is given against a spurious gem fabricated by Persians and now offered for sale in Constantinople for the modest sum of 2,000 francs. The fraud is betrayed by the inscription, which, though handsomely cut, is only a bit of artistic patchwork. The recent swindling of the Berlin Academy by a Greek forger, and the reported purchase of a lot of well made Bagdad "antiquities" by the British Museum for \$10,000, are proof enough that the warning is not uncalled for.

METEOROLOGICAL AND MEDICAL STATISTICS.

A Boston scientist has observed that a diminution of atmospheric pressure, indicated by a low state of the mercurial column of the barometer, not only increases largely the gases set free by putrefactive fermentation, but even causes such gases to be evolved in localities otherwise considered healthy, often manifesting their presence by a nauseating odor in the best portions of cities like New York or Boston. This discovery may be unexpected by some persons; but it is not by others, who are aware that a similar effect of diminished atmospheric pressure is experienced in mines. Evolutions of explosive or suffocating gases are always more common when the barometer is low; while the evolution is stopped, and even the gases filling some galleries in the mines will disappear, when the mercury in the barometer ascends. The increased atmospheric pressure which causes the rise in the mercurial column prevents the expansion of the gases in the subterranean caves and crevices, and may in some localities, favorably situated for the effect, press the gas from the mining gallery or shaft back again into the recesses whence it was evolved by diminished pressure. All this explains the reason why explosions in mines seldom or never take place when the barometer is high, but usually when it is low; whence some mining masters always recommend special care in regard to the use of safety lamps, etc., when the mercury is descending; and at very low states of the barometer, they even stop the working in certain galleries of dangerous mines altogether.

We see then how dangers may increase from changes in natural conditions. A change in atmospheric pressure, which here is the inducing cause, is not an isolated illustration of this class. Local changes in gravitation, for instance, will also result in the production of unusual phenomena; such local changes are constantly being brought about by the moon, as seen in the ocean tide wave. When at new moon, the combined attraction of both sun and moon, acting in the same direction, diminishes the regular terrestrial gravitation in a certain locality; and when to this diminished gravitation, a diminished atmospheric pressure adds its influence, the terrestrial crust is more easily ruptured, and volcanic gases escape, especially in localities where its weight is scarcely sufficient to resist the upward pressure of the liquid or gaseous material confined under the solid shell which constitutes the terrestrial envelope. It has indeed been observed, in volcanic countries, that eruptions and earthquakes more commonly occur at new moon, and they are especially most common when, at the same time, the barometer—that is, the atmospheric pressure—is low.

That diseases like yellow fever, typhoid fever, fever and ague, consumption, etc., are more common in certain defined regions, and that some of these are confined within given belts of low, moist countries, and that they are comparatively unknown in certain dry, elevated plateaus, situated at from 5,000 to 10,000 feet above the surface of the ocean, proves that emanations produced by excess of moisture are powerful helps for the engendering of miasma; while a change of wind has often had the most striking effect in arresting the virulence of an epidemic.

KITE TAILS AND TELEGRAPH WIRES.

To keep the telegraph lines free from entangling alliances in a city like New York is no easy task, and the chief of sinners in this respect is the small boy's kite tail. As though presuming on the service to telegraphy rendered by one of their class in the hands of Franklin, these playthings—of future Franklins, let us hope—are incessantly taking liberties with the wires, breaking thereby their own continuity, and endangering the continuity of the messages the wires are intended to convey. To assist the kite tails in this mischievous work, naughty boys tie stones to strings and strips of cloth, and then sling them so that they wind round the wires, and suspend the stones—a perpetual menace to passers underneath. In this way the wires in many neighborhoods are made to resemble the limbs of an African prayer tree, with its burden of rags, tags, and strings hung on by pious wayfarers.

The effect is not ornamental, nor does it add to the efficiency of the wires, especially on rainy days. At almost any moment on the side streets you may see the telegraph men climbing the poles to remove the strings, or reaching for the nuisances with long rods like stout fishpoles, which they twist among the strings until they are firmly attached, then by main strength strip them from the wires, sometimes at imminent risk of the integrity of the wires and their attachments. We never see the operation without wondering at its clumsiness. Why not burn the strings? It would be an easy matter to attach a light to the end of a slender bamboo pole, so that the flame could be slid along under the wire, charring any string or rag it might encounter, thus dislodging the snarls that are so hard to remove by force. The light could be bunged, if need be, so as not to touch the wire or in any way interfere with the transmission of messages. A simple hook, or a grooved wheel at the top of the pole, would enable the apparatus to run along the wire so that it would be no trouble to guide it.

INFLUENCE OF THE EARTH'S FIGURE ON GEOLOGIC CHANGES.

The slow oscillation of portions of the earth's surface, now above, now below, the mean level of the sea, has long been recognized as an occasion of geologic changes, with their attendant alterations of climate and consequent successions of living forms. The cause of such oscillations has never been satisfactorily explained. The latest hypothesis comes from the Canadian geologist, H. Y. Hind, who shrewdly suggests that it may be due to the wavelike movement of the equatorial bulge which gives the earth the figure of a squeezed orange.

The reader may not be familiar with the fact—which has been established but a short time, comparatively—that the equatorial circumference of the earth is not a circle, but an ellipse, the diameter which pierces the earth from long. 14° 23' E. to 194° 23' E. of Greenwich being a little more than two miles longer than the diameter at right angles thereto. This gives on each side of the earth an equatorial ridge fully a mile high, which may have been much greater in earlier geologic epochs, when the crust of the earth was in a more plastic condition.

It is scarcely possible that this element of the earth's figure should form an exception to the universal rule of change, and be immovable. In case it does move, its influence would be felt on the elevation and depression of land, especially near the equator; on the simultaneous elevation and depression on opposite sides of the earth; on ocean currents, consequently on climate, etc.; on the thickening and thinning of formations to the east and west; on the flow of rivers, hence on river and lake terraces, beaches, etc. The geology of North America tallies singularly well with the effects of such a cause. The successive risings and sinkings of the continent appear to have always taken place very gradually and with a progressive motion from west to east and from east to west, as though produced by a vast equatorial undulation, moving, with extreme slowness, eastward at one epoch, westward at another.

The latest evidences of this great earth wave are seen in the stupendous escarpments which rear their wall-like fronts above the Ontario, Red River, and Saskatchewan plains, and in the symmetrical terraces and lake beaches so largely developed throughout the northern part of the continent. Mr. Hind looks to it, also, to account, in part at least, for the changes which diverted the water of the Great Lakes to the eastward, sending their drainage into the Gulf of St. Lawrence, instead of the Gulf of Mexico whither it originally flowed, leaving their ancient outlets southward to be filled with drift from 200 to 600 feet in depth.

Should corresponding effects be observed on the southern slope of the "bulge," and also on the opposite side of the earth during the same geologic periods, it is possible that geologists may find in the movements of this (now hypothetical) undulation the measure of time which they have been so long in want of.

OUR SIX LEGGED RIVALS.

It is a remarkable circumstance that those creatures which mimic man most nearly in mental and social development should be not his nearest allies among the vertebrates, but members of an entirely different order. It is something more than remarkable that they should stand to their order—the articulates—precisely in the same relation that man bears to the order with which he is classed.

Though surpassed in every detail of physical accomplishment by his subordinates, man nevertheless excels them all in intellectual power and capacity for self-improvement. Similarly our six legged rivals, though the least of the ar-

ticates, are first in grade of development, surpassing the next below them—the bees and the wasps—as man surpasses the lower mammalia. This in itself is not surprising; but it does surprise one to see them excelling the higher vertebrates also, and pressing hard upon man's prerogative.

Accustomed to find brain power associated with and measurably related to brain bulk, it is simply astounding to discover a few microscopic specks of nerve pulp—the ant's cerebral ganglia—harboring a degree of intelligence such as the infinitely more bulky brain of man alone gives evidence of.

We have printed a good deal of late in regard to the manners and customs of these interesting creatures, and think the facts will warrant the position we have taken.

The question is not one of difference between undeveloped reason and a high order of instinct, but of difference between instinct and instinct, reason and reason. In the first, which we are too apt to consider an attribute peculiar to the lower forms of life, the ant might possibly be accounted our superior. But ants also reason, profit by experience, make a judicious use of new means for the accomplishing of new ends or the overcoming of new obstacles, and in many ways exhibit a degree of quickwittedness and intelligence which we may look long for among many tribes of man.

The completeness and complexity of the social organization of ant communities, the magnitude and variety of the works which they plan and execute, the perfection of their military and industrial discipline, the evident scope and flexibility of their language, their sympathetic regard for each other in times of distress or danger, their forethought and calculation, have been celebrated by every observer of insects from Solomon to Belt; and the more they are studied the more do their various civilizations and the motives which animate the members surprise and delight us.

Now we see them roaming about as independent warriors or hunters—formic Iahmaelites or Indians—fierce, vindictive, self-reliant, and marvelously fertile in tricks and traps for the securing of their prey. Again they appear in organized armies, nomadic swarms without settled habitation, like the Tartar hordes of Genghis Khan, marching from conquest to conquest, sweeping all before them. Others are pastoral in their habits and more or less permanent in their habitations. In temperate regions they rear and maintain, on suitable plants, herds of honey yielding aphides and beetles, which they tend with assiduous care, transporting them from pasture to pasture, and defending them from their enemies and the elements as zealously as the shepherd does his sheep; in the tropics the same kind offices are performed for domesticated scale insects and leafhoppers, in return for the honey-like secretions they emit. Some constitute themselves standing armies for the defence of plants which yield them substance directly or by affording pasturage for their cattle. Others are a scourge to plant life, gathering leaves by wholesale to make hot beds for the cultivation of fungi in underground chambers.

The harvesting ant—which provideth her meat in the summer and gathereth her food in the harvest—has been proverbial for thrifty wisdom, certainly since Solomon commended her ways to the sluggard: how much longer, we have no means of telling. Had the wise man enlarged upon the way some of her kind have learned to secure plenty without labor by the enslaving of others—the raiding ants of our correspondent in Arkansas are probably given to the practice—his advice would doubtless have been more highly appreciated by lazy humanity, too many of whom have hit upon the same expedient without the help of revelation.

But wiser than the common harvesting ants are the agricultural ants of Western Texas—the only Simon Pure and original Grangers—who have solved the transportation problem, by bringing not the grain but the grain fields to market. They have learned—possibly through the gradual desiccation of that now almost desert region—that chance productions are but a precarious support in a climate like theirs, so they surround their communities with fields of rice grass, which they protect by killing all rival growths, and in due season harvest their crops, doing all by well timed and concerted labor. Could there be a happier illustration of that ideal state of organized industry and mutual helpfulness, which philosophers have dreamed of and enthusiasts labored for since Plato planned his Republic? As in Sir Thomas Moore's Utopia (reading ant for man), every ant has a right to everything; and they do know that, if care is taken to keep the public stores full, no private ant can want anything; for among them there is no unequal distribution, so that no ant is poor or in any necessity; and though no ant has anything, yet they are all rich.

We have seen how all the common attributes of mankind are mimicked by these six legged rivals of ours, to a degree unapproached by any other class of animals. But man, we are told, has a faculty higher than thrift, higher than fellow feeling, higher even than reason. It is the faculty of reverence, the basis of religion, whether manifested in the fetishism of the Fantee or the faith of the Christian. This the theologians are wont to declare is shared by no other terrestrial creature. But here comes the French observer M. Lespès, with a story which disturbs our sole remaining ground for pride of peculiarity, raising the suspicion that ants too may have a religion!

In the nests of certain ants, and nowhere else, there is found a species of blind beetles which appear to be entirely dependent on their voluntary guardians for food and shelter, yet make no material return for the kindly services they enjoy. To complicate the matter, some of the communities of this species of ants are found to be destitute of beetles, which they greedily devour the moment the beetles are exposed to them. On the contrary when the beetles are placed

near the nests of the communities which possess them, they are straightway fed and cared for most tenderly, and defended as resolutely as the ants defend their own young. Clearly the strongest of natural instincts, appetite, is somehow restrained in the case of these little keepers of asylums for the blind. What is the restraining influence?

Similar conduct on the part of a tribe of men would be unhesitatingly attributed to a rude sort of religious feeling; and Sir John Lubbock wonders whether something of the kind may not actuate these ants, whether they do not regard their helpless though relatively gigantic wards with a feeling akin to reverence. Is it possible that they have arrived at a stage of development parallel with that of the beetle-worshipping Egyptians?

In our pride of bulk, we despise the ants for their littleness. But suppose they were as big as horses, proportionately strong for their size, as thoroughly organized and as intelligent as they now are, where would we be?

SMALL ENGINES AND BOILERS.

A cursory examination of the correspondents' column of the SCIENTIFIC AMERICAN will show that many of our readers are building model engines and boilers. We endeavor, as questions in regard to their proper construction arise from time to time, to give useful hints; but in the limited space devoted to the answers, we have not been able to treat the subject as fully as seemed desirable. We have, however, taken note of the various points arising in connection with this subject, and it is our intention, at an early day, to give some general directions and rules for the proportions of small engines and boilers. Many of our readers can render us valuable aid in preparing a complete article on the subject, and we feel confident that they will be glad to help us, when the way is pointed out.

We desire to receive accounts of the performance of small engines and boilers, embracing the following data:

Description and dimensions of boilers, manner of setting, and means adopted for heating the water. Size and description of engine, pressure of steam, number of revolution, and work performed. Amount of water evaporated by the boiler per hour, expressed in cubic inches or cubic feet, also temperature of the feed. We hope that those of our readers who have small engines will take note of our request, and let us hear from them as soon as possible.

SCIENTIFIC AND PRACTICAL INFORMATION.

EFFECTS OF TORPEDOES.

Experiments are now being conducted at Cherbourg, France, in order to determine the effects of submarine torpedoes. An apparatus charged with 3,300 lbs. powder was sunk to a depth of 50 feet. On explosion a column of water 500 feet in height was thrown into the air, and a bulk anchored at a distance of 18 feet from the spot was broken completely in two. The earth at the bottom was torn up, making a hole 40 feet in diameter and about 5 feet deep.

NEW GLAZING FOR POTTERY.

A kind of lead glazing is used upon common pottery, the employment of which often causes cases of lead poisoning among the workmen. M. Constantin, of Brest, France, has recently devised a substitute which is said to be much superior and to possess the hardness and inalterability of glass. He uses silicate of soda, pulverized quartz, chalk, and a small proportion of borax. This glazing may be colored green by copper and brown or violet by manganese. It is already coming into use in many of the largest French potteries.

WATERPROOFING LINEN.

Professor Kühr gives the following directions for this purpose: Pass the linen first through a bath of one part of sulphate of alumina in ten parts of water, then through a soap bath, of which the soap is prepared by boiling one part of light colored rosin and one of crystallized carbonate of soda with ten parts of water until the rosin is dissolved. The rosin soap thus formed is to be separated by the addition of one third of common salt. In the soap bath the rosin soap is dissolved, together with one part of soda soap, by boiling it in 30 parts of water. From this bath pass the articles finally through water, then dry, and calender. Made-up articles may be brushed with the solutions in succession and be rinsed in the rain. Wooden vessels may be employed.

A COMPOUND ENGINE ROCK DRILL.

M. Jules Garnier, according to the *Revue Industrielle*, has lately devised a modification of the compound engine which he employs with great success in connection with rock drills. In M. Garnier's engine, the two cylinders are placed end to end and the two pistons are attached to the same rod. Two slide valves are so arranged that one serves to admit live steam to the small cylinder, while the other distributes the steam directly from the latter to the large cylinder. By this means the steam does not become condensed in passages or reservoirs between the two cylinders, and hence power is economized.

The inventor adapts this arrangement to drills which operate by compressed air. Ordinarily air at full force is used to drive the drill into the rock, and a second supply is needed to lift the tool back, the latter operation, of course, not requiring so much power as the down stroke. M. Garnier uses the air directly from the compressor to give his powerful stroke, and then exhausts it into a larger cylinder and uses it over again to lift the drill back. The single piston rod is retained working through the partition between the two cylinders. Further details of the machine, which will convey an accurate idea of its construction, will be looked for with interest.

THE TRANSIT OF VENUS.

On the 9th of December, 1874, the planet Venus will pass between the earth and the sun, and will appear as a round black spot traveling across the sun's face. This phenomenon is what is meant by the transit of Venus, and it is expected that by its careful observation data will be obtained by which, generally speaking, we shall be able to measure the distances of the heavenly bodies, their weight, and their dimensions.

As matters now stand, our knowledge of the celestial world in the above respect is not exact, although a scale of measurement has been approximately constructed. The last observed transit of Venus, which took place in 1769, gave us data on which our ideas of celestial distances are now based. But errors have been discovered in the observations, owing, perhaps, to the primitive instruments used. For example, the sun's distance, then estimated at about 92,000,000 miles, is now believed to be at least 500,000 miles too great. Naturally, the finding of such serious errors has caused great anxiety in the scientific world to make the coming observations perfectly accurate, and hence the transit will be watched with the greatest care by some two hundred observers, stationed in seventy different places where it will be visible: that is, in Northern India, Australia, New Zealand, Mauritius, Japan, etc., but not in the United States.

Now by means of the transit of Venus, it is expected that we shall be able accurately to measure the distance between the sun and our earth; and with this gage once established, it will be a very easy matter to apply it to the spaces between the orbits of all the other bodies of the solar system.

The most direct and valuable practical result of the determination of the sun's distance is that which enables us to tell the exact attraction of the sun for the moon, and hence to predict the motions of our satellite. Our lunar tables, by the aid of which we can determine longitude, will then be rendered, instead of approximately, absolutely correct. The result will be that the moon will become not only our nocturnal luminary, but a reliable clock, from which the astronomer or navigator can read the time with certain accuracy.

When Venus crosses the sun's face, the observers on opposite sides of the earth will see the planet on different points of the sun's disk. This will be clear from Fig. 1, where S is the sun, E the earth. If three observers, stationed at a, b, and c on the earth, note the transit at the same time, to the first the planet will appear to be at f, to the second at e, and to the third at d. In our second figure are shown the posi-

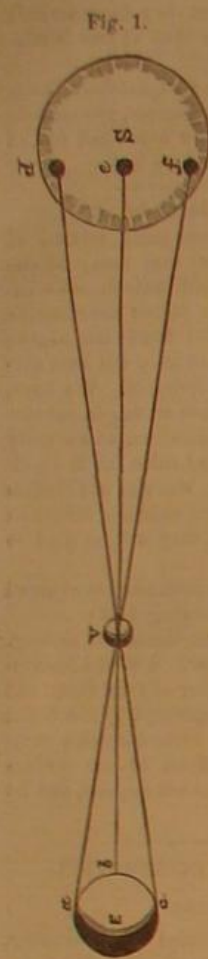
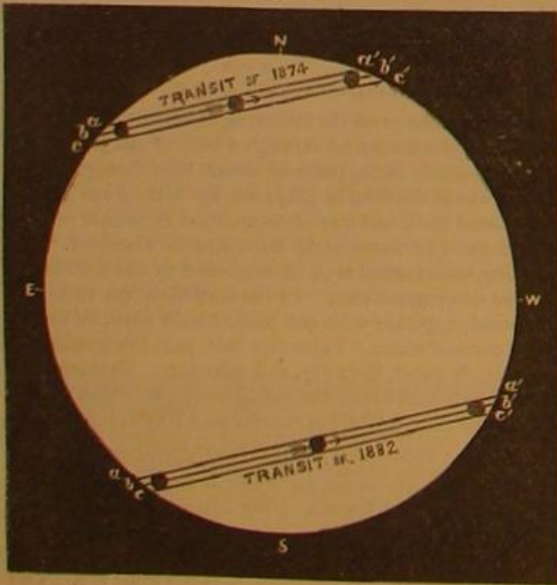


Fig. 2.



tions of the planet as regards the sun's disk in the transit of 1874, and also in the transit to happen in 1882. At northerly stations, Venus will seem to pass along the line c c'; at southerly points along a a', and at central points along b b'. The arrow shows the direction of the motion. Now, if we can measure the solar parallax—that is, the distance between lines a a' and c c'—we shall know the angle subtended by any known distance on the earth's surface at the distance of the sun, and hence be given the necessary means for the trigonometrical solution of the triangles, and the determination of the sun's distance.

To find this distance, various ways will be used. Observers stationed in both northern and southern hemispheres will measure the lines a a' and c c'. This gives the length of two chords of a circle, from which it will not be difficult to find the distance between them. This is called Halley's method. Then another way is for two observers, widely

separated, to note the exact time when the planet enters and leaves the sun's disk. The difference in the hour and minute recorded will show what effect the separation of the observers has on the apparent position of the planet. This is the principle of Delisle's plan. Besides this, the sun will be photographed, and the positions of the black spot as seen from different places can be afterwards compared. A new instrument, called the heliometer, will also be used to measure directly the distance of the black spot from the edge of the bright circle of the sun.

It is generally admitted that the United States has shouldered the most difficult share of the work, not only in appropriating the largest sum, but in accepting the most difficult stations. Of the latter our astronomers take eight—three in the northern hemisphere and five in the southern. The former are at Wladewostock, Yokohama, and in Northern China, the latter at New Zealand, Tasmania, and Chatham Island on the east, and Macdonald Island and the Crozets on the west. Our expeditions rely chiefly on Halley's and the photographic methods, but Delisle's and the direct plans will also doubtless be availed of. The whole transit will be visible at all the stations. We have already noted the departure of the Swatara, and of the various parties to their distant posts.

All the English expeditions, excepting one, which goes to Alexandria, in Northern India, in October, are already en route. They are stationed at Oahu and at Rodenck's and Falkland Islands.

The Germans send four parties to Falkland, McDonnell's, and Kerguelen Islands, in the southern hemisphere. France sends five expeditions—two to Northern China, one to Japan, one to Campbell Island, and one to St. Paul's Island. Russia has twenty-five stations in Siberia. Besides these national preparations, a number of private observations will be taken by parties under Lord Lindsay at Mauritius, and at the observatories of Madras, Capetown, etc.

Heat and its Relation to Construction.

The present extensive use of iron in building operations necessitates the careful consideration by architects of the molecular changes which that metal undergoes, owing to changes of temperature, and the consequent effect of the same upon the structure. It is well known that a powerful conflagration, occurring in an iron edifice, warps and twists the walls and facings to such an extent as to necessitate their prompt destruction; while a like casualty, taking place even in a brick building in which iron beams and girders are employed, is often apt to expand the metal so greatly that walls are dragged out of place and thrown down. Cases have also occurred in which, owing to careless construction, summer heat and winter frosts have caused serious deterioration in iron fronts and have necessitated alterations and the application of strengthening devices, involving considerable trouble and expenditure.

The *Building News* of recent date contains a carefully prepared article on heat and its relation to construction, which embodies several useful hints and suggestions.

It is somewhat surprising, says our contemporary, that architects and engineers so frequently neglect this expansibility of metal in girders, ribs, columns, etc., and provide no means for their free movement. Sometimes, it is true, the bearings of long girders in bridges are made of sufficient depth to allow for this increase of length; but even in these cases the mere weight of iron and superincumbent loads upon the points of support render the intended result nugatory, the weight of the iron girder alone often creating so much friction on the bearing surfaces as to overcome the rigidity of the supporting piers or walls, or the cohesion of mortar at certain points. This immovability of the ends of iron girders and joists is often increased by their being clenched or fixed by the weight of wall above, which often improperly is allowed to bear upon the top flanges.

To obviate this, some engineers have contrived movable bearings, more or less effective. One simple method we would suggest. Let each template be of cast iron of sufficient substance and bearing surface, and let it be placed upon an under template of stone or metal, the surfaces being either left smooth simply or brought into contact by a friction roller, of small diameter and of the length of the bearing surface. By this means free dilatation could take place, provided, of course, the ends of girders are left a free space of sufficient distance. No weight should be allowed to rest upon the ends of these beams, but in all cases the bearings should be free all round, and may be made as cast iron sockets, built into the wall, or standing out independently.

The linear expansion a bar of iron undergoes when heated from the freezing to the boiling point, or from 32° to 212° Fah., is about one 812th of its length; at higher temperatures, the elongation becomes more rapid. Thus the progressive dilatation of wrought iron, as determined by Daniell's pyrometer, allowing one million parts at 62°, is as follows:

At 212°.	At 662°.	At fusing point.
1,000,984	1,004,483	1,018,378

Cast iron is rather less.

It may be mentioned here, that the expansions of volume and surface are calculated by taking the linear expansion as the unit, following a geometrical law; thus the superficial expansion is twice the linear, and the cubic expansion three times the linear.

These figures show how sensible a change takes place when iron undergoes an ordinary variation of temperature; and it may be said that in all ordinary cases of building this change is quite sufficient to cause serious disruptions of parts. Thus a bar or beam of even 10 feet long and subject to an ordinary change of temperature, say from 32° to 180°,

will elongate more than $\frac{1}{4}$ of an inch—a sufficient modicum to cause fracture in stonework, to snap the thread of a screw, or to endanger a bridge floor or roof truss. When we think of lengths ten and even a hundred times this dimension, the danger of uncompensated expansion or contraction is increased a thousand fold. In ordinary cases, the margin of safety is really dependent upon the amount of flexibility or elasticity of the parts of a building connected with iron, or to imperfection of joints; yet we should not rest satisfied with such presumptive security.

It would appear that the most promising mode of using iron is in combining it with concrete, brickwork, and other materials; but it appears to us such a combination would be still more advantageous if the iron were completely imbedded or encased in such materials.

It appears that there are some substances particularly bad conductors of heat; such are brick earth, composed of a variety of bodies, and porous: porcelain, asbestos, pumicestone, charcoal, sand, etc. These substances are, in fact, such bad conductors that a red hot iron ball may be held some time in the hand if it be first coated with one of them. Such materials offer themselves as coverings for iron girders, columns, etc., and we do not see why compound materials of a porous kind, as animal charcoal and plaster, should not be applied to such iron work *in situ* by first filleting the girder or column, or surrounding it with a perforated plating of thin earthenware or metal on which to lay the coating, which could be run as molded work or finished ornamentally. A lining or casing of such materials, molded to the form of the iron to be protected, could also easily be prepared in cast blocks, rebated or grooved together, the external facing being molded to any section.

Animal charcoal should be one of the ingredients in the compound used, as it is one of the worst known conductors. Fire clay lumps could be well treated in this manner, or plastering—which materials have been suggested lately by recent English experiments which proved that iron protected with fire clay can withstand a fierce heat and yet remain uninjured in its elasticity, while the brick arching and concrete backing can resist any amount of heat likely to occur. We think, if an air space were left between such casing and the iron, it would provide a still more effectual barrier, though a few perforations would be required in the casing to allow the heated and expanded air to escape. If, also, brick earth mixed with charcoal were used, a still more effectual non-conducting casing would be obtained, and the iron would be comparatively preserved at a moderate temperature. By thus encasing a good conductor of heat in a bad one, the evils of expansion and contraction are avoided, or considerably lessened, and we are thus left the advantage of using in our construction a material which may aptly be called a "good servant but a bad master."

A FOUR-ANTLERED DEER'S HEAD.

The *American Sportsman* publishes a description of a remarkable specimen of the deer (*Cervus Virginianus*), the head of which carries four antlers, three on one side and one on the other. The editor of our contemporary gave the head a critical examination, and found that the antlers are located in their natural positions, having a total number of twenty-one tines—eight on one side and thirteen on the other. To the casual observer, no deformity at the base of either is perceptible, although a minute examination and strict measurement would reveal a slight variation in diameter at the extreme base. If there is any enlargement, however, it is indicated, if not visibly shown, above the burr.



The enlargement, if any exists, is so slight as only to be detected by the most skilled eye. At this point of the pedicle there appear to branch out three distinct antlers with tines. One very remarkable feature, as will be noticed in the engraving, is the fact that on either side of the head there projects from the burr a small tine, the one on the left resembling in size and shape a large tooth. On the right side can be seen, between the burr and the brow antler proper, an additional tine.

The engraving very faithfully represents a significant fact in connection with these horns, namely: the extreme points of the brow antlers curve naturally toward each other, while in other species they are quite erect.

TO AVOID explosions with hydrogen generators, adapt a safety jet made of disks of wire gauze placed in the delivery tube between plugs of cotton wool.

MODERN GERMAN ARTILLERY.

Our engraving represents a 10 inch 22 ton cast steel gun, manufactured by Krupp, the celebrated founder of Essen, Prussia, and now in use in the German artillery service for coast defence. The arm is made of two layers of rings or hoops over the barrel, and fires a shell of 423 pounds, with a charge of 66 pounds of powder, at 1,200 yards, through an 8 inch armor plate. The illustration shows the gun mounted in a sea fort, and resting on a thick bed of concrete so as to fire over an earth breastwork 40 feet thick, the muzzle of the

sufficient to fight a 10 inch gun, and for a long time can fire once every 1½ minutes, or about 40 rounds per hour.

NEW GEOLOGICAL DISCOVERY.

During the recent voyage of the Challenger, a discovery has been made, the significance of which must strike every one who gives the matter even a passing thought; but to those who possess a knowledge of chemistry or geology this discovery is of peculiar interest.

In sailing from Teneriffe, off the west coast of Africa, to

the depth and the character of the dredgings. When worked on the 1,500 fathom ridge, the dredge brought up *globigerina* ooze, multitudes of minute shells, and fragments of coral, the whole, with the exception of a few silicious sponges, being composed mainly of carbonate of lime. As the depth increased, the proportion of these shells regularly diminished, until in the deep water they had altogether disappeared, and the dredgings then consisted of a fine, red mud which did not effervesce with acid. This red colored deposit of the silicates of peroxide of iron and alumina was met with everywhere all over this vast submarine plain; everywhere it had the same unmistakable appearance; it could not, therefore, be the fine sediment brought down by rivers and carried out to sea, slowly settling in deep water, for then it must have differed in different localities; the absence of currents, too, as well as the great extent of the deposit, precluded this view of the origin. Another remarkable feature of this area was the absence of those pelagic shells which are littered in such numbers over all other parts of the bed of the Atlantic.

How, then, was this gradual disappearance of shell to be accounted for? Why was it that on this red mud area the shells of those animals that frequent surface waters were not found, since, when these creatures die, their shells must inevitably fall to the bottom? Whence came this enormous accumulation of impalpable clay?

Air dissolved by water is richer in oxygen and carbonic acid than the air of the atmosphere. The ratio of the carbonic acid to the total amount of dissolved gases is greater in water taken from a depth than in surface water.

If, to the depth of 3,000 fathoms, the amount of carbonic acid keeps on increasing, relatively to the other dissolved gases, in a ratio at all comparable with that indicated by the foregoing analyses, it is easy to see that the water at this depth, under such enormous pressure, must be capable of dissolving a large quantity of those solid substances which, like carbonate of lime, are soluble in water containing carbonic acid. It is clear, too, on account of both the pressure and the amount of carbonic acid being less, that water near the surface must possess a much feebler solvent power than water at a great depth. This being the case, we should expect to find more lime-secreting organisms in the shallower than in the deeper parts of the ocean; now, as has been seen, this is exactly what was found by the explorers in the Challenger.

Under these circumstances, Professor Thomson concludes that this vast deposit of fine red clay is neither more nor less than the insoluble portion of myriads of shells, the residue, in fact, of a chalk formation now dissolved.

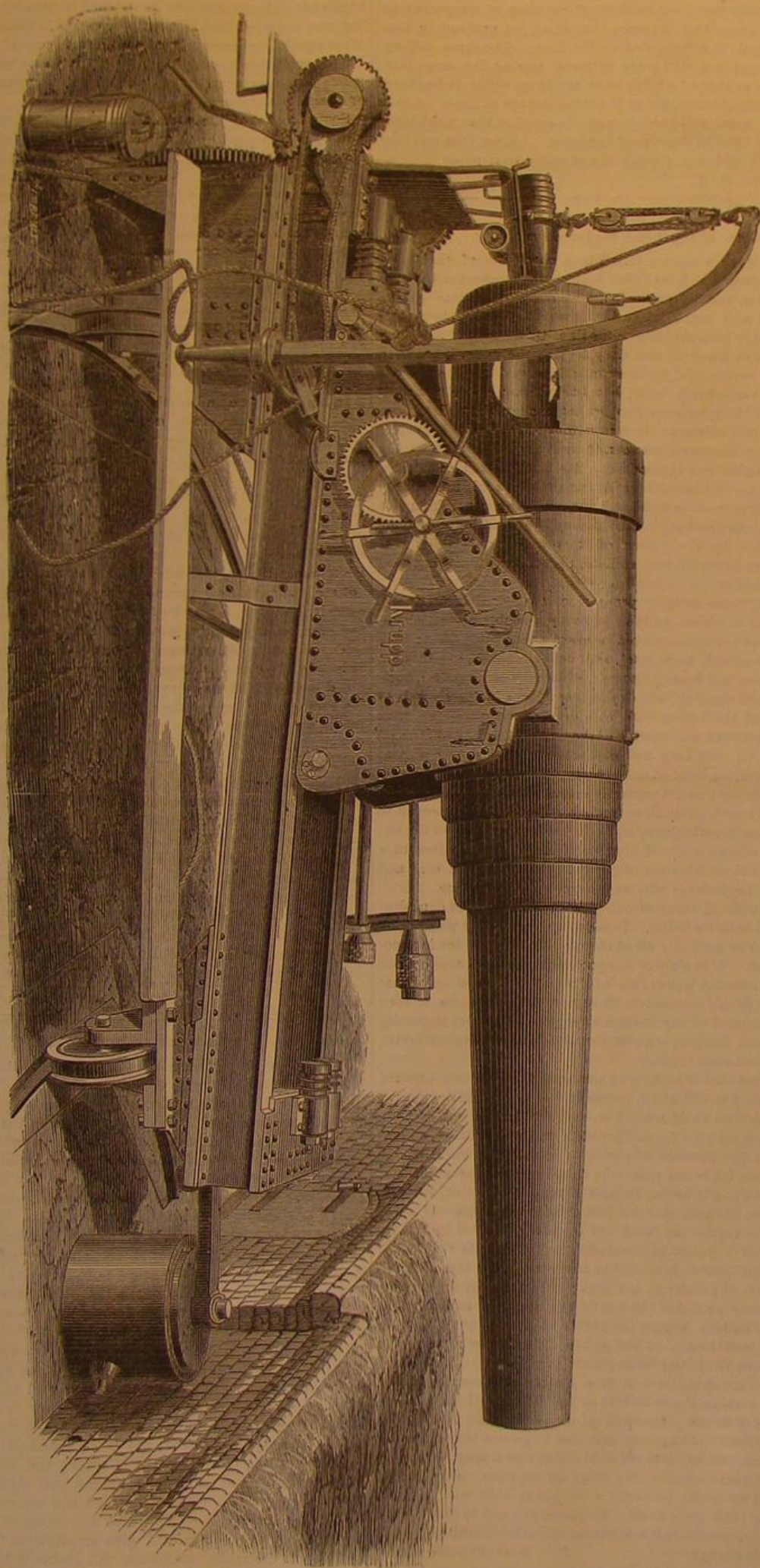
It appears then that, just as the higher regions of the Alps or the Andes are buried beneath a pall of eternal snow, so the higher regions of the sea bed are covered by a layer of grayish white ooze, prolific in organisms whose vacated shells will one day form chalk; and just as at the edge of the snow sheet the glacier melts away into a liquid, ocean-seeking stream, so, where the chalky covering of the sea bottom descends into submarine valleys, it descends into ocean, leaving behind it the red mud, like a terminal or bottom moraine.

Suppose, now, that a geologist should come across an ancient ocean bed, undisturbed by volcanic eruptions and undisturbed by denudation: he would expect to find, on the higher levels, chalk or limestone of some sort, and, as he descended into the lower plains, that the rocks would gradually lose their calcareous character, passing from chalk to argillaceous limestone, from that to a calciferous slate, and finally into slate containing no lime whatever.

There is every reason to believe that the fine red clay accumulation is but incipient slate rock.

If, then, the great bulk of these rocks be removed from the category of mechanically formed, into that of chemically formed, or of organic, rocks, it will appear that geologists have been in the habit of underestimating the importance of organic processes as geological agents. We will no longer be able to affirm with confidence, of a single grain of the commonest materials found on the earth's surface, that it has not at one time or other been associated with the manifestation of those mysterious forces which we call living. Our globe therefore resolves itself into a great charnel house or mausoleum. Man has been called a plagiarist from oxen and sheep; but his house, whether it be of mud or of marble, is equally a plagiarism from the deserted dwellings of the invertebrata.

The tendency of modern geology has been to break down the well marked divisions into which the older geologists were wont to parcel out past time. The old notion, which in some measure still clings to the terms Devonian, carboniferous, cretaceous, etc., was that of a distinct period in the history of the earth. Each of these epochs was conceived to have begun and closed before the succeeding era began. In this way the world was believed to have passed through so many stages, in each of which only rocks belonging to that particular formation were deposited anywhere on the earth's surface. Thus, all the rocks of the gneiss were thought to have been formed before the lowest of the Cambrian began to be laid down; similarly with the succeeding silurian and Devonian systems. Now, however, these terms are used without reference to time, and we think of systems, widely separated according to the old method, being formed simultaneously. The chalk age was formerly supposed to have come to an end at a period long prior to man's appearance on the earth, but the researches of Carpenter, Thomson, Huxley, and others have established the "continuity of the chalk," and shown that a fauna, very similar to, if not identical with, that of the chalk, inhabits the Atlantic at the present day. The discovery of this red clay seems to point to the continuity of those ages when slate rocks were supposed to



THE KRUPP 10 INCH CANNON

piece being 7 feet above the platform. A tramway, not shown in the engraving, runs behind the guns upon the terreplain, upon which trucks loaded with projectiles, after being hoisted up from the casemate below the gun platforms by means of a hydraulic lift, carry the required ammunition to the battery. The trucks are so high that the projectiles can be rolled from them direct upon the platform, where two davits with tackles receive them and lift them up to the breech. In the engraving a shell is shown just entering. The arrangements are said to be so perfect that six men are

St. Thomas, one of the outlying West Indian islands, the soundings indicated that the bottom of the Atlantic rose into a ridge about 300 miles west of Teneriffe, and that from that, where the depth was 1,500 fathoms, it sloped gently down until, at 750 miles west of Teneriffe, it had sunk to a depth of 2,950 fathoms. From this point to within 300 miles of Sombrero, the depth was pretty constant, and for 1,800 miles the explorers seem to have been sailing over what geologists term a plain of marine denudation.

A remarkable relationship was found to subsist between

have attained a maximum, that is, of the Cambrian and Silurian formations.

Chalk deposits and coral reefs are, by a process of metamorphism, converted into crystalline limestone, and by the action of sea water even into dolomite. Granite and other so-called primitive rocks have been shown to be in many cases only metamorphosed sedimentary strata, so that we are unable to say in what particular line the recurring cycles of geological operations began; nor, on this account, can we assert, except in the case of species which have become extinct, that the fauna of any preceding differed from that of the present age.

When this red clay comes to be slate, the only traces of life it can exhibit will be derived from silica-secreting organisms of a low type, like those doubtful appearances in older slate rocks which have been described as fossils. It is therefore altogether unwarrantable to regard this low type as the sole, or even prevailing, form of life during the time when these rocks were formed; nevertheless, there have not been wanting supporters of this view.

For aught, then, that geology can say, while the oldest rocks of Britain were being laid down in 3,000 fathoms of water, far away Silurian man may have been cultivating vines on the fertile slopes that flanked the volcanoes of the period.—A. S. Wilson.

Correspondence.

Hardening and Tempering Tools.

To the Editor of the Scientific American:

It has been with no inconsiderable degree of interest that I have read Mr. Joshua Rose's several papers, published in your recent issues, treating on machinists' tools and their treatment in forging and tempering for specific purposes. He prefaces his remarks on tool hardening, in his fourth paper (in your issue of July 11), with the remark: "The degree to which a tool may be hardened is dependent in a great measure on its shape;" and he states what particular shapes or forms of tool require special treatment, in forging and tempering, to render them of maximum utility. With very great clearness, he sets forth the practice of lowering the degrees of hardness by watching the hue assumed by the polished surface of the tool that had been immersed in water at a "moderate red" after it had been reheated, or allowing that part of the tool that had not been immersed to impart its heat to the part that had been immersed to "draw the temper," or obtain the required degree of hardness or tenacity: while in other specific cases, he states that tools require to be "as hard as fire and water can make them." His several papers have evinced considerable practical knowledge, and he evidently writes his experience with great perspicacity.

I would not now have obtruded upon you had I not noticed, in your issue antedated August 1, a communication from Mr. John T. Hawkins, in which he makes an extract from one of a series of lectures he had delivered to the engineer class at the Annapolis Naval Academy, in 1868. "It is safe," he had stated in this lecture, "to say that a cutting tool cannot be too hard for any purpose whatever, so long as the edge will not crumble or break up." Mr. Rose, in his paper, says: "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," and enumerates the several steels (with the makers' names) capable of such treatment. Mr. Rose, treating his subject in quite a masterly manner, states that tools for particular kinds of work require to be "as hard as fire and water can make them," while the temper of others, for other special service, should be "lowered in temper" (hardness) "to a light straw color, which leaves them stronger than they would be if hardened right out," that is, changing the condition of the tool by sudden immersion and allowing the tool to remain in the fluid until cold or of a temperature equal to that of the fluid, for he also states (and correctly) that the "chill should be taken off the water." Mr. Rose is evidently giving the result of his experience, for the benefit of those who have not had the varied experience he evinces in his papers on tools and their treatment under the elements of fire and water. His language is plain; he makes the object of his investigation speak, as it were, in its own language.

Steel or iron, immersed in water at a "moderate red" or white heat, hardens. In this Mr. Rose and Mr. Hawkins are agreed; but Mr. Hawkins states that Mr. Rose makes his "greatest oversight" in the final operation of drawing the temper, and adds that to "give simply a certain color to a tool is the least of what is required to be known or observed." By whatever chemical action or cause the various hues appear, that guide the operative in tempering tools, it is doubtless a natural law or sequence, and, as such, is subject to conditions. The different hues will appear, faster or slower, which alike are subject to conditions of degrees of temperature at which they commence to evolve, rapidly at high, and gradually at low, temperatures, to produce what Mr. Hawkins calls "films of oxide."

I have failed to see where Mr. Rose has made his greatest oversight. Mr. Rose states: "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," etc. Mr. Hawkins says: "If a tool be dipped at the lowest temperature at which it will harden at all, it will be harder when ready for use than if dipped at any higher temperature, if required to be drawn at all."

Here the gentlemen in question evidently mean the same thing, namely, that low temperatures are best for tempering

tools. Each seems to regard the color evolved during the process of tempering tools as important. Still while Mr. Rose speaks of positive colors, Mr. Hawkins treats of conditions. Mr. Rose treats things as they are and as they appear to every observer, and advises the easiest means to the end. Mr. Hawkins writes of films of oxide and conditions necessary to produce them, as if they were negative or absent. Mr. Rose, on the contrary, mentions them as ever present and attendant upon the operative for him to avail himself of.

Many tool drawers there are who regard the hues evolved in the process of drawing the temper as the steel maker or iron maker does those evolved or emitted by the spectro-scope, while watching to shut off the blast at the proper instant of time; and it seems that the hues evolved in tempering tools is so regarded by Mr. Rose. The hues will appear sooner in a thin piece of metal having the same temperature as that of a thick one; but these differ in hardness or tenacity if immersed at the same instant of time. A thin piece of metal will harden more thoroughly than a thick one and will differ in degrees of hardness. I hope that you may deem my criticism worthy of a place in your paper.

Trenton, N. Y.

JUAN PATTERSON, C. E.

Steam Cars.

To the Editor of the Scientific American:

Some months ago I referred to a short line of three feet gage railway which was then being put in operation between Worcester and Shrewsbury; and since that time I have watched with much interest the working of the steam cars which have been running on the line. On account of the heavy grades, one hundred and sixty feet to the mile, it has been a pretty severe trial for these machines, and they have stood the test remarkably well; but I think that a slight modification in their construction would render them far more durable and efficient. It was demonstrated practically and in a most thorough manner, seventy years ago, that the steam engine was applicable to the hardest kind of locomotive work. Where Oliver Evans propelled his mud scow, weighing sixteen or eighteen tons, over the sand, from his shops along the bank of the Schuylkill, a distance of some two miles, by the power of its own engine—which was about five horse—it was sufficient proof that the thing was quite feasible.

During these seventy years since that exploit of Evans, the thing has been verified in every possible way; locomotives have been constructed in every conceivable form: with boilers vertical, horizontal, and both combined; with one, two, three, and four cylinders; with cylinders vertical, horizontal, and slanting, with cylinders placed inside as well as outside of the boiler, with cylinders of unequal size, with cranks between and outside of the drivers, etc. And the result of all this long and costly experience is our present locomotive, an ideal at once of simplicity, symmetry, beauty, and efficiency; and it certainly seems that a model which is the outgrowth of such an ordeal, and which has proved so so eminently satisfactory and efficient for the whole of the immense railroad work of the world, ought to be more of a guide for those who are engaged in making steam cars and traction engines for whatever purpose of locomotion.

The great efficiency of our present locomotive is doubtless chiefly due to its boiler. It seems to be the only plan which possesses so perfectly all of the qualities needed for locomotive work. It is simple, compact, accessible for repairs, has vast generating power; all of its parts exposed to intense heat are deeply covered with water, and, of course, it may be constructed of any desired strength. Its center of gravity is low, and this part is an important item in the construction of all locomotive engines.

I believe that if makers of steam cars or traction engines of any kind would adopt precisely this type of boiler for the foundation of their machines, and then make and correct their running gear in as thorough and symmetrical a manner as is the practice of our best locomotive builders, we should see far better results in this line of engineering. The common upright boiler, though an excellent boiler for certain uses, is unsuitable for first class locomotives. If made short, the tops of the tubes are too much affected by the intense heat required to maintain the 120 or 150 lbs. to the square inch, which is necessary to do the work; if made long, the center of gravity is too high; if made with an annular steam chamber above the top of the tubes of sufficient capacity, this also brings the center of gravity too high, and also renders the top of the tubes unhandy for repairs. In either case the boiler lacks generating power.

I have much confidence, as a matter of economy, in the idea of making the cylinders of locomotives of unequal capacity, say in the proportion of three or four to one, the small cylinder exhausting into the large one through a superheater, but so arranged that direct steam may be used in both cylinders whenever an exigency requires. Our present locomotives might be easily arranged in this way without affecting their style at all. In passenger and express work especially, considerable economy would doubtless result from this change.

F. G. WOODWARD.

The Zodiacal Light.

To the Editor of the Scientific American:

The erroneous assertions made by one of your correspondents (page 371 of the number for June 13), in regard to the zodiacal light, ought not to remain uncorrected. He says: "The zodiacal light is not on two sides of the sun, neither is it all around the sun; but, on the contrary, it is ever on one side of the sun only, his hinder side, if you will," etc. This error proceeds from the fact that he judges only from its appearance in our latitude, where we see this phe-

nomenon distinctly only in April and May after sundown, and in October and November before sunrise. If this were the case over the whole earth, his assertion might have some foundation; but as in the southern hemisphere it is not visible at the periods stated, but only distinctly seen in April and May before sunrise, and in October and November after sunset (exactly at the very times that it is invisible in our northern hemisphere), the assertion that it is only at one side of the sun falls to the ground.

Between the tropics this phenomenon shows itself the whole year round, every morning and evening, with great splendor. Humboldt states, in his "Cosmos," that in the highlands of South America he watched it morning and evening, and observed that it sometimes varied in brilliancy, and often equaled in luminosity the brightest spots of the Milky Way; sometimes it was weaker, but it was always there, whether the observer was on land, or on the mountain tops, or at sea, on shipboard.

Some account of the latest observations between the tropics were furnished by Chaplain Jones, of the United States Navy, who observed it in the years 1856-57 from the elevated equatorial region in which the city of Quito is situated. His observations verified the fact that the light is entirely confined to the region of the zodiac; that it was very strong in the central band and broadly diffused at the sides, where it gradually faded away; however, a boundary line between the stronger and weaker portions was quite distinct.

He not only saw the light every night, but at midnight at both sides of the horizon, in the east and in the west at the same time; and during favorably clear nights, it extended as a broad, luminous arch over the zenith, entirely from one horizon to the other, having a pale white luster, and a breadth of about 30°.

In high northern and southern latitudes it is never visible, as the ecliptic is too much inclined to the horizon; in the temperate zone, it is only visible in those periods of the year in which the zodiac is as nearly perpendicular to the horizon as possible. In the northern hemisphere, this is the case in April and May, at evening, and in October and November, at morning; and in the southern hemisphere, the cases are reversed. At other seasons, our atmosphere obstructs the diffused light from reaching our eyes, as it is too far from the zenith, and this is the sole reason that we do not see it always, as is the case between the tropics. In December, however, it may be faintly observed, both morning and evening, even in the latitude of New Jersey.

The discovery of Professor Wright that it is caused by the reflection of solar light from solid meteoric material, combined with the above observations, proves that this zone of meteors extends beyond the earth's orbit, and that the earth moves among them. It is certain that they revolve around the sun, so as to counterbalance solar gravitation, and it is highly probable that, in regard to their orbits and velocity, they are subject to Kepler's laws. In the course of ages, their mutual gravitation causes some of them to combine, and so their number must diminish; while also, from time to time, the earth, Mars, Venus, and Mercury appropriate others of them. In regard to our earth, at least, we know that the fall of meteorites is not a very uncommon occurrence. It is probable that our whole planetary system has been made up in this way, and that the different belts of meteors, the zodiacal light, the asteroids, etc., constitute what there is now left of the material from which sun and planets were primitively formed by the action of universal gravitation.

New York city.

P. H. VANDER WEYDE.

The Business Outlook.

In a time of drouth, it is safe to predict rain, because we know that in the economy of Nature there is an inevitable law of reaction; and in a period of business depression, we know that it cannot always last, because the elements exist which are certain to bring about renewed activity. These elements are manifest and visible all around us. The great staple products of grain and cotton, to say nothing of other crops which promise an abundant yield, will in a few weeks add untold millions to the wealth of the nation. There is midsummer stagnation now, and dullness prevails in all departments of trade and manufacture; but is it rational to suppose that the crops now maturing are to be gathered in to rot in warehouses, that exchanges and consumption will cease, the reduced stocks of general merchandise remain un replenished, and the accumulation of unemployed capital wait in vain for profitable investment, and all because a few railroads have been built on speculation, and have come to grief for the lack of capital and earnings to meet their obligations? We admit there is a present want of confidence in railroad securities which ties up capital and keeps it in abeyance; but it is a significant sign that, notwithstanding the Wisconsin imbroglio and the record of embarrassment and bankruptcy of the past eight months, choice securities are more in demand and command better prices than before the panic. The movement of the crops which must soon begin will give employment to capital and also to the roads; confidence will gradually be restored, the machinery of trade set in motion, and the activity thus inaugurated will be legitimate and lasting. The crippled roads will gradually get upon a better basis; and with the natural development and increase of traffic, there is no reason to doubt that existing lines will be improved, and new ones constructed wherever they are really required. If this is a rose colored view of the situation, not justified by present appearances and indications, then the history of previous revulsions in trade and business is no criterion by which to judge, and any speculation in regard to the future is of no avail.—National Car Builder

Concrete as a Building Material.

In a paper lately read before the British Association of Gas Managers, by Mr. J. Douglas, of Portsea, upon the subject of making gas tanks of concrete, he presents the following information: "At the London Exhibition of 1851 it was found that a beam of pure Portland cement 14 inches long and 4 inches square, fixed at one end, bore 1,580 lbs. at the other, which is about half the strength of Riga fir. The reduction in strength by mixture with sand was the subject of experiment this year by Mr. Lamb, of Newcastle on Tyne, who found the following remarkable results.

	Pure.	1 cement and 1 sand.	1 cement and 2 sand.	1 cement and 4 sand.
7 days.....	830	550	375	77
113 days.....	1,065	859	580	234
Increase per cent.....	36	55	60	200

The inference he draws from these figures is that, seeing that pure cement at 7 days is ten times the strength of mortar containing one cement and four sand, and at 113 days is only five times the strength, there is good reason to believe the process continues till there is very close approximation. In corroboration of this, Mr. Colson, of the Portsmouth Dockyard Extension Works, who has tested within the last few years about 80,000 tons of cement, has furnished me with the following figures respecting the relative strength of pure cement and one cement to two sand:

	Pure cement.	Increase per cent.	1 cement and 2 sand.	Increase per cent.
6 months.....	1,200		246	
12 months.....	1,400	16.6	404	64.2
3 years.....	1,600	33.3	1,174	377.2

These are extraordinary results, no doubt, but they are the average of many tests, and most of us will be able to appreciate them when we remember with what difficulty a piece of brick and cement mortar in the above proportions can be broken; frequently the brick gives way before the cement joint. I have at this moment a slab of concrete, 10 feet by 8 feet 6 inches and 12 inches deep, in all 85 square feet, bearing 6 cwt. to the square foot without any appreciable strain. On the other hand, the resistance of Portland cement concrete to compression is greater than that of any of our best building materials. At nine months old, the comparison stands thus, upon a block showing 40 inches of surface:

Portland stone.....	47 tons.
Fire brick.....	50 "
York landing.....	96 "
Portland cement.....	120 "

Experiments were made by Mr. B. P. Smith, the well known engineer, for Mr. Hawkshaw, prior to determining the foundation of the Spithead forts; so that, whether for resistance to crushing weight or to tensile strain, Portland cement concrete is stronger than any other ordinary materials.

Chemical and Galvanic Action upon Teeth.

Dr. S. B. Palmer, of Syracuse, N. Y., publishes in *Johnston's Dental Miscellany* an interesting paper on chemical and galvanic action upon the teeth and the material used for their preservation. The author appears to have conducted extended original investigations into this curious and important subject, the results of which will be found below, condensed from the article above mentioned. He considers that chemical action and the electric current stand in the same relation to each other as do electricity and magnetism—inseparable. This brings us to consider the action of the force upon the teeth. We adopt the theory that chemical action, which results in the disorganization of the teeth, is stimulated generally by acids. An investigation of the constituents of tooth bone and its surroundings warrants such conclusions, and numerous recorded experiments attest the same. Calcium, magnesium, and sodium are ingredients of dentine; the saliva in which teeth are bathed is usually alkaline; the calculi which become attached to the teeth are also of the same nature, having no chemical action upon the bone or dentine. Having decided that these agents are acids, how do they find their way to the mouth?

Chemically speaking, the oral cavity is an electro-chemical cell and laboratory, in which Nature employs certain forces, that act by laws as inflexible as Nature herself. Mechanical force for crushing and pulverizing is furnished in mastication; heat and moisture are not wanting to facilitate fermentation.

Saliva contains chloride of sodium and soda; galvanic currents decompose this compound, the chlorine unites with the hydrogen derived from the water of the saliva, and hydrochloric acid is the result. We have sent the current from two cells of Daniell's battery through litmus paper wet with saliva, and been able to write, in acid, characters with the copper wire forming one pole of the battery. Hydrochloric acid is the result of decomposition of saliva by the current. The singular combinations of nitrogen and oxygen as satisfactorily explain the manner in which nitric acid finds its way to the teeth. Abundant material is furnished in the lodgment of meat fiber, rich with nitrogen, also in other articles of food that are permitted to decompose between the teeth.

The galvanometer teaches that the filling and tooth in which it is inserted, or an approximate tooth, are sufficient for two elements, the saliva of food forming the third; or, by union, a more complex current may be established. We take gold foil as a unit, or negative element for our experiments; with it and tin, we make a test and pronounce tin positive to gold, or, in chemical language, it is an electrolyte, a substance that is oxydized, or, if a compound, that is decomposed. We find tooth bone, also an electrolyte, or positive; the gold will remain a negative. Between the tooth and the gold, the action of the needle will be slight; between the tin and gold,

very great. The tenth part of a grain of each will deflect the needle fifteen or twenty degrees. Tooth bone and tin foil are both below the gold, and both positive to gold, therefore electrically nearer to each other than either is to gold. The trial of tin and the teeth shows but a slight difference, the tin occupying the place of gold, still throwing the action and consumption on the side of the tooth.

Substitute alkali for acid, and the current is reversed; the bone now occupies the negative, and the tin the element oxydized. There is less galvanic action between tin foil and tooth bone, than between gold and tooth bone. In other words, a loose porous tin filling would be better in a tooth than a gold one in the same condition. If the saliva be alkaline, the tin might be blackened and wasted away, while this action would throw the tooth into the electro-negative condition to be preserved. In an acid saliva the tin would be oxydized upon the surface, and by that means form an insoluble compound to greatly lessen further action.

Gold, being so far superior to tooth bone, throws the latter into positive relations with itself, be it in a poorly applied plug, or in approximation to another tooth, or in a clasp for the support of an artificial denture. In the latter case we need not look for base solder to prompt the action. The only remedies to correct the evils that arise from this source are cleanliness and perfect filling. A gold filling so imperfect as to show discolor will in time enlarge the cavity.

A tooth containing an amalgam plug has in it the elements of a minute yet intense battery, capable of decomposing not only the plug, but the tooth around it; this is in accordance with a law of chemical affinity. The moisture in the tooth bone is sufficient to communicate the current which exists in the plug, to the tooth, and thus enlarge the cavity, or diminish the plug, or both.

The galvanometer shows that the intensity of a current between two elements in a battery increases as the metals approach each other, inversely as the square of the distance from one to four. In the amalgam, the elements are in the nearest possible relations. The smallest possible particle of gold and tin or amalgam, even the dust that may be taken from separating files used for those metals, shows decided action, by turning the needle. On separating the elements a short distance, no action is perceived. Thus minute surfaces, excited in close proximity, equal larger ones at a distance. Again, a current, if very feeble, continued for a long time, is equivalent to an intense one for a short period.

In view of the above statement, the importance of thorough amalgamation of the compound, and cleanliness of the mouth, cannot be ignored. Amalgam should be resorted to, as the physician resorts to other mercurials, to arrest a violent and threatening disease. A tooth, that would be speedily lost without it, is a proper tooth to be preserved by it.

Iron Dams.

The *Elmira Gazette* urges a new departure in the method of constructing dams. It says:

Masonry is but a little better than earthwork when opposed by rushing water. What is needed, it seems to us, is material which will not crumble or break up when attacked by rushing water. A dam might be constructed with a frame work of iron, held by subterranean guys anchored beyond the reach of the water. The foundation could be planted in a rock bed, or, in the absence of rock, against a system of piling, so as to be absolutely immovable. Thus strength would be attained. By planking the iron frame and covering the latter with earth or cement, tightness would be secured. This system would achieve one end, at least. In case of a break in the dam, no disaster could follow to the region below, because only a small portion would give way and the water would escape comparatively slowly. The anchor could be so disposed as to render complete giving-way impossible, or at least improbable. The matter of cost, and the process of rendering the iron durable as against rust, are matters for engineers and iron makers to consider. We believe that, for dams as well as bridges, iron is destined to come into use.

[We have no doubt, as the *Gazette* suggests, that dams of almost absolute security could be made of iron. The only difficulty is the expense. The interest on the outlay would in many cases pay or nearly pay for the fuel required to produce an amount of steam power equal to the water power furnished by the iron dam.—EDS.]

How to Tell a Goose from a Gander.

In sorting out a flock of geese for home breeding or to make sales, it is often difficult to distinguish the males from the females. A correspondent of the *Farmers' Home Journal*, Ky., thus delineates the difference:

"The goose has always a feminine appearance and the gander the opposite. Her head is smaller and her beak shorter; knot on forehead smaller and not so pointed; her neck shorter and more delicate; the black streak on back of neck not so high; colored ring around head not so bright; her neck comes out of her body more abruptly (this is occasioned by her having a larger breast than the gander), giving a square appearance to the body. The voice of the gander is keener and louder; coloring about head more brilliant; eyes keener and always on the lookout. With such marks plain to view, any practical gooseman can readily distinguish one from the other."

THE British steamer *Tagus* is now taking on board, at the Jersey City wharf, opposite New York, ten large locomotives, built at the Grant locomotive works, Paterson, N. J. They are for a Russian railway and are to be delivered at Taganrog, on the Sea of Azof. They are said to be splendid examples of American mechanism.

New Theory Comets.

The following novel theory of comets is proposed by a correspondent of *Iron*: "Comets are supposed to consist of thin vapors of gases, held together by the mutual attraction of their particles. Like all bodies so circumstanced, they necessarily assume the spherical form; and therefore the common notion, that they consist of a comparatively small and bright nucleus and an immensely long and illuminated tail, evidently derived from their appearance in the heavens, cannot for a moment be entertained. That their spherical form, as shown by the reflected light of the sun, would scarcely be discernible at the distance of our earth, even though the comet were as dense as the densest cloud of our atmosphere, would not be surprising; but if their attenuation, as described by Sir John Herschel, be considered, all wonder ceases. Sir John Herschel says 'that the most unsubstantial clouds, which float in the highest regions of our atmosphere and seem at sunset to be drenched in light and to glow throughout their whole depth as if in actual ignition, without any shadow or dark side, must be looked upon as dense and massive bodies compared with the filmy and all but spiritual texture of a comet.' Owing to this extreme tenuity of matter, the rays of the sun's light, as reflected by it, are absolutely invisible to the inhabitants of the earth; but the other rays, penetrating into the center of the comet, are refracted by this powerful lens of twenty millions of leagues diameter into the focus which forms the nucleus of the comet, where there is, perhaps, a greater concentration of rays of light than anywhere else, not in the body of the sun. Hence this large body of concentrated light, streaming in a narrow path through the remaining half of the comet, in a direction opposite to the sun, forms that splendid appendage called the tail.

It seems scarcely necessary to point out that this mode of viewing a comet accounts for the circumstance of the tail being always in opposition to the sun, whether in advancing or receding. Also for the wonderful celerity shown by the tail in turning round the sun when the comet is in perihelion, and for the rapidity with which the comet darts out its tail after the perihelion passage. It explains, also, on the principle of the aberration of light, the bend which the tail of some comets have towards the region they have left, also the absence of a solid nucleus, and the non-obscuration of the stars by the body of the comet. If the conjecture be correct that the nucleus of a comet is near its center, and that the comet extends in every direction round the nucleus to as great a distance, at least, as the length of the tail, then it follows that at this present moment the sun is feasting on our comet, and that when it emerges from his embraces, a few days hence, it will have suffered some diminution of size."

Coating Cast Iron with Copper.

The Society of Forges and Foundries of Val d'Osne has recently opened in Paris an exposition of their curious products, consisting of objects of art in cast iron, some of considerable volume, which are covered with copper by the Gaudoin process. This operation admits of the deposition of copper upon cast iron without necessitating any previous coating of the latter. The difficulty of accomplishing this has been the scouring of the iron, the baths of chemicals hitherto used being incapable of thoroughly cleaning the metal. M. Gaudoin has found that very acid solutions are necessary to remove the oxides of iron which escape the scouring; but at the same time the acids do not attack the subjacent metal. Such a solution acts continually on the points upon which the copper is not deposited, and ends by dissolving the oxides and allowing the deposition to take place. A large number of organic acids have been found suitable for the purpose. The oxalates of copper combined with the quadri-oxalates of soda are said to give excellent results. An electric current is employed to secure the fixing of a thick layer of copper.

Moles.

W. S. N. says: "On page 50 of your current volume, you have an item about moles; and I would like to give you my experience with them this spring. I planted some sweet corn in the garden very early; and after waiting longer than the proper time for it to come up, I examined it to see what the cause was, and found that a mole had taken every grain in four rows of corn, across a garden three fourths of a square acre, not only once, but two more plantings after the first. On the rear end of my farm, in a piece of 'new ground,' they finished half of an eight acre field. I would like to know what Monsieur Flourens would say to that? The negroes in this section always plant several hills of castor oil beans in their gardens to keep the moles out."

Powdering Camphor.

G. T. Eberts, in the *Pharmacist*, says that the methods and suggestions for powdering camphor and retaining this refractory body in its powdered state, have not alone been numerous but curious.

Glycerin is the simplest and most efficient substance to keep camphor in a finely divided state. Take camphor 5 ounces, alcohol 5 fl. drachms, glycerin 1 fl. drachm. Mix the glycerin with the alcohol and triturate it with the camphor until reduced to a fine powder.

FRENCH RAILWAY CARS.—Some of the double deck cars which are quite common upon French roads, exhibit a most extraordinarily small proportion of dead weight. One on exhibition at Vienna, with a capacity of 90 persons, weighed only 11-75 tons. Freight cars weighing but 10,000 lbs., carry 20,000 or even as much as 30,000 pounds.

YOUNG'S WATER MAIN TAPPING MACHINE.

This invention, an engraving and description of which we presented in the SCIENTIFIC AMERICAN of June 7, 1873, has recently been the subject of several improvements. These mainly consist in the material used in the construction, the main bar being made of cast steel, and all other portions of steel or brass, thus avoiding any difficulty from springing while in operation. The two parts of the drill case, A, are clamped by bolts and receive the drill, B. At the end nearest the pipe is a detachable washer, in a socket having a concave face to be clamped against a packing gasket in order to make a watertight joint. Instead of making this packing in two parts as formerly, it is now formed solid and a round stop cock employed, over which the packing is pulled when the machine is removed. The handle at C communicates with a cock within, to close the aperture when the drill is removed, said cock having a notch to allow of the passage of the tool. After the hole is drilled and the point of the implement drawn back beyond the cock, the latter is turned so as to close the orifice. The connecting pipe is then substituted for the drill, the cock turned back, and the connection made. The hose at D serves to conduct away chips blown out. The drill is operated by the ratchet lever shown and fed by the screw, E.

The apparatus as improved may be adapted to 1, 2, 3, and 4 inch pipe, by substituting different drills.

This inventor has also patented, through the Scientific American Patent Agency, April 1, 1873, an extra improvement on his device, by which a disk of glass, F, Fig. 2, is substituted for the stop cock usually employed and left buried in the earth, thereby decreasing the expense and simplifying the process. For the purpose of keeping the water back while the connection is being made, the service pipe is constructed in sections coupled together by a union and having between their ends the glass plate. As soon as the work is done, one of the sections is screwed up tightly, thus crushing the glass and permitting the water to flow. The pieces are, of course, quickly washed out.

Further particulars regarding these devices may be obtained by addressing Mr. William Young, Easton, Pa.

IMPROVED DUMPING WAGON.

The action of the dumping wagon represented in the annexed illustration is in one sense automatic, inasmuch as, in order to dump the load, it is merely necessary to back the vehicle up to the place of deposit. The construction is such that, when the wagon is thus situated, the rear axle and wheels remain stationary while the front axle and wheels are moved toward them, causing the wagon body to slide over the rear axle and finally to tilt rearward. The reverse operation—that is, simply starting the draft animal ahead—pulls the wagon body back into its place.

The mechanism and its mode of operation are as follows: Under each side of the wagon box are two longitudinal timbers, each of which is made in two parts hinged in the center. The front ends, A, of these timbers are connected by the foot board and are secured to the upper part of the fifth wheel, while the rear portions, B, are permanently fastened to the wagon body. On the sides of the rear bounds are pivoted slides, C, which fit over and move on guides attached to the inner sides of the parts, A, of the bed timbers. Just forward of the rear axle, and suitably connected thereto, is a shaft, on either end of which are adjusted rollers in eccentric journals. To the latter are attached handles, D, by pressing down which the rollers are thrown in action, lifting the wagon body clear of the axle.

Supposing the wagon to be first in the position of the dotted lines in the engraving, it is evident that, the rollers being turned into action and the front axle and frame being pushed to the rear, the wagon body will slide over the rollers until the hinge of the long timbers under the bed is reached. The weight of the load will then bear the rear end, left unsupported downward, and the contents of the wagon will necessarily be discharged. The vehicle is represented in our illustration while in this position.

It will readily be understood, without further explanation, how the application of draft to the pole or shafts of the wagon speedily pulls the front axle forward and causes the body to fall back in its former position. A longitudinal bar, E, having a horizontal projection, and which passes through a keeper in the rear bounds, is then turned by means of the handle, F. The projection, assuming an upright position, just forward of the cross piece of the rear bounds, prevents the same from moving forward and locks the parts in place. The rear levers, D, are also turned up, thus allowing the body to rest directly upon the axle. The forward end of the box is also secured by pins passing through staples, G, which enter slots in the body timbers. The rear wheels are pro-

vided with suitable brakes, and the general construction of the vehicle is of strong and durable description. We are informed that the invention is now in use in Louisville, and has proved both efficient and useful.

Patented August 19, 1873. For further particulars regarding sale of rights, etc., address the patentee, Mr. Daniel D. Smith, 376 West Jefferson street, Louisville, Ky.

The Philosophy of Welding.

In order to find a true analogy to welding, we need go no further than the vulgar "sticking together" of two pieces of cobbler's wax, pitch, putty, or clay. These are in a viscous or semi-fluid condition, and they cohere by an action similar to the transfusion or intermingling and uniting of

with sufficient force to drive out from between them all the liquid silicate, and thus he secures a true annealing or actual union of pure metallic surfaces.

Cast iron or steel containing more than two per cent of carbon cannot be welded. Why? I think I may venture to reply to this oft repeated question by stating that the compound of iron with so much carbon is much more fusible than pure iron, or than steel with less carbon, and that it runs more suddenly or directly from the solid state into that of a liquid, and hence presents no workable range of weldable viscosity.—W. Mattieu Williams, in Iron.

Fishing by Means of Explosives.

At a recent meeting of the California Academy of Sciences, Mr. A. W. Chase, of the U. S. Coast Survey, read a short paper on the capture of fish by the explosion of cartridges by means of fuses under water, which he has practiced with much success. He says: "I have found that the ordinary waterproof fuse will burn about one foot to every twenty-five seconds, and by experiment that a cartridge will explode in from four to six fathoms with from three to four inches of fuse. I have, however, made no exact experiment on the subject. The shock of the explosion is most severely felt downwards, as the resistance is greater; and the different varieties of sea fish found near the rocky shores of the islands as a rule being found on or near the bottom, it is desirable to explode your cartridge about midway between the surface of the water and the rocks beneath, as you thus reach both the deep lying fish and those, like mackerel and smelt, which swim between."

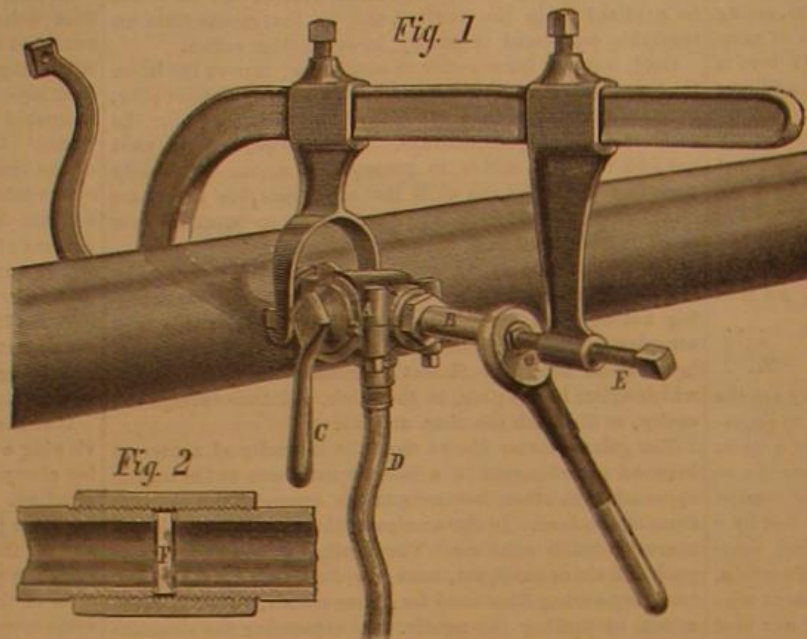
The *modus operandi* adopted by Mr. Chase was to take a small skiff and row out to the kelp beds surrounding the island. "Here, in six or eight fathoms of water, the bottom is distinctly visible. When an unusually large school of fish would swim by, I would quietly light the fuse and drop the cartridge into the water gently. If the water was, say, eight fathoms deep, I would graduate the fuse for explosion at four. The cartridge would slowly sink—generally in a spiral—and a few bubbles of air or smoke arise to the surface. When the fire reached the fulminate of mercury, there would be a sudden white flash, then a quick, sharp detonation, the blow striking the bottom of the skiff as if some one had struck it with a hammer. Then, in a space of time varying from eight to ten minutes, every fish within a radius of forty or fifty yards would slowly come to the surface. Those within the immediate vicinity of the explosion, of course, were killed by bursting the bladder and injury to the large intestines, and had to be speared up from the bottom. Those, however, at a greater distance would be simply stunned, and could be taken in with a net. Care had to be taken to avoid touching those only slightly stunned until the net was fairly around them, as the slightest blow would arouse them from their torpor."

I am now about to relate what will, perhaps, be called a genuine 'fish story'; but as I have, in addition to my own, the testimony of my men to the fact, I give it as it occurred:

I had brought up by an explosion a number of yellow bass fish, weighing about four pounds each. These are delicious in chowder, and so instead of putting them in alcohol I had them cleaned, which was done by scaling, removing the intestines, and cutting off the fins and tail. The head, however, still remained joined to the back bone. These fish, from the time they had been taken from the water up to the time of cleaning, remained apparently lifeless. Nor did the removal of the intestines arouse them. They were then taken up to the old barracks, where I was temporarily camped, and hung upon nails driven in the clapboards. Some little time after they had been thus disposed of, one of the men came in and asked me to go out to look at the fish. I did so, and found every individual bass slapping around in as lively a manner as if he had been freshly caught and hung up. They had, in fact, recovered from the explosion, and proceeded to die in the common fashion. I took one down and broke the backbone where it joined the head. Its struggles ceased instantly,

thus showing that the vital force had been arrested in the nerve centers and brain at the time of explosion, and, when the effect had passed away, that the fish had resumed a galvanic life. It was probably about half an hour from the time of explosion when this occurrence took place. I have not been able since, however, to secure the same result, although I must state that the only time since then that I have tried the experiment was on the Oregon coast, where I brought up a school of salmon, all of which were pickled for Agassiz. These fish were, however, too close to the explosion, as they were killed outright."

REMEDY FOR INSECT STINGS.—M. Danver says that 30 or 40 grains of quicklime dissolved in water is a thorough remedy for the stings of insects, and far superior to ammonia or any other alkali.

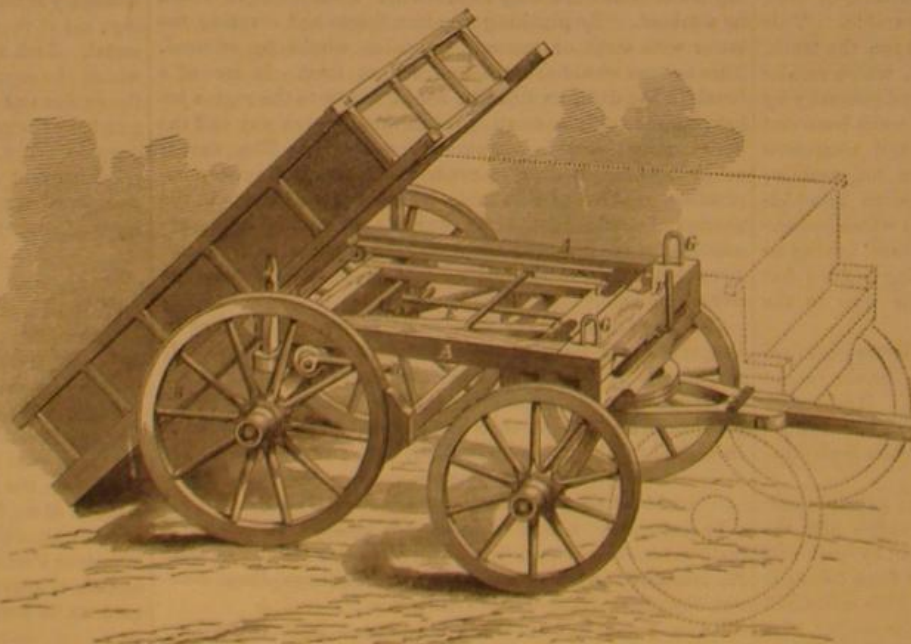


YOUNG'S WATER MAIN TAPPING MACHINE.

two liquids. Iron and platinum pass through a viscous or pasty stage on their way from the solid to the liquid states, and the temperature at which this pasty condition occurs is the welding heat. Other metals are not weldable, because they pass too suddenly from the solid to the liquid condition. Ice, although it fuses slowly, in consequence of the great amount of heat rendered latent in the act of fusion, passes at once from the state of a brittle crystalline solid to that of a perfect liquid. It passes through no intermediate pasty stage, and therefore is not weldable, or does not cohere like iron, etc., at a temperature below its fusing point.

It is usual to cite only iron and platinum, or iron, platinum, and gold as weldable substances, but this, I think, is not correct. Lead should be included as a weldable metal. The two halves of a newly cut leaden bullet may be made to reunite by pressure, even when quite cold. This is obviously due to the softness or viscosity of this metal.

Outside of the metals there is a multitude of weldable



SMITH'S IMPROVED DUMPING WAGON.

substances. I may take glass as a typical example of these. Its weldability depends upon the viscosity it assumes at a bright red heat, and the glass maker largely uses this property. When he attaches the handle to a claret jug, or joins the stem of a wine glass to its cup, he performs a true welding process.

The chief practical difficulty in welding iron arises from the fact that at the welding heat it is liable to oxidation, and the oxide of iron is not viscous like the metallic iron. To remedy this oxidation the workman uses sand, which combines with the oxide and forms a fusible silicate. If he is a good workman he does not depend upon the solidification of this film of silicate, as the adhesion thus obtained would be merely a soldering with brittle glass, and such work would readily separate when subject to vibratory violence. He therefore beats or squeezes the surface together

THE WESTERN LOCUST PLAGUE.

We supplement the description recently given of the locusts, which are producing such widespread destruction to the Western crops, with an engraving representing the insects devastating a grain field. An estimate of the damage done to the harvests of Iowa and Minnesota during the present year places the value of the vegetation destroyed for the former State at \$2,000,000, and for the latter at \$3,000,000. It is also said that about 4,000 people in both States will require help to the total extent of some \$800,000.

The present belief is that the locusts originate in the great prairies, and, when fully developed and able to use their wings, become carried off by the wind. Their instinct compels them to alight upon the first fields of young crop encountered, which they speedily strip of every leaf. If they remain long enough to deposit eggs, the following year will see the plague resumed with even greater severity. Professor Humiston, of Worthington, Minn., who has studied the habits of the insects with care, describes the process of egg laying as follows:

The tail of the female locust consists of a hard, bony, cone-shaped substance, capable of being thrust into the ground from one half an inch to an inch in depth. Just above this on the body of the insect, and attached to it, is the

fact, had the matured locusts let it alone, it would have yielded more than an average crop of wheat. The theory is that turning the eggs well under prevents many of them from hatching, and delays those that do hatch so long that the crop has a chance to get a good start.

The locusts generally begin to fly each day between 10 A. M. and noon, and alight about 4 P. M. If they alight in a wheat or oat field, they are generally so thick that there are from three to ten locusts on every stalk of grain. In the cornfields they actually cover the corn that is three or four feet high, and in many cases bend it down to the ground with their weight. Neither flax, potatoes, garden vegetables, nor any other crops escape.

One of the most effectual means recently employed for saving the grain of Minnesota farmers was to "rope" the fields—that is, to hitch each end of a rope 200 feet long to a horse and drag it over the grain. This disturbed the "hoppers" and brushed many of them off the heads of the grain upon the ground, where they would remain until the swarm got ready to fly, and doing little damage. Others would return to their work of destruction, but would be allowed to remain but a few minutes before they were again disturbed. This "roping" was continued until the locusts became disgusted and flew away. Some farmers found

material came to be produced in many German towns. In a report by Mr. E. Locke, an expert deputed by the English Society for the Promotion of Scientific Industry, we find the following description of how the china is now made at the Dresden Royal Works:

The material of the porcelain body is found near Meissen, and it is washed on the works. It has the appearance of being of a loose, sandy nature. The fine particles are floated away, and carried with the water along a series of spouts till deposited in tanks of slate, after which the water is gradually drawn off. The thick slip is then put in bags about two feet long and eighteen inches wide, which are laid on their sides upon wooden hurdles plaited with wickerwood. Several layers of hurdles and bags are put upon each other, a flat board is placed on the top, and a screw is brought to bear gradually, till all the water is squeezed out. The clay is then ready for tempering. The plates and round dishes are made upon the thrower's wheel, and are then blocked upon a mold on the wheel, the foot upon it being worked with a roll. When it has left the mold, it has to be hardened and the back turned on a wheel, to give the finished outline to the foot. The bottoms of all the plates and dishes are raised up about a quarter of an inch, to allow for the dropping in the firing of them. Another man does the fin-



LOCUSTS DESTROYING A GRAIN FIELD.

egg cell. The grasshopper is able to push its conical shaped tail down into the ground, and to leave it there with the cell containing the eggs. The warm sun in the spring causes the eggs to hatch, and the field is covered with millions of young grasshoppers, not as large as a kernel of wheat, just when the tender shoots of grain begin to show themselves above the ground.

A correspondent of *The Tribune*, writing from Minnesota, states that many farmers knew last fall that their land was full of these locusts' eggs, and anticipated that, unless they could be destroyed, the crops would be greatly injured again this year. Professor Humiston and others conceived the idea of plowing deep and thus covering the eggs with a layer of earth so thick as to postpone, at least, the time of hatching. Much of the land in which these eggs were deposited was the prairie which had just been broken, this being only the second year that a crop has been raised there. Some of the farmers "back set" the land in the fall—that is, turned the sod back again and covered it with a thin layer of earth. In one of Professor Humiston's wheat fields, a part has been treated in this way, while part has been sown among the locusts' eggs. The contrast is wonderful. The part that had been "back set" will yield at least four times as much wheat to the acre as the other. The young locusts that hatched on the field appeared later and in much smaller numbers. In

smoking very effectual. When the locusts were flying, they placed damp prairie grass on the windward side of their fields and set fire to it. The locusts either did not alight, or, if they did, did not stay long. But this was not always successful. One farmer who tried it states that at first he thought the "hoppers" about to leave; he went away for a fresh load of grass, and when he came back he "found the rascals roosting on the fence and warming their feet by his fires." After that, the hotter he made the fires and the denser the smoke, the better they seemed to like it.

China Making in Dresden.

The fashionable mania now existing in Europe, and especially in England, which is also extending to these shores, is for old and curious china, and for odd and rare specimens prices are given which are ridiculously enormous. At an auction sale recently, a professional china dealer paid \$50,000 for a single pair of vases, after a very sharp competition, and several instances have happened where sums of nearly equal magnitude have been lavished by the wealthy in gratifying this peculiar taste. The old Dresden china is extremely valuable, more from its quaintness and richness of design than for the method of its manufacture. The latter at one time was kept a profound secret, but, like many other trade secrets, this one eventually leaked out, so that the true

ishing of the edges of the plates and dishes, for there is a clear waste upon the plate of half an inch, level with the edge, and that has to be cut away with a knife. The figure makers have their labors divided. The figures are all made very thick, and the bodies of some of the figures are all pressed solid; and to get the molds close they are put under a screw press. The parts of the figures are then taken to the finishers, who have to go over all the surface with their tools, and every fold and embossment is retouched; it is a great waste of labor. The molds are all very dull, and the lines of fine drapery hardly be seen.

The plaster of Paris used for the molds seemed very hard, with a gray look, and heavy in its gravity. The cottles used by the mold maker were of a very rude description, and those for the square molds were made of plaster bats fastened at the corners with twisted wire; the plaster seemed to take a good finish.

The figures are burned the first time, laid upon their backs, with short props dipped into ground quartz. The kiln is divided into two parts by a low dome about six feet high, with a hole in the center, of two feet. The clay is placed in the bottom part and the gloss above, and all the saygers are luted. The ware fired in the bottom part of the kiln is hardly out of clay, and has done scarcely any contraction; it is as porous as an earthen piece in the biscuit state. It is

afterwards dipped; and the glaze being in a very thin state, the dipper gets it on the piece very equal and thin. They do not use a wash for the bottoms of the saggars, but a thick bat of sagger clay, with a deal of sand in it, and it seems to answer the purpose well.

From this it will be seen that the piece of ware has to do almost all its contraction in the second burning with the glaze upon it, and with no support at all. Mr. Locke was told the contraction was one sixth; but, from what he saw, he thought it about one eighth. The glaze is composed of felspar from Norway, good clear quartz, and a limestone, of a bluish gray color before it is calcined. The clay with which they make the saggars is found in the neighborhood of Meissen; it is not a fire clay, but more after the nature of a ball clay. They use the ground grog and a sand mixed with it. Coal is obtained from Bohemia; it is of a very dull looking black, and the cost must be considerable from the distance it has to come.

The Henderson Brake.

This improvement has lately been subjected to a practical trial with much success, on the West Chester and Philadelphia Railway, the train consisting of engine, tender, and five cars. On a level, speed 35 miles per hour, the stop was made in a distance of 180 yards in 19½ seconds; boiler pressure, 130 lbs. Trials on grades were made with equally favorable results, all showing that the brake has no superior. Its construction and operation are as follows: Between the wheels of each truck there is placed a cylindrical vessel of cast iron, whose ends are formed of two dish-shaped flexible diaphragms of india rubber, secured to the drum, and making an airtight joint at the periphery by flanges bolting thereto. Two rams working in opposite directions are fitted against and into the hollow part of the diaphragms; their outer ends are attached by rectangular flanges and bolts to the brake beams carrying the brake shoes. The several castings are simply bolted together, with the diaphragms, as they come from the foundry, without recourse to the usually expensive mechanical fittings.

When pressure comes between the diaphragms, it simply forces them apart, projecting the rams, which act immediately on the brake beams, applying the brakes; and when the pressure is relieved, the atmosphere reacts on the area of the rams and forces them back, assisted by the tendency of the diaphragms themselves to recover their normal condition.

The peculiar construction of this device, it will be seen, possesses all the requirements of a cylinder and working piston, as well as recoil springs. All piston packing and stuffing boxes are dispensed with, and no lubrication is required; the interior is sealed from dust, all complications of levers and rods and attendant lost motion is done away with, and its operation is free from all connection with the usual hand brake gear, which remains as efficient as it was before.

The power is derived directly from the boiler of the locomotive; we have therefore at our command the same power to stop the train which is used to impel it forward. The device employed to transmit this power, to the pressure boxes just described, consists of a hydraulic press, operated by a double acting steam cylinder, the valve of which is worked by the hand of the engineer. There is a piston in each; steam actuates the one to force the water from the other, thus creating hydraulic pressure on the pressure boxes, and to withdraw the same to release the brakes. An air cushion is provided above the press piston to prevent striking the heads when coming back light. The press receives water from a tank, which may be the engine tank or a special tank provided for the purpose, through a pipe furnished with a check valve opening towards the press cylinder, in such manner that the fluid cannot return to the tank; the supply is arranged to feed automatically; any excess or leakage past the press piston is at once returned to the tank. For low temperatures, a mixture of equal parts of glycerin and water is used in lieu of water, which is safe to 30° Fah. below zero. Iron pipes are used under the cars with flexible hose between them, furnished with hydraulic couplings, which it is obvious must be tight both with and without internal pressure, a peculiarity possessed by this coupling alone.

Vaporizing Metals by Electricity.

The following simple results, communicated to *Nature* by G. H. Hopkins, obtained by frictional electricity may be of interest, perhaps too of use in the investigation of certain minerals and the action of intense heat upon them.

The description of a characteristic experiment is all that will be necessary to explain the process and to show how similar results may be obtained from other substances. A very fine thread of sheet platinum, of about an inch in length, is placed between two microscope slides of glass, and two pieces of thin sheet copper with rounded ends are placed in contact with the extremities of the platinum, the copper being any of convenient length and breadth, so as to extend beyond the glass slides, but not to be as broad; a charge of electricity from about eight square feet of Leyden jar is passed through the metals; the effect of the heat from the charge is to vaporize the platinum, which is instantly condensed in a transparent layer upon the cold glass. The layer can be investigated by a microscope, and employed in various ways to determine the character of the metal and its effect upon reflected or transmitted light.

Copper, tin foil, tin foil amalgamated with mercury, gold and silver, can be used in a similar manner, but they produce layers very dissimilar in appearance. To act upon finely ground substances, such as vermilion, sulphate of antimony, sulphur, etc., a line of the powder must be made and

the charge be passed through in the same way as through the platinum.

Part of the vapor escapes from between the slides, but this can be easily condensed upon each of two pieces of glass placed in such a way as to intercept the vapor as it passes from between the two slides; it is then condensed in a long but narrow line. The manner in which the glass is affected by the heat, and the concussion produced by the expansion of the vapor, are worthy of notice.

Considerable difficulty will be found in vaporizing copper, doubtless from its being such an excellent conductor. Some of the powdered substances appear to require a small spark to be passed through them before they allow a larger charge to pass, as if the particles needed polarization.

Patented Car Improvements.

There were one or two points in the proceedings of the Car Builders' Association, at its late meeting, in which a peculiar sensitiveness was developed about discussing the merits of patented devices. The impression seemed to prevail with many of the members that such devices were not only inadmissible as legitimate topics for discussion, but that committees, in making their reports, must not indorse or recommend any such devices for adoption, no matter what might be their actual merits. This, in our judgment, is a mistake which can not be too soon corrected; nor do we think that, in order to do so, any alteration of the constitution of the Association is necessary. That instrument, as it is now, merely forbids the admission of patentees or their agents to advocate their claims at any of the meetings of the society, but does not prevent the members from freely expressing their views in the regular course of discussion upon any invention or device, whether patented or not. To suppress all discussion which respect to patents would seriously hamper the Association in the exercise of its proper functions, and so far destroy its usefulness. It must necessarily be progressive or die.

It is not the business of the Association to make or unmake the fortunes of inventors or patentees, or to discriminate between rival claims, except on the score of actual merit, and as the interests of railroads may be affected thereby. If the Miller platform or the Westinghouse brake is a good device now, let it be indorsed and approved; but as soon as either is surpassed by something better, let it be condemned. There is no evading this obvious duty. The Association has got to recognize patented inventions and pronounce upon their respective merits, so far at least as they apply to railway cars, or to be exposed to comment and criticism, such as may be found in the *SCIENTIFIC AMERICAN* of July 18.—*National Car Builder*.

The Fireless Locomotive System.

A correspondent, Mr. Michael Flurschelm, mechanical engineer, of Gaggenu, Germany, asks: "Could not the principle of the fireless locomotive be applied to coaches, cabs, and private vehicles? By calculation, I find that a tank of 1½ feet diameter and ¾ foot length, jacketed by a non-conductor of heat, would be sufficient to propel an ordinary vehicle, containing two persons, on a Macadam or wooden pavement, at a speed equaling that attained by ordinary cabs. It seems to me that, in cities like London, Paris, New York, Boston, and even in smaller towns, large charging boilers could be kept at each cab stand or in each street, where, at a minute's notice, a charge of hot water could be obtained at a moderate expense, which would propel the vehicle, say, 7 miles, and then another charge of hot water could be obtained. Horses could thus be entirely done away with; and traveling would be cheaper, more convenient, and less dangerous. A man who now keeps a horse and carriage could, at less expense, purchase a little buggy provided with a fireless engine, and keep it at the boiler stand in his street. If he wants to drive, he sends his boy or man to the stand; in one minute the boiler is charged, and the cab at his door. He need not be afraid of keeping his horses waiting at his door, as no weather will injure his steam animal. If this system were generally adopted, the municipalities would probably be forced to lay narrow gauge tracks along each street, connecting with the cross streets by easy curves; and tracks for longer distances all over the country would follow, connecting with the city roads and provided with boiler stations. We could then easily come to town from our country places, or travel all over the country, in our own vehicles, at very little inconvenience, needing no one to look after or feed the horses."

Sensitized Paper.

At a recent meeting of the Photographic Section of the American Institute, in this city, Mr. H. J. Newton, President, made some observations on this subject. He said: The preparation of a sensitized albumen paper as a commercial article has not been successful. It has been either too expensive to meet the popular demand, or deficient in keeping quality. There are several ways by which paper can be prepared so that it will keep indefinitely; but as a rule, it is exceedingly difficult, if not impossible, to make a print on such paper that would not ruin the reputation of any photographer, especially after it is a week old. Some time since, in experimenting in this direction, I found that, by floating the albumen paper back down for one or two minutes on a solution of hydrochloric acid—one ounce of acid to forty ounces of water—and drying, it would render it capable of keeping perfectly for ten or twelve days after sensitizing. Not only this, but the prints made on paper thus prepared were remarkably fine, and also those made after ten days' keeping were equal to those printed immediately after sensitizing. Paper so prepared should not be fumed until required for use. After the paper has been removed from the

acid solution and dried, it would be well to pack it away under a light pressure, placing the albumen surfaces together, so that when required for use it will be in proper condition to put upon the sensitizing bath. As it is a great convenience for photographers to be able to keep paper for several days after sensitizing without its deteriorating, I would suggest that some of our many manufacturers of albumen paper prepare some of it in this way, as I am sure that photographers would willingly pay the extra expense. In the toning of these prints, I used a little tartrate of antimony, and it worked very well. In the first place, the prints turned red—a very deep, rich color—and toned up from that. I have not experimented enough to give a reliable formula, but I would suggest half an ounce of tartrate of antimony, which is commercially known as tartar emetic, dissolved in sixteen ounces of water; for each grain of gold use half a dozen drops of that solution, and increase it until you get the desired effect.

The Railway Rolling Stock of the United States.

The return of railway rolling stock, as given in *Poor's Manual* for 1874—5, on the roads of the United States and Canada are as follows:—

Passenger cars of all classes.....	29,900
Baggage, mail, and express cars.....	4,157
Box, merchandise, and house cars.....	87,009
Platform, gondola, and flat cars.....	52,198
Stock cars.....	14,222
Coal cars (number of wheels not stated).....	66,887
Four wheel cars (mostly coal).....	37,892
Caboose cars.....	1,549
Oil cars.....	3,154
Ore cars.....	2,102
Lumber cars.....	193
Freight cars not classified.....	94,694

Total.....373,959
Locomotive engines.....14,939

Deducting from these aggregates 774 engines and 13,980 cars of all classes, as returned by the Canada roads, leaves for the roads in the United States a total of 14,165 engines and 359,979 cars, exclusive of what are denominated service cars, and exclusive of narrow gauge cars.

Simple Dyspepsia Remedies.

Dyspepsia arises from a great variety of causes, and different persons are relieved by different remedies, according to the nature of the disease and condition of the stomach. We know of a lady who has derived great benefit from drinking a tumbler of sweet milk—the richer and fresher the better—whenever a burning sensation is experienced in the stomach. An elderly gentleman of our acquaintance, who was afflicted for many years with great distress after eating, has effected a cure by mixing a tablespoonful of wheat bran in half a tumbler of water, and drinking it half an hour after his meals. It is necessary to stir quickly and drink immediately, or the bran will adhere to the glass and become pasty. Coffee and tobacco are probably the worst substances persons troubled with dyspepsia are in the habit of using, and should be avoided. Regular eating of nourishing plain food, and the use of some simple remedies like the above, will effect in most cases quicker cures than medicine.

High Buildings.

A visitor to our office recently, coming to New York for the first time in several years, mentioned the prevalent mania for lofty buildings as one of the most noticeable, to a stranger, of the changes which have taken place in our city architecture. It is curious to remark that the tallest of these high edifices are situated within the radius of a few blocks of the *SCIENTIFIC AMERICAN* office, and our out-of-town friends, in visiting the latter, may spend an interesting hour in making the round of these very imposing structures. Their heights are as follows: Trinity church, 284 feet; Union Telegraph building, 226 feet; Brooklyn bridge tower, 223 feet; Tribune building, 221 feet; shot tower, near Beekman street, 220 feet; St. Paul's church, 203 feet; post office dome, 195 feet; Equitable Life Insurance building, when two stories, soon to be added, are finished, 175 feet.

A Natural Curiosity.

Massachusetts papers report that a portion of Winchendon, Mass., covered with grass, cranberry vines, whortleberry bushes, and over four hundred trees, recently floated off into Monomack lake, between Rindge, N. H., and Winchendon, Mass. The newly formed island was first seen near the town of Rindge on May 30. The following day it again floated off about two miles down the lake, but on June 3 returned to its first place of anchorage.

The island covers six acres, and is in a lake covering an area of 2,500 acres. It was probably started from its natural site by the lake being unusually high and a strong southerly wind prevailing. But it has also been suggested that it left Massachusetts for a summer vacation in New Hampshire, to escape the effects of protracted legislation, and that after all it may only have originated in a Yankee trick for attracting summer tourists to the lake.

New Property of Metallic Rhodium.

MM. H. Saint Clair Deville and Debray state that rhodium, precipitated from its solutions by formic acid or alcohol, decomposes the formic acid with a disengagement of heat, and reduces it to its elements, hydrogen and carbonic acid. This action continues almost indefinitely.

When the action of the rhodium on the formic acid becomes weak, it is merely necessary to wash and dry the metal in contact with air in order that the phenomenon be repeated with its primitive intensity, disengaging equal volumes of carbonic acid and hydrogen.

Agricultural Life in Missouri.

What can be pleasanter, says an exchange, than the life of a Missouri farmer? At daylight he gets up and examines the holes around his corn hills for cut worms, then he smashes codling moth larvae with a hoe handle until breakfast. The forenoon is devoted to watering the potato bugs with a solution of Paris green, and after dinner all hands turn out to pour boiling water on the chintz bugs in the corn and wheat fields. In the evening a favorite occupation is smudging peach trees to discourage the curculio; and after a brief season of family devotion at the shrine of the night-flying coleoptera, all the folks retire and sleep soundly till Aurora reddens the east and the grasshoppers tinkle against the panes and summon them to the labors of another day.

New French River Steamboat.

A large steamboat has recently been constructed at Seyne, France, after the plans of M. Dupuy de Lome, for the navigation of the river Rhone. She is 496'8 feet in length, and has 37'1 feet beam. With her coal on board she draws but 17'5 inches of water, and can receive 126 tons of load per 3'9 inches of immersion. At a draft of 50 inches she carries a load of 900 tons. The vessel has four boilers and two inclined compound engines, which drive two large bell-shaped wheels placed in the stern, each of which has twelve wings. Each wheel moves independently of the other, so as to be used for steering. The craft has been tried once, but without good results, through some mistake in the construction of the machinery. It was found that a high speed threatened to shake her to pieces. This, however, it is said, will be shortly remedied.

American Telegraphy.

The efficiency of the service of the Western Union Telegraph Company is well illustrated by a statement which we copy from Mr. William Abbott's *Monthly Circular* for July 1. This statement, which alludes to the perfect organization of the Anglo-American Telegraph Company, says that messages are exchanged between London and California in the same space of time occupied for similar service between London and Paris, the distances respectively being about 5,500 and 250 miles. As the Western Union Company perform over two thirds of the entire service between London and California, the exhibit is a remarkable evidence of the efficiency of that company, and, considering the respectable source whence it comes, the appreciation is all the more valuable.—*Journal of the Telegraph*.

Spiritual Phenomena.

At a private party, given at his London house during the past month, Sir Charles Wheatstone exhibited some curious electrical experiments for the amusement of his friends, which would seem to throw some light on certain so-called "spiritualistic manifestations." In a dark room, by a stamp of his foot, Sir Charles produced a brilliant crown of electric light in mid air, while musical instruments seemed to be played by invisible hands, whereas the sounds really came from an adjoining room, in which the player sat, and were made to appear to be produced by the instruments before the spectators by an ingenious contrivance. A contest between Science and the "spirits" in their own chosen feats would be almost as memorable as the celebrated competition between Moses and the magicians.—*Liverpool Post*.

An Interesting Discovery.

Some workmen, while engaged in laying water pipes in Cividale, Italy, recently encountered a large flat stone. On raising this, a bed of mason work was revealed, in which was placed a stone sarcophagus covered with a marble lid. Within the receptacle were the remains of a human skeleton, some portions of which were yet perfect. Beside the body lay a sword, lance, helmet, spears, a gold clasp and ring, a piece of very beautiful gold tissue, and a flask of water, which was still remarkably clean. The removal of clay from the bottom of the grave brought out the letters GISVL—from which archaeologists have decided that the remains are those of Gisulf, Duke of the Lombard Marches of Friuli, who fell in battle in 611, while repelling an invasion of the Avars.

THE NEW COMET.—Professor Parkhurst says that the new comet may be found, by the aid of a small telescope, 7° south of γ Ursa Minoris, the upper pointer of the Little Bear. Between 9 and 10 P.M., it will be almost directly to the left of that star. The distance of our new visitor is estimated at about 100,000,000 miles. In about a week it will be found midway between the γ and Thuban.

TOOTHACHE CURED BY ELECTRICITY.—Dr. Bouchard, of Paris, says that toothache may be almost instantly arrested by a constant battery current from ten cells. The positive pole is placed against the jaw, on a level with the painful tooth, and the negative pole to the antero-lateral region, on the same side of the neck.

THE EARL OF CAITHNESS, of whose novel form of ship's compass we recently gave an illustration, has produced another invention in the shape of a machine for cleaning and brushing railway carriages. The device, we understand, is an excellent one, and has been adopted by the London and North-western Railway Company.

SUCCESS, says Josh Billings, does not consist in never making blunders, but in never making the same one a second time.

THE immersion of hides for hours in a two per cent solution of carbolic acid, and then simply drying them, has been recently substituted for the tedious and expensive process of salting them for transportation from South America and Australia, and with most satisfactory results. Bones have been similarly treated for transportation.

HOW SHALL I INTRODUCE MY INVENTION?

This inquiry comes to us from all over the land. Our answer is: Adopt such means as every good business man uses in selling his merchandise or in establishing any business. Make your invention known, and if it possesses any merit, somebody will want it. Advertise what you have for sale in such papers as circulate among the largest class of persons likely to be interested in the article. Send illustrated circulars describing the merits of the machine or implement to manufacturers and dealers in the special article, all over the country. The names and addresses of persons in different trades may be obtained from State directories or commercial registers. If the invention is meritorious, and if with its utility it possesses novelty and is attractive to the eye, so much the more likely it is to find a purchaser. Inventors, patentees, and constructors of new and useful machines, implements, and contrivances of novelty can have their inventions illustrated and described in the columns of the *SCIENTIFIC AMERICAN*. Civil and mechanical engineering enterprises, such as bridges, docks, foundries, rolling mills, architecture, and new industrial enterprises of all kinds possessing interest can find a place in these columns. The publishers are prepared to execute illustrations, in the best style of the engraving art, for this paper only. They may be copied from good photographs or well executed drawings, and artists will be sent to any part of the country to make the necessary sketches. The furnishing of photographs, drawings, or models is the least expensive, and we recommend that course as preferable. The examination of either enables us to determine if it is a subject we would like to publish, and to state the cost of engraving in advance of its execution, so that parties may decline the conditions without incurring much expense. The advantage to manufacturers, patentees, and contractors of having their machines, inventions, or engineering works illustrated in a paper of such large circulation as the *SCIENTIFIC AMERICAN* is obvious. Every issue now exceeds 42,000 and will soon reach 50,000, and the extent of its circulation is limited by no boundary. There is not a country or a large city on the face of the globe where the paper does not circulate. We have the best authority for stating that some of the largest orders for machinery and patented articles from abroad have come to our manufacturers through the medium of the *SCIENTIFIC AMERICAN*, the parties ordering having seen the article illustrated or advertised in these columns. Address

MUNN & CO.,

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Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)
From July 7 to July 20, 1874, inclusive.
AMMONIA FROM GAS.—B. Sullivan, New Haven, Conn.
ARTIFICIAL STONE.—J. O. Friel, Brooklyn, N. Y.
BOILER TUBE SCRAPER.—J. Collicott, Boston, Mass.
CAR AXLE.—G. W. Milmore, Janesville, Wis., et al.
CHEMICAL TELEGRAPH, ETC.—T. M. Foote et al., New York city.
COAL CUTTING MACHINE, ETC.—H. F. Brown, Indianapolis, Ind., et al.
COD LIVER OIL.—J. G. Hays, New Orleans, La.
CONSTRUCTING PIERES, ETC.—C. E. Hill, New York city.
DAMPING PAPER.—R. M. Hoe, New York city.
FERTILIZER.—R. A. Chesebrough, New York city.
HORSE SHOE.—G. Dunning et al., Waukegan, Ill.
LIGHTING GAS.—E. E. Bean, Boston, Mass.
MAKING BOOTS, ETC.—D. Mills, Brooklyn, N. Y., et al.
MAKING BOOTS, ETC.—H. G. Thompson, Milford, Conn.
MAKING GAS.—W. Elmer, New York city.
MAKING ICE, ETC.—J. M. G. Beath, San Francisco, Cal.
MATCH IGNITION SURFACE.—L. O. P. Meyer, Newtown, Conn.
PUNCHING TICKETS, ETC.—J. H. Small, Buffalo, N. Y.
REGENERATOR FURNACE.—M. Foster, Allegheny, Pa.
RENDERING FATS, ETC.—H. S. Finner, New York city.
SAW AND HANDLE.—H. Diston, Philadelphia, Pa.
SCREW-CUTTING MACHINE.—C. Sellers, Philadelphia, Pa.
SIGNAL LANTERN.—Universal Signal Light Company, New York city.
SPINDLE AND BOLSTER.—F. J. Rabbeth, Pawtucket, R. I.
STEAM BOILER.—G. G. Lobdell, Wilmington, Del.
STEAM ENGINE AND GENERATOR.—E. A. L. Roberts, Titusville, Pa.
STITCHING AND STRETCHING CLOTH.—A. S. Dismore, Boston, Mass.
TUCKER FOR SEWING MACHINE.—J. Barrett, Buffalo, N. Y.

NEW BOOKS AND PUBLICATIONS.

THE POEMS OF VIRGIL. Volume I, containing the Ten Bucolics and the First Six Books of the *Æneid*. Price \$1.75. Boston, Mass.: Ginn Brothers.

A handsome reprint of classics of worldwide fame, edited with care by Messrs. Allen and Greenough, with notes of great value to the student and translator.

MINING INDUSTRY OF THE STATES AND TERRITORIES OF THE ROCKY MOUNTAINS, including Descriptions of Quartz, Placer, and Hydraulic Mining, Amalgamation, Concentration, Smelting, etc. By Rossiter W. Raymond, Ph. D., United States Commissioner of Mining Statistics, etc. Illustrated with Engravings and Maps, and a Colored Geological Map of the United States. 8vo., 540 pp. Price \$4.50. New York: J. B. Ford & Co., 27 Park Place.

There is little need to inform our readers of Professor Raymond's extended knowledge of the topography and resources of the mineral districts of the West. Probably no one has so thoroughly explored these regions, pregnant with the future prosperity of the whole continent, as Professor Raymond, and certainly no one can speak more authoritatively on the subjects of mining and metallurgy. The great experience and information of the author have been admirably elaborated in the volume before us, and we welcome it as a valuable addition to our list of technical and statistical works. It is excellently illustrated, the maps being especially commendable for accuracy and clearness.

STATISTICAL ATLAS OF THE UNITED STATES. Part III.—VITAL STATISTICS. New York: Julius Bien, 16 & 18 Park Place.

The third part of this magnificent publication is ready in advance of the others, and consists of charts of the proportional prevalence of various classes of disease and bodily infirmities, as well as of nationality of the people and other valuable statistics. The whole work is to consist of fifty maps, with explanatory text, the expenditure for which has been authorized by Congress; and from the initial section sent us, we are able to assert that no more elaborate or valuable compilation has ever been organized, printed and published. We are indebted to the Secretary of the Interior for the copy of this work.

WILEY'S AMERICAN IRON TRADE MANUAL of the Leading Iron Industries of the United States, with Descriptions of the Iron Ore Regions, Furnaces, Rolling Mills, Bessemer Steel Works, Car, Locomotive, Steam Engine, and Bridge Works, Iron Ship Yards, Stove Foundries, etc. Compiled and Edited by Thomas Dunlap. Price \$7.50. New York: John Wiley & Son, 15 Astor Place.

The promise held out in this very comprehensive title is amply fulfilled in the book, wherein Mr. Dunlap has, with great labor, care, and perspicacity, given an elaborate account of every establishment in the country which makes or uses iron in its trade. It is a complete directory of our most important industry; and the descriptions of the various mines, works, and factories are graphically written, giving the most detailed particulars of every branch of the subject. As a book of reference, it is indispensable; and it is also a very interesting and instructive work for the general reader.

THE LABORATORY is the name of a new monthly journal of the progress of chemistry, pharmacy, medicine, etc. Price 50 cents per annum. Boston, Mass.: W. W. Bartlett & Co.

Recent American and Foreign Patents.

Improved Bottom Plate for Range Chimney.

Hamilton C. Garwood, Jersey City, N. J.—This is a bottom plate for range chimneys having a conical or pyramidal elevation in the middle portion, with an opening and valve at the top, and above the top a pipe or flue for carrying off the odors, smoke, etc., from the range when cooking, and for ventilating the room.

Improved Burglar Alarm.

James H. Whitelegge, New York city.—This invention relates to the construction of safety bolts for burglar alarms; and consists mainly of a spring bolt so constructed and arranged in relation to a hole in the lock bolt that when the lock is acted upon by a key or other instrument from either side it stops the movement of the lock and rings a bell.

Improved Joint Connection for Top Chords of Iron Bridges and Improved Girders and Columns.

Walter G. Coolidge and Edward Hemberle, Chicago, Ill.—The first invention consists of a peculiarly constructed joint piece for wrought iron top chords in bridges having what are known as pin connections, the joint piece being made either of cast iron or wrought iron. This connection is adapted for the construction of the top chords entirely of wrought iron without necessitating any riveting at the place of connection; it further has the advantage of enabling the connection of ties and posts with the pin, being made independent of the top chords, and the chord sections being put on afterward, which expedites and cheapens the labor of the erection of the structure. The same inventors have devised a new form for iron bars for columns, consisting of a plate with ribbed edges. Into the trough of the said plate other plates are fitted to form thickening plates at the ends of the columns. Rolled π beams or plate girders are attached to said plates connecting two together. A plain plate, straight or tapered, may be employed between two π beams. Pins pass through the ends of the columns. The advantages are superior strength for a given amount of metal, simplicity and cheapness of construction, and accessibility of all exposed parts for inspection and painting.

Improved Boiler Washing Machine.

Reuben Wood, Grand Ledge, Mich.—This is an improved washing machine so constructed that the steam and hot acids may be poured upon the clothes while they are in agitation and constantly changing their places, and may flow off, carrying the dirt with it, and may leave the dirt in the bottom of the boiler, so that it will not again be carried up and deposited upon the clothes. By suitable construction, as a cylinder is revolved, the clothes will be carried up by the wings and flanges nearly to the top of the cylinder, when they will give way in the middle of the mass, and fall back into the bottom of the cylinder, so that they will be all the time changing their position, and all the time will have streams of steam and hot water discharged upon them, so that they will be washed clean in a very short time. The water, as it flows back into the space beneath the false bottom, carries with it the dirt taken from the clothes, and leaves it there, so that very little of said dirt will again be thrown upon the clothes.

Improved Steam Boiler.

Carlos A. Clark, Bloomfield, Iowa.—This is a boiler constructed with two steam domes connected with each other by tubes, and with horizontal steam-generating tubes by vertical tubes. The steam may be used from the upper tube or from either of the domes, as may be found most convenient. With this boiler, fuel may be utilized to a great extent. No large body of water is to be heated, and danger of explosion is less than with ordinary boilers.

Improved Horse Blinder.

John W. Kennedy, Central Village, Conn., assignor to himself and William H. Kennedy, Oberlin, O.—This invention consists of a blinder made independent of bridle or halter, and applicable to prevent horses from jumping over fences and thereby escaping from a pasture. It passes under the eyes, stopping all vision from side views as well as front, and as the horse approaches a fence, not seeing it or the ground on the opposite side, he fears to and will not leap the fence.

Improved Curtain Fixture.

Levi Bradbury, Bennington, Vt.—The brackets are made of wire with one or more convolutions to form springs, and with prongs, so that they may be driven into the wood, and fastened without screws or nails. These spring brackets are made to press against the ends of the roller with any required amount of friction to hold the curtain in any desired position.

Improved Hay Elevator.

Uel H. Shockley, Ringville, Kan.—In this hay elevator a carriage is arranged to travel horizontally and carry a bundle of hay suspended by the cord, by which movement is imparted to the carriage. The improvement relates to the construction and arrangement of parts, whereby, when the carriage has reached the place of deposit for the hay, the suspending rope may be swung laterally to free it from hinged doors or clamps, and allow the load or bundle to descend.

Improved Feed Water Heater.

Richard Garstang, St. Louis, Mo.—This invention consists of a feed water heater composed of two cast metal oval heads, with short cylinder attachments, connected to an intermediate cylinder containing tubes fitting into tube sheets in the cast metal cylinders. This forms a heater of three compartments, in one of which is a filter, and in another of which the feed water is supplied in direct contact with the waste steam, after which it is forced by a pump through the other compartments, also through the tubes surrounded by the exhaust steam, and also through the filter into the boiler all in a way calculated to be very efficient in heating the water.

Improved Hog Ringing and Marking Instruments.

Philip Listemann, Collinsville, Ill.—This invention consists of pinchers so constructed that a semicircular ring blank for the hog's nose is formed, and the ring blank inserted. The partly finished ring blank is placed in the grooves of the jaws, and, in this position, it is slipped on the upper cartilage of the hog's nose, the jaws are compressed, and the ring blank is inserted. The blade for marking a hog shuts into one of the levers.

Improved Machine for Making Hollow Cylinders of Paper.

Marble D. Keeney, Rockton, Ill.—This invention consists of a forming roller, which is keyed to the free end of a shaft driven by suitable power, and constructed of two semicircular sections. These are pivoted by their diametrical arms and fulcrumed at some distance from one joint of the sections, while the other joint is acted upon by a pivoted wedge piece, so as to hold the edge of the continuous paper firmly in the clamping joint by spreading the other joint, and form then the box or barrel on the roller.

Improved Journal Bearing.

De Witt C. Clough, Auburn, N. Y.—This invention consists in a journal box, cast with longitudinal side grooves or channels, extending between shoulders near the face parts for producing a firm binding of the Babbitt metal lining cast therein.

Improved Hay and Cotton Press.

Hiram Lupton and Dexter S. Munger, Tullahoma, Texas.—This invention relates to novel means for operating the follower of a hay or cotton press, the object being to give a maximum pressure in applying the muscular strength of men, and to enable the greatest weight to be compressed into the smallest bulk. This not only produces greater convenience in the manipulation of the bale, but diminishes the freight chargeable thereon by railroads and steamers.

Improved Cooking Apparatus.

Mary A. Scott, Patoka, Ind.—This invention consists of a metal case containing a steam boiler, oven, and steaming chambers, adapted to be placed on a stove or range, to generate the steam for heating the cooking chambers. It is designed to distribute the heat better, and thus utilize it to a greater extent than is done in the common stoves and ranges.

Improved Corn and Bean Planter.

George H. Smith, Osburg, Can.—The object of this invention is to plant corn, beans, etc., in rows of any width, and to fertilize and cover the same in one operation. It consists in an upper frame containing the fertilizer and grain boxes and mechanism actuating the same, and a lower or supplemental frame containing openers, spouts, coverers and rollers attached to the upper frame by links, and elevated by means of an elbow lever. A cylinder in the grain boxes having cavities upon its periphery is actuated by a squared shaft, and as it revolves inside a jacket of sheet metal, an arm attached to its end alternately opens a feed slide admitting the grain which fills the cavities in said cylinder; and the said cavities, when inverted from the revolution of the cylinder, discharge their contents through the spouts below. The mechanism in the fertilizer boxes is similar to that of the grain boxes, except that the hopper is provided with a stirrer, and the cylinder has no jacket. Both grain and fertilizer boxes are laterally adjustable upon the squared shafts, as are also the bars of the supplemental frame supporting the opener, spouts, coverers, etc.

Improved Rolled Metallic Bars.

Benben P. Colton, Ganansogue, Can.—This invention is a new manufacture consisting of iron rods or bars from three fourths to half an inch in cross section, rolled from piles or fagots, and provided with edged projecting ribs parallel to the planes of piling.

Improved Car Axle Lubricator.

John W. Bellman and John G. Ernst, Baltimore, Md.—This invention relates to a novel and economical mode of applying lubricants to car axles, and consists in using a spring, one or both of whose ends clasp a side or side of the journal; while, on the inner side of each of these ends is attached the end of a wick which is saturated with and has part of its length resting in the lubricant.

Improved Bedstead.

Stephen P. Leake, London, Can.—This invention relates to the construction of cribs, cots, cradles, and bedsteads, so that they may be made cheaply, durable, and without the use of metallic fastenings, such as screws, catches, or hooks; and so that the labor, machinery, and expense of letting the fastenings into the frame, and fitting them thereto, may be entirely avoided.

Improved Thrashing Machine Attachment.

Asa Low, Shell Rock, Iowa.—This invention consists in causing the grain to pass from the thrasher cylinder to an upwardly moving endless straw carrier made of leather belts or wooden slats, and then to reach the rattle rake while the grain that drops from the straw falls upon the bottom of said rake, and is carried back where the apron deposits. The grain that is blown over the ordinary thrashing machine riddle passes directly to the riddle of the inventor's attachment; while that carried away in the straw is first dropped through the ventilators, and then returned with the straw carrier on the lower floor of the stacker to the same destination.

Improved Stump Extractor.

Randolph P. Cory, Connecong, Can.—This invention relates to and consists in mechanical means for extracting stumps and roots of trees from their native soil, in lifting heavy bodies, and in transplanting them with convenience, dispatch, and facility.

Improved Apparatus for Hoisting and Tying Cotton.

James B. Wendel, Memphis, Tenn.—This invention relates to means whereby cotton bales may be raised and transferred to any given position so as to form a succession of tiers or piled bales in a building.

Improved Stove Grate.

M. Augustus Withers, Pottstown, Pa.—This invention relates to stove grates, and consists in novel means whereby the clinkers may be detached and removed from one part of the grate without the necessity of tipping, disarranging, or emptying the whole grate.

Improved Horse Detacher.

Thomas E. West, Nicholasville, Ky.—In this device the traces are released from pivoted levers by pulling a strap and allowing the levers to turn into a position at right angles to the whiffletree, to which they are pivoted.

Improved Railroad Car Stove.

John H. Mahrenholz, New York city.—Railroad car stoves are usually so constructed that, when the car upsets or the stove is displaced by a violent collision or other cause, the car is frequently set on fire, and the roasting of the helpless passengers is added to the other horrors of a railroad accident. The present inventor arranges a closed top firepot and drop flue in a cylinder having an openwork top, so as to present a large area of heating surface, and to allow the air free access to the pot and flue on all sides, and free escape through the top of the cylinder. He also arranges a water reservoir and steam generator beneath the floor of the car. The stove is firmly attached to the floor of the car, and cannot be readily displaced. It may be turned over or bottom side up without discharging any fire into the car, and is, therefore, safe in cases of accident.

Improved Balanced Slide Valve.

John T. Hill, Warren, Pa.—Slide valves for steam engines, as usually constructed, are subjected to the full pressure of the steam, and consequently wear and cut on their faces, and frequently become useless. The object of the present invention is to so construct a valve that it will not be subjected to this down pressure; and it consists in a valve having an elastic top plate or follower confined between flange plates on the sides and ends of the valves. The valve having this plate thus arranged is placed on the face of the cylinder within the steam chest, and the steam chest cover put on, which forces down the plate against the pressure of the springs. The reaction of the springs and the action of the steam on the lip forces the plate upward with a constant pressure.

Improved Table for Vessels.

Captain Edward P. S. Andrews, Havilah, Cal.—This is an improved table for use on vessels, constructed with sectional top leaves, swinging in suitable supporting standards by means of weights connected to them by pivoted lever rods for the purpose of retaining a level position of the top during the rolling motion of the vessel.

Improved Bluing Package for Laundry.

Alexander M. Van Lier, New York city, assignor to himself and Frederick R. Gillespie, same place.—This invention relates to the manner of putting up bluing used for laundry purposes, and consists in a perforated glass casing in which the bluing bag is enclosed.

Improved Steam Boiler.

Philip T. Brownell, Elmira, N. Y.—This boiler has a flue leading to its smoke discharge pipe, connected with a sliding fire box, to take off the products of combustion when said firebox is withdrawn. The sliding fire box is provided with a lip arranged to close the flue when the firebox has been pushed under the boiler. The firebox is also combined with a plate hinged to the boiler base, covering the top of the firebox when said box is drawn out, and swinging up out of the way at other times.

Improved Game Apparatus.

Henry L. Crist, Midletown, Pa.—In playing this game the object is to throw rings into the coils of a spring, so as to be suspended. The spring is vertically fastened to a suitable standard. It is also a part of the game to throw the rings over pins on the table beneath. The suspended ring counts a certain number, and the other rings encircling the pins are given less values.

Improved Vapor Burner.

Frederick A. Sawyer, Houston, Texas, assignor to himself and Addison H. Baldwin, same place.—The oil is carried through a wick tube to the reservoir. The burners are simple perforated tubes, radiating from the center, but in communication with an annular generating chamber which forms the base of the reservoir. The flow of oil to the chamber is regulated by means of a valve. The burner tubes are closed at their outer ends and are provided with pans to catch the drip. The liquid consumed may be any of the light hydrocarbons, as gasoline, naphtha, etc., and is carried up to the reservoir by capillary attraction, and is converted into vapor as it enters the burners by the high temperature caused by the flames.

Improved Adjustable Window Reflector.

Charles Christensen and Charles Olsen, New York city.—This invention has for its object to furnish reflectors for windows, so constructed that they can be readily adjusted to give an inmate of the room a view of the street in both directions without being seen. It consists in a simple arrangement of gearing so constructed that, by turning the knob, the reflectors may be extended at any desired angle, as the observer may desire.

Improved Fruit Dryer.

Judson Allen, Everett, Mo.—The hot air enters into spaces at opposite sides of the drawers. These spaces are separated from the space under the lower drawer by plates. They are also separated from the spaces between the drawers, except the upper one, by valves, and they are enclosed below the upper drawer by curved deflecting plates. The drawers are arranged with a passage, alternately on opposite ends, and have slots or perforations in the bottom, to allow some heat to pass up between them. The heat is supplied to the drawers mostly from passages by the valves, which are graduated so that each one will take its due measure, the upper one entirely cutting off the space when necessary. The heat escaping beyond the upper valve is all turned in under the upper drawer, or the next to the upper one. The dampers are connected to levers outside of the case by links which are so adjusted as to graduate the valves to the air currents.

Improved Finger Ring.

James Annis, Le Roy, N. Y.—This invention consists of a spring filling piece, to spring into the ring inside of the finger after it is put on, to fill up the slack space and make the ring fit the finger closer above the joint, and secure it against being lost. The filling piece is provided with points, to spring into sockets in the ring to hold it in place; or it may have clips to overlap the edges of the ring.

Improved Ditching Machine.

Thomas F. Cooke, St. Louis, Mo.—On the right hand side of a plow is arranged a wheel the rim of which is a long endless belt of plates jointed together and running up over a sprocket wheel on an elevated frame, and carrying buckets which, in passing under the wheel, go alongside of the moldboard of the plow, so as to receive the earth turned over by it, and carry it up and discharge it into a spout, to be thrown upon the bank at the side.

Improved Wind Wheel Toy.

William Gorton, New York city.—This is a toy wind wheel consisting in a wheel and staff, the former being provided with a sleeve box and pin journal, and the shaft with one or more ferrules. The wings may be placed at any desired angle, so that when the wheel is moved rapidly through the air it will revolve.

Improved Link Block for Locomotives.

William A. Alexander, Mobile, Ala.—This link block is not constructed of one solid piece, as ordinarily the case, but composed of two longitudinal parts, whose adjoining sides are produced under suitable inclination for the introduction and close fitting of a wedge piece; the latter is adjusted from time to time, and forces the block parts closely on the link, producing equal wear over the whole surface of the same.

Improved Washing Machine.

William E. Banzett, Brooklyn, Pa.—This invention relates to that class of machines that combine in one apparatus a washer and wringer. It consists of a receptacle for the water having a concave false bottom, made of ridged or grooved slats, over which vibrates one or more rubbers attached to the ends of a pair of levers containing a wringer. Said wringer oscillates with the rubbers when the same are in operation, and when not in use is folded out of the way in the receptacle. Said receptacle is provided with a double hinged lid, which, in connection with a pair of hinged leaves upon the sides of the washer supported by brackets, forms an ironing board when the wringer is folded within the machine.

Improved Wheel for Vehicles.

Milledge B. Weaver, Johnston's Depot, Edgefield county, S. C.—This invention relates to methods of adjusting the spokes of vehicle wheels to the felloes, and is a new and improved method of doing the same by means of oval-shaped thimbles terminating in screw-threaded stems. Said thimbles are attached to the ends of the spokes, and the screw-threaded stem provided with a nut. The projecting end of the stem passes into a socket or cavity in the felly, and the nut forms a shoulder by turning which the length of the spoke is increased and the connection correspondingly tightened, the oval shape of the thimble preventing the same from turning upon the spoke.

Improved Hay and Cotton Press.

Fielding L. Kirtley, Cleburne, Texas.—This invention relates to that class of machines known as hay and cotton presses. It consists in a strong, substantial box, for the purpose of holding the material to be pressed, provided with doors opening on all sides of the portion of the box into which the bale is compressed. Said box is mounted on rollers upon a frame work, one set of which are contained within a pair of keepers which allow the box to turn upon the frame and assume a vertical position when the same is to be filled. Securely attached to the box are metallic straps provided with links, one set of which engage with a ratchet toothed bar above and below, and the other set, with a rack, on each side of the apparatus. Said rack is contained within a frame work mounted upon rollers and moving upon a level with and upon the same supporting frame as the box. In the same frame with the rack is a shaft, bearing pintoas which engage with the racks, said shaft being driven through cog wheels by a second shaft which is actuated by a spring-seated lever that engages with a ratchet wheel made fast to said shaft. As these levers are operated, the movable frame is advanced, and a follower block attached to the same is forced into the box, there compressing the material contained therein into a bale.

Improved Car Wheel.

Isaac Dripps, Philadelphia, Pa.—The wheel is formed of wood and metal, the object being to render it light, elastic, and yet strong and durable.

Improved Jigger for Separating Ores.

William H. Plumb, Mauch Chunk, Pa.—This invention consists, mainly, in the arrangement of an ore-receiving receptacle with inclined perforated bottom and central tubular extension, which is vibrated rapidly by suitable mechanism in connection with a central perforated disk. The latter is inclined in opposite direction to the bottom of the receiving receptacle, and provided with vertical downward extending guide lugs, and a mechanism for adjusting the relative position of the perforated parts. The central bottom extension of the receiving receptacle is guided in its motion by a sleeve, while the upper part of the same is guided in a surrounding perforated cylinder, with similarly recirculating but considerably slower motion. This slides up and down in the upper wall of the main casing, and discharges intermittently the lighter part of the ores when its perforated inclined rim rises above the upper rim of the casing, conducting the lighter parts off to a chute of suitable inclination, extending around the main casing. The ore or coal is fed through a suitable hopper to the center of the receiver, and kept continually submerged in the water in the tank, and acted upon by the currents of the same. A piston valve serves, in connection with the bottom extension of the receiver round the conical base of the main casing or tank, for the regulation of the flow of water from the extension to the interior part of the tank where the heavier particles are discharged. An inclined casing connects with the bottom of the tank and incloses the ore elevator for carrying up the heavy particles and discharging them above the water level of the tank.

Improved Washing Machine.

John S. Headen, Freeman, Mo.—This invention consists in combining, with the beater or press board frame, a cover, in such a manner that the same is free to reciprocate with the beater frame for preventing splashing of the water, the cover being also detachably applied, so as to enable the clothes to be readily inserted and removed.

Improved Candle Holder.

William Ulrich, Newark, N. J., assignor to himself and F. Haupt, same place.—This invention relates to a candle holder for use on Christmas trees. Spring legs are soldered to the under side of the socket base, and bent in such a manner that they pass sidewise of each other and give to the curved parts, immediately below the point of intercrossing, a spring action, so that this part not only fits to the branch of the Christmas tree, but also adheres firmly to the point to which it has been applied. The lower parts of the legs are spread out in inverted V shape, and are detachably connected by a piece of wire to which a weight is hung.

Improved Sewing Machine.

William W. Abbott, Philadelphia, Pa.—The first part of this invention consists of a guard attachment on the bugged take-up plate used in connection with the rotary looper of a machine in which a commercial spool is used for the under thread, to prevent the said looper from hooking into the old loop. The second part consists of an improved arrangement of devices for actuating the loop spreader; and the third part consists of an improved arrangement of devices for operating the under thread spool carrier.

Improved Form Gate.

George Hoskins, Gilead, Mo.—This invention consists of a gate which slides by its double end piece along T-shaped pieces hinged to the main post, and is retained thereon by pins passing through perforations of the end pieces. A lever, pivoted near the middle part of the gate, raises the gate by its pivoted upright rod near the fore end of the lever, while the rear end of the same locks into notches of the gates for the adjusting of the supporting pins. The adjustment of the gate for the passage of small stock above the snow or other purposes is easily accomplished.

Improved Pill Machine.

Pierre Cauhaye, New York city.—This invention consists of a couple of sets of pointed hooks in a jointed stock, which opens and closes the hooks for gripping and releasing pills, in combination with a table and a holding bar, for holding the pills so as to be taken by the hooks for dipping them in the gelatin coating bath; also, a socket clamp for taking the pills from the hooks after the first dipping; and also a spring clamp for taking the pills from the socket clamp and dipping them a second time in the coating bath. A special advantage of this apparatus is that the pills may be dipped each time exactly to the center, so that the two coats will meet and join thereat without overlapping, and thus make the pills uniform.

Improved Horse Shoeing Harness.

John Claridge, Mount Sterling, Ohio.—This invention consists of a strong harness with ropes from the breech band to posts near the head of the horse; also, straps from the breast strap to the post at the rear; also, straps for fastening the breech and breast straps to the floor, for preventing the horse from going forward or backward and rearing or kicking. It also consists of a strong saddle, having a windlass on it for raising the foot to be shod by a rope, said windlass being adjustable along the top of the saddle and capable of turning as required for hitching to the different feet; and it also consists of a strong bar on each side of the saddle, for the support of an adjustable hook, with straps attached, with suitable ring and buckle for lifting and holding the feet while being shod; also, for holding the guide pulley (which is adjustable), over which the rope passes from the windlass to the foot to be lifted.

Improved Gate for Railway Crossings.

Elmer Ridge, Philadelphia, Pa., assignor to himself, Amos H. Taylor, and Isaac C. Shallock, of same place.—This is an improved gate for railroad crossings, consisting of balanced folding gates placed parallel to the track into recesses of the ground, and hung to side standards, combined with connecting lever rod and lateral crank shaft with lever handle, so as to be rapidly and easily thrown into position on the approach of a train for preventing the passage of vehicles or persons over the track, and instantly folded out of the way after the train has passed.

Improved Hot Air Furnace.

Edwin H. Camp, Jackson, Mich.—The fire box extends horizontally, and is made diamond-shaped in cross section, a little larger one way than the other, and arranged with its greatest diameter in its vertical axis. Flanges in the horizontal axis separate the parts below from the part above, so that the cold air, which is first admitted to the lower part, will all be caused to pass through the fire chamber by tubes into the upper part of the heating chamber. The upper set of the horizontal tubes of the radiator in the space above the furnace is supported directly over the top of the furnace by two short flues, discharging the smoke and hot air from the furnace into it. The other tubes are suspended over the sides of the furnace by middle and end flues. Disks are placed on a rod, which extends along the interior of the upper horizontal tube and projects out at the front for a handle for working the disks which constitute a damper for controlling the escaping smoke, hot air, etc.

Improved Vehicle Spring Brace.

Andrew J. McRay, Alma, Wis.—The rear end of a brace is connected with the rear axle, and its forward end is connected with the forward bolster. A rod passes up through a hole in the reach, through a hole in the brace, and its upper end is firmly secured to the body of the vehicle. The rod has a head formed upon its lower end to prevent it from being drawn up through the reach. By this construction, the rod and the brace will prevent the body of the vehicle from being thrown forward when the wheels enter a hole, and will also prevent the springs from jumping up, so that the springs will be prevented from being injured or broken by these causes.

Improved Drawing Board.

Charles Poore, of Lexington, Ill.—This is an improved drawing board, on which the paper can be placed quickly and neatly without the use of mullage or glue, and without producing stiff glued edges or ridges, and thereby an inaccurate working of the T square. The board is provided with grooves running parallel to and at a suitable distance from the edges of the same. The inner sides of the grooves are slightly inclined, and the fastening strips, of the width of the grooves, are pressed down over the edges of the paper, to bind the same to the board.

Improved Tile Machine.

Ira P. Merwin, Syracuse, N. Y.—This invention relates to that class of machine in which the pipe is mounted on a vertical core in a vertical case supported on a base plate, so that the core can be removed from the molded pipe, and the latter removed in the mold case to dry, and consists of a core standard or core base for the support of the core, detachably connected to the latter by a bayonet fastening, to allow of connecting and disconnecting them readily; also, a novel mode of fastening the core standard in the machine.

Improved Sink Trap.

Henry Miller, Johnston, R. I., assignor to himself, George Miller, and Alfred B. Irons, same place.—The nozzle of the cesspool extends down so as to afford a considerable fall of water, and discharges into the cup of the trap. Thence the water escapes over the edge in such manner that small articles, falling down the nozzle when the strainer is raised, will not be carried out of the cup and down the pipe. Lugs are cast on the stretch trap, with a bolt cast in for attaching the trap by lugs on it to be screwed up by the nuts. This trap is adapted for the use of revolving scrapers for cleaning it out, if required. In case the strainer be screwed down, the scrapers being fixed on arms under the strainer connected to the pivot of a turning knob at the top of the strainer, in the center.

Improved Paint Compound.

George W. Pond, Brooklyn, N. Y., assignor to Mary E. Pond, same place.—This invention is a paint which readily dries and hardens under water either salt or fresh, effectually resists the attack of the teredo navalis, and is consequently very valuable as a paint for all marine vessels. It is made from coal tar by combining with the latter nitric acid, rosin, and sulphuric acid.

Business and Personal.

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

Annealer Wanted—To take charge of the furnaces in a malleable iron foundry; must be able to give reference, and state where and how long he has been engaged in the business. Address John H. Thomas & Co., Dayton, Ohio.

To Engine Builders and Boiler Makers—A practical Boiler Maker desires a location for a small shop, or would purchase an interest in one already established. Address J. C. P. O. Box 2728, St. Louis, Mo.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Engines 2 to 8 H.P. N. Twiss, New Haven, Ct.

For Sale—A lot with building suitable for a small manufacturing business, in a very healthy, thriving village, where coal and lumber are cheap. Enquire of Box 204, Canton, Bradford Co., Pa.

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. Address A. B. Cook & Co., Erie, Pa.

Wanted—A Good, Cheap Cotton Compress. Address A. Shorter Caldwell, Rome, Ga.

Steam Air Pump Wanted—A good Second-Hand Steam Air Pump, capable of a pressure of at least 40 pounds. Address J. Barnard, 23 So. 3d St., Camden, N. J.

C. B. Cotton & Co., Agents for the Sale of Patents, West Gosham, Maine. This firm are reliable, and possess superior facilities. Patentees will find it for their interest to secure their services.

Clock Movement Stamping Co., send Price List to J. F. Ronan, Boston Highlands, Mass.

I have a small brass (stamped) article that I want manufactured. S. K. Seelye, Hudson, Mich.

Button-Hole Worker—Patent for Sale—Sample worker sent for 75c. A. W. Webster, Ansonia, Ct.

Best and Cheapest Wind Wheel Wanted, for raising Water 6 ft. Davidson & Silvers, Cranberry, N. J.

Scientific Books—Send stamp for Illustrated Catalogue. E. & F. N. Spon, 445 Broome St., N. Y.

Wanted—Circulars and Price Lists from Makers of small Water Motors, suitable for running light machinery. Address Porter Blanchard's Sons, Concord, N. H.

Safe Investment—For Sale—Big Muddy Coal, Timber, and Farm Lands. The whole or one interest in 74½ Acres of the Big Muddy Smelting Coal Lands, in Jackson County, Illinois. Vets 3 and 6 feet in 80 feet from surface; five improved Farms, with 2½ acres under fences; Timber, such as White and Burr Oak, Walnut, Poplar, Ash; being 500 acres. The Timber alone will pay for the land. The St. Louis and Cairo Railroad runs through said lands, two miles from Murphyboro, the county seat of Jackson County, Ill. Will sell the whole for \$25 per acre, and take half or one third interest. Address Doherty & Abend, Owners of three Mines in St. Clair Co., Illinois, Belleville, St. Clair Co., Ill.

Deane's Patent Steam Pump—for all purposes—Strictly first class and reliable. S. and for circular. W. L. Chase & Co., 95 & 97 Liberty St., New York.

Models of all kinds made to order. All kinds of light metal work. H. B. Morris, Ithaca, N. Y.

Tornado Windmill Co., Elba, Genesee co., N. Y.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass. Send for sample and price list.

Wanted—The Manufacture of "Specialties" made mostly of Wood. Sayer & Co., Meadville, Pa.

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Portable Engines 3d hand, thoroughly overhauled, at ¼ Cost. L. R. Shearman, 45 Cortlandt St., N. Y.

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

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.

For Surface Planers, small size, and for Box Corner Grooving Machines, send to A. Davis, Lowell, Mass.

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All Fruit-can Tools, Ferracuts, Bridgeton, N. J.

Brown's Coal-yard 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.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 479 Grand Street, New York.

Dickinson's Patent Shaped Diamond Carbon Points and adjustable holder for working Stone, dressing Emery Wheels, Grindstones, &c., 64 Nassau St., N. Y.

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

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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, 30 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 Belting. C. W. Aray, Manufacturer, 301 & 303 Cherry St., Philadelphia, Pa. Send for circular.

Temple & Oileans, Draper, Hopedale, Mass.

Buy Bout's Paneling, Moulding, and Dovetailing Machine. Send for circular and sample of work. B. O. Mach'y Co., Battle Creek, Mich., Box 227.

Engines, Boilers, Pumps, Portable Engines Mechanists Tools. L. H. Shearman, 45 Cortlandt St., N. Y.

For Best Presses, Dies and Fruit Can Tools. Bliss & Williams, cor. of Plymouth & Jay, Brooklyn, N. Y.

Price only three dollars—The Tom Thumb Electric Telegraph. A compact working Telegraph apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 205 Broadway, New York.

Rua's "Little Giant" Injectors, Cheapest and Best Boiler Feeder in the market. W. L. Chase & Co., 95 & 97 Liberty Street, New York.

H. B. will find a recipe for modeling wax on p. 58, vol. 24.—A. J. L. can remove stains of ink and fruit by the recipes on p. 171, vol. 20.—C. A. B. will find that the construction of paper boats is fully described on p. 165, vol. 27.—J. D. G. will find details of the manufacture of tin plates on p. 377, vol. 29.—E. L. will find directions for canning green corn on p. 197, vol. 31.—W. R. H. will find a description of an eolian harp on p. 330, vol. 26.—I. L. N. will find directions for making paper fire and waterproof on p. 129, vol. 28.—F. A. M. can learn small tin articles by the process described on p. 132, vol. 34.—J. E. can join pieces of rubber by using the cement described on p. 303, vol. 30.—W. B. can keep cider sweet by following the directions on p. 10, vol. 25.—F. C. R. can enamel leather by the process given on p. 122, vol. 27.—P. O. F. and W. R. T. do not send their addresses.

O. P. B. asks: What mode of procedure is necessary to prevent paint from blistering and cracking? I have three doors, all facing the east, which blister exceedingly, from the size of a pea to that of a Mexican half dollar. I have had them painted twice in the last year, each time with the same results, blistering, scaling, and cracking. They are pine of the best quality. Would boiling the oil have any effect? Or would hot oil, first applied, help the case? Is the use of shellac any advantage? A. The cause of the blistering is most probably a too rapid execution of the work. After the first coat of paint is put on, time should be allowed for it to shrink into the wood and get hard upon the surface before the next coat is applied; and the same for each coat, when there are more than two. Use spirits of turpentine to thin the paint, and not benzine.

F. A. H. says: 1. You deny that a solid body, projected vertically, returns to the earth with the same force as was used in projecting, by reason of the resistance of atmosphere, whereas the atmosphere has just as much resistance one way as the other. A. If you have any idea that our statement was incorrect, you can easily settle the matter by an experiment. Get a friend to throw a ball into the air, as far as he can, and you catch it as it returns. Then stand off two or three feet from him, and ask him to throw the ball to you, with all his force, and again catch it; you will thus be able to determine whether the force at starting and returning are the same. We do not think that we have given any rule for the horse power of steam boilers. If you have any information on the subject that you would like to impart, we shall be glad to hear from you.

W. E. D. says: I am building a conveyer to convey feed and grain and wish to turn an angle with a universal joint. The angle is of 110°: can the conveyer be made to work? A. It would be better to make the conveyer in two parts.

J. J. T. asks: Which will discharge the most water, two 6 inch pipes or one 12 inch pipe? A. All other things being equal, the discharges of water from pipes are as the areas of their cross sections. A 12 inch pipe has an area of 113.0978, and a 6 inch pipe, of 28.2744. Therefore a 12 inch pipe has double the capacity of two 6 inch pipes.

J. E. asks: What will restore the color to a black coat which has been stained by perspiration? A. Try ammonia.

L. E. A. says: In your issue of July 29, wax is recommended for softening violin tones. In what part of the bridge should the wax be placed, and what wax is the best to use? A. Use a hard white wax, and place it on the edge of the bridge where the strings are strained.

B. M. & Co. say: In casting an iron roller around a cast steel mandrel, the cast iron always bubbles up and forms, after cooling, a honeycomb. We have tried borax, and warmed the mandrel; but we had no better result. What will prevent it? A. Dry the molds and cast the rollers upright, suspending the steel shaft if necessary, and cast the roller rather longer than is necessary. By this means your casting will be sound; and cutting off the top end of the roller, to bring it to its proper length, will take away the few air holes that are liable to remain there.

J. A. B. asks: A freemason's lodge has a hall in a brick building, using the second story. The lower story is used for store and dwelling; and in building, the usual method of defending was used, namely, a door midway in the joints, and then an inch or so of plaster, and then the floor laid down as usual. But this fails to deaden the sound, in fact it seems to make it more hollow sounding, and the noise comes below too much. Our proposition is to lay strips one inch thick on the floor, say 1 foot apart, and then fill that even with mortar, and lay another floor tight on that; will you please inform us about it? Would several thicknesses of sheathing paper, tacked down under the carpet, help it? A. The deafening was probably put in with a lousy mortar, which is too often the case, and has since shrunk from the wood and cracked, and perhaps turned to dust. If it were possible to take up the floor and put in a fresh layer of good lime mortar, it would help it. If not, two thicknesses of building paper laid under the carpet would improve it.

R. M. says: 1. I have a boiler about 16 inches in length and 8 in diameter. What would be the best size for a cylinder for such a boiler? A. You should use a cylinder of 1 inch diameter and 2 inches stroke. 2. What could I best make it of? A. Either of iron, brass, or white metal. 3. What should be the power to the pressure per square inch? A. It will equal the pressure on pistons in pounds, multiplied by space passed over in feet per minute, and divided by 33,000.

What power is required to run an ordinary sewing machine? A. About one thirtieth of a horse power, on an average.

W. S. P. says: I have hit upon a crank which gives two strokes of the piston to one revolution of the crank shaft. I made a model and showed it to several machinists, and they all said that they had never seen or heard of anything like it. Do you know if such an invention was ever made? A. A device for the purpose is quite old.

M. & H. ask: Will leather last longer than rubber, if continually under sweet water, and bent forward and back under a little strain? How long will each last? Is there any other flexible stuff more durable for the same purpose? A. Rubber will generally be the more durable of the two. We cannot answer your other questions without knowing more details.

A. S. asks: Having to renew the firebox to my hot air engine, having a cast iron bottom with flange on the same and sides of heavy sheet iron, I find it impossible to draw the sheet iron to the bottom tight, although the rivets are only ¼ inch apart. Can you tell me of a cement that will close them and withstand the heat, the bottom being often of a white heat? The leaks are small. I have tried pulverized firebrick 2 parts, with 1 part plaster of Paris, also litharge and glycerin. The former is the best, but flakes under the intense heat. A. A well made rust joint may answer.

R. G. T. says: I have a spindle of three inches diameter, and I want to bore a ring out, driving it. What additional allowance am I to make to get that ring to go on, and what is the specified rule to take in practical work of that kind? A. Set your outside calipers to just perceptibly touch the shaft, and your inside calipers on a pointed wire gauge to barely touch the points of the calipers, and to barely touch the hole in the collar. Why do you not try the spindle in the collar while the latter is in the lathe? If the collar is to be a permanent fixture, why not warm it and then shrink it on? There is no rule as to the allowance on calipers for a driving fit; it is too fine an operation to allow of any practical rule. An expert workman can rely upon his judgment; others try and re-try the fit.

B. H. S. says: I am running an engine of the following dimensions: 20x26 inches cylinder, 125 revolutions per minute, 100 horse power, 7½ inch crank shaft, and 11,000 lbs. fly wheel of 12 feet diameter. There is an opening in steam pipe from steam dome to engine of 3 inches diameter, and east from steam pipe 18 feet in all, with 3 elbows. I have 3 boilers, 24 feet long and 43 inches diameter, with two 16 inch flues in each. A steam drum runs across the 3 boilers at ¼ the distance from the back end of boilers. The dimensions of steam drum are 18 inches diameter, 7, 14 feet length, and there are three 4 inch openings in connection. At certain times, just after firing up, we have a severe rushing and hissing sound, just as if steam were passing very rapidly from one boiler to the other; this lasts for 3 or 4 seconds, and is then followed by a heavy thumping and rumbling noise and a quick sudden jarring of the boilers. All of this probably lasts for 6 seconds, and at low stages of water and high pressures of steam; and the needle on the steam gauge shakes and trembles, and the water leaves either the middle boiler or one of the side boilers. Can you tell me what is the trouble? I think the openings in the mud drum connections are too large, and the water passes from one boiler to the other from uneven firing. A. The trouble seems to be caused by excess of pressure on one boiler, due to uneven firing. We have frequently pointed out, on former occasions, the trouble and danger likely to result from this arrangement of feed pipe. Each boiler should be fixed so that it can be supplied with water independently of all the rest, and so that water cannot be forced from one boiler into the other.

G. & W. say: Sixty days since we put up a boiler of 44 inches diameter and 30 feet long, with nine 6 inch return flues, to run a 12 x 30 engine twenty feet distant, and connected thereto by a steam pipe of 2½ inches diameter, with a furnace 18 inches deep and bridge wall carried within four inches of boiler and circular in shape, with side walls 3 inches from boiler. The side walls are carried up to make fire linings high, and there is a combustion chamber, at rear of bridge wall, 16 inches deep, divided by two walls equal distances apart, and carried up like the bridge wall; but it fired hard and ate up too much fuel. We changed it several times with no improvement, and now have the bridge wall 5 feet 2 inches below the boiler. We took down the division walls of combustion chamber and filled it up to within 9 to 12 inches of boiler; but it is not as good as at first, firing much harder and not keeping steam so easily. We use shavings from yellow pine for fuel. We sometimes run three planers, besides a carpenter's shop. We require 100 lbs. steam to run everything well, but cannot keep it up now by any kind of firing. Our chimney is 30 inches diameter and 40 feet high. We shall await your advice before changing again. A. It may be that your furnace is not large enough, that your grate bars are of the wrong kind or improperly set, that there is a large leak of steam in the engine, that the boiler is not large enough for the work, etc. Matters of this kind are best settled by a good engineer, after an inspection.

J. D. asks: 1. Of what horse power should an engine be to run a boat 25 feet long and 4 feet wide, built with a flat bottom (like the boats on the Mississippi river) with a depth of 18 inches, with a 12 inch guard on each side? A. From 6 to 8. 2. What amount of tonnage could such a boat carry? A. From 3 to 4, including the weight of the boat. 3. Would a propeller or stern wheel be the most efficient? A. Stern wheel, probably. 4. Which would be the cheapest? A. There would not be much difference in cost between the two.

A. M. S. asks: What will be the pressure on 128 square feet when the wind blows against it at the rate of 40 miles per hour, 20 miles per hour, and 10 miles per hour?

A. Velocity of wind, in miles per hour.

Pressure against a perpendicular surface, in lbs. per square foot.

10 0.492
20 1.968
40 7.872

2. Would the pressure be the same if the air was still, and the plane moved against it at the same rate? A. Yes.

1. What is the cost of aluminum? A. About the same as that of silver. 2. Can it be procured in this country? A. Yes.

N. B. S. asks: Where was the first railroad on which the first locomotive engine was used, for conveying passengers or freight, in this country? What was the date thereof? A. The late Joseph Harrison, Jr., states that the first locomotive run in America was the "Lion," built at Stourbridge, England, and used on the Delaware and Hudson railway in 1829.

A. & W. B. C. asks: How can we soften a broken circular saw, so that we can easily cut it up to use the steel for other purposes? A. Make the steel red hot, and leave in a heap of dry sawdust till cold.

G. D. asks: Suppose a man were stationed at every degree, or only four minutes of time apart around the globe, and a man should start from New York, say at noon on Monday and keep pace with the sun, which station would first inform him that it was Tuesday noon? A. At 180° from the meridian from which time is reckoned. All vessels keeping Greenwich time change the date one day either backward or forward, according as they are moving east or west, in passing the place where the longitude is 180°.

At what place opposite the sun on the earth should an observation be taken to be in a straight line through the center of the sun and the earth at the moment of perihelion, in order to establish a point in the heavens at the moment the earth is nearest the sun? A. The time of the earth's perihelion passage is given in astronomical almanacs in Greenwich time, and an observer who wishes to be on the line between the centers of the sun and of the earth at that time must place himself on the meridian of longitude there indicated.

M. H. R. says: I have a large brick building, built of common brick, which I am now having painted and penciled. Would you advise me to mix any liquid glass with the last coat of flat brick red, or to put on a coat of liquid glass, after the painting and penciling is done? If the liquid or soluble glass makes a permanent covering, I think it would be a valuable addition to put on a last coat of it, as otherwise in a few years the oil dries in and the red will rub off unless a coating of oil is applied. Perhaps it might be well to wait a year or two before applying the glass. A. We do not think the use of soluble glass would improve the paint; it is used mostly for inside work. If your building is a new one, it would be better to let it stand as long as possible without painting, to enable the walls to dry.

P. D.—The problem of a boring bar being out of true, boring a true or oval bore is capable of three explanations: If by "being out of true with the lathe shears" is meant that the bar is out of true as if in consequence of being bent in its length, it will bore a true hole, providing, as stated, that the carriage feeds up to the cutter. If the term "out of true with the lathe shears" means that a line drawn between the centers of the lathe will not be parallel, both horizontally and perpendicularly, with the shears of the lathe, still the bore will be true if the boring bar runs true and the cutter head feeds along the bar; if, however, in this latter case, the cylinder feeds to the cut, the bore of the cylinder will be oval. Boring bars with immovable heads are not, however, under any circumstances, good tools to use, because their length must necessarily be twice that of the length of the cylinder; hence they are not so rigid, and are therefore more liable to jar and spring than bars having traveling heads, which need be only long enough to allow the head to pass through the cylinder.

E. L. E. and others: A child is in the second year of his age when he has completed the first, and so on. So that a man is in the twenty-sixth year of his age when he has completed twenty-five years, the twenty-sixth year commencing on the twenty-fifth anniversary of his birthday.

W. P. G. asks: Where can I get a copy of the American Astronomical Ephemeris? A. At the Hydrographic office, Washington, D. C.

J. H. G. asks: What objections are there to the use of raw gas tar with clean bar sand, thrown on as applied, for a coating on an English roofing felt? Would such a coating last, say, two or three years? Gas tar is sold here for eleven cents per gallon. Will it last long enough to pay for the putting it on? A. Gas tar is used as a paint or varnish on wooden fences, and all wood exposed to the weather, and is found to be beneficial as a preservative; especially is it used to advantage on the bottom of fence posts in the ground, to prevent decay. It will no doubt preserve the felt, and we do not know of any objection to its use. But they charge you too much for it; two cents per gallon is enough.

G. W. S. asks: Is there any device for taking steam out of a boiler by a tube and conveying it under the grates of the fireplace, to keep the fire down when the engine is stopped? A. We do not know of anything of the kind.

C. asks: How can I blue gun work? A. Having a quantity of charcoal ashes or an iron plate or in a box, place over the fire and heat slowly. Put the articles to be blued in the ashes; and as they heat up, take out occasionally to observe the color. When the color is a blue, do not take them out, but leave them until they have become white again, when they should be taken out and allowed to cool. By returning the articles and re-heating, you will have the second blue; the first will rub off easily, but the second will wear a long time.

H. D. A. asks: What is the correct weight of cast iron balls of ¾ inches diameter, made of hard iron, such as is used for car wheels? A. Average weight, about 2¼ lbs.

Z. asks: How many lbs. of steam of 160° Fahr. can one lb. of ice condense, leaving its water deposit at 39°? A. About 9.182 lb., if there is no loss by radiation and conduction. A line in our Business and Personal column will doubtless obtain an answer to your other questions.

H. H. H. asks: 1. Can an engine be made to cut off at any desired point with a cut off valve working on top of an ordinary slide valve, by lengthening or shortening the cut off valve rod? A. Yes. 2. If so, what is the relative position of eccentric? A. The cut-off eccentric should be set so that the cut-off valve has motion coincident with that of the piston.

W. C. asks: Will you please tell me the usual proportion between the high and low pressure cylinders in a compound engine? A. The low pressure cylinder is made from 2½ to 4 times as large as the high pressure.

Is it difficult to determine the horse power of a locomotive? A. It would be necessary to attach a dynamometer to the locomotive, or to take indicator diagrams from the cylinders.

Is the Science Record printed every year, and can I get back numbers? A. Yes.

J. B. says: I have seen it stated that, for accurate shooting, a muzzle loader beats a breech loader. Is this the case? A. A good breech-loading rifle is better than a muzzle loader.

C. M. A. says: 1. In a late number of your paper you advise a correspondent, who wants to build a sail boat sixteen feet long, to build a centerboard boat six or seven feet beam, and cat-rigged. What is a cat rig? A. Single sail with boom and sprit mast. Would you have the boat clinker built or caulk-seamed? A. Caulk-seamed. 3. How far from the bows should the widest place be? A. From 3¼ to 10 feet.

E. S. G. asks: In setting the valves on a locomotive engine in which the throw of the eccentric had been changed from 5 to 3 1/2 inches, I could not get her valves square. I first set her at full stroke; and when hooked up she was out very badly. I laid it to the links, but do not think the fault was in them altogether. I next set her hooked up to 1 1/2 inches, and found that at full stroke, on the forward center, giving her no lead and putting her on the back center, she was blind 1/4 of an inch. This was with the reverse lever in the forward motion, with the engine cold. The valves have 1 1/2 outside lap and 1/4 inside lap. When she went out, she was square at full stroke. I told the foreman that the expansion had divided that 1/4 inch blind, and made her blind 1/4 inch on each end. Was I right, and what is the reason we can get her square only at one notch? Would the link lifters affect it any? They are very short. A. It is generally impossible to get equal action of the valve at each end, on account of the angularity of the connecting rod, etc. A valve which is right when cold is frequently very much out of adjustment when steam is turned on. A trial with the indicator is the surest test, and in general the only one that can be relied upon to ensure accuracy.

B. W. says, in reply to W. H. M. L., as to accelerating the making of good butter in warm weather: When milk is reduced to between 50° and 60° Fah., immediately after coming from the cow, the cream will rise in four hours. If the temperature is kept at 54° without variation or agitation, all the cream will come to the surface in one hour. One of the secrets of making good butter is to remove the cream before lactic acid commences to form. Hence the reason why farmers who have milkhouses situated over cool springs invariably make the best butter. A few years ago, business necessitated my remaining in the South for about two years, and feeling the want of good, fresh butter, I arranged a block tin worm in a wash tub, with funnel in upper part, the lower end protruding through the side of the tub near the bottom. I filled the tub with ice water, and as the milk came in pails from the cows, poured the milk through the worm, regulating the flow and temperature by pouring it in. I could run it off at 54°, and kept it so for one hour by setting the pan in ice water, when the cream was removed and churned, making the "Simon Pure." "Orange county" milk will keep one day longer without souring by the same process.

W. H. W. says: In your issue of July 25, 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?" You add: "We shall be glad to receive replies to the above for publication." Thorough coating with amorphous black lead paint will effectually deter the worms; they will no more attack the carbon of that paint than they would charcoal; only by an abrasion which shall lay bare the wood, is there any danger from the worm. The paint should be carefully made, wholly with raw linseed oil. Let each coat be well worked on, and perfectly dry before a succeeding coat be put on; polish each coat gently with sand paper. Three or four coats of good paint, properly put on, will prevent any attack by the worms. This paint becomes exceedingly hard, and adheres with singular tenacity.

B. says, replying to the query of H. D. M.: "How can I clean petroleum barrels, fitting them to hold cider?" Steam the barrels by means of a pipe from a boiler introduced at the bung hole until all the glue and dirt comes away, then wash once or twice with scalding vinegar. The outside is of course to be cleaned with a brush and soap and water. Petroleum barrels cleaned in this manner, and with wooden hoops and the usual plastered ends, are extensively used in Europe for shipping the finest salad oils which come to our tables.

C. B. L. says, in reply to J. A. J., who asked how to kill house flies: Fill a tumbler about half full of soapy water; cut a piece of pasteboard somewhat larger than the top of the glass; put a hole in the middle about the size of a cent; then smear one side of the pasteboard with molasses or other sweet stuff, and turn it so that the molasses will be on the lower side, nearest the water. Be careful not to get any of the molasses on the outside of the pasteboard; and put it in the place frequented by the flies. In trying to get the molasses, they will tumble off and be drowned. You will soon have a tumbler full of flies.

B. asks: How can I melt steel scraps in a crucible, and have it retain the nature of steel? My experiments thus far, when the steel was melted and poured into a sand mold, have produced castings of a very poor kind of rotten white iron. J. E. asks: How is the phosphorescent light (which the Navy Department have adopted) made?—D. C. G. asks: Why is it that some of the human teeth (most frequently the cuspids) have corrugations or rings around them, similar to corrugations around the horns of cattle?—C. B. F. asks: Will some one give me full instructions for making a racing boat?

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 C. J. H.
- On a Mechanics' Political Organization. By V. T.
- On Davies' "Arithmetic." By L. H. S.
- On an Improved Furnace. By B. T. S.
- On a Mosquito Net. By L. E.
- On Lightning Rods. By B. W.
- On Ice Machines. By J. W. H.
- On Aerial Navigation. By Dand by J. H. D.

Also enquiries and answers from the following:

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

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 pa-

tentability 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 mullage? 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.]

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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:

- 30,450.—BURNER CAR SPRING.—T. F. Allen. Oct. 7.
- 30,451.—CLOTHES SQUEEZER.—F. Arnold. Oct. 7.
- 30,452.—CAR WHEEL.—G. S. Bosworth. Oct. 7.
- 30,457.—CAR SEAT AND COUCH.—E. Burke. Oct. 7.

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- 29,228.—MOVING MACHINE

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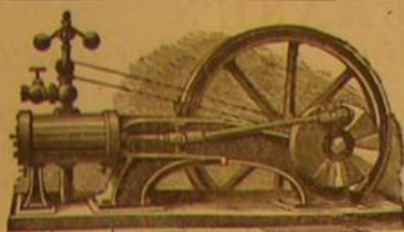
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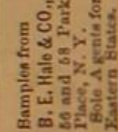
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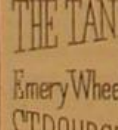
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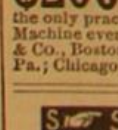
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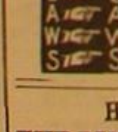
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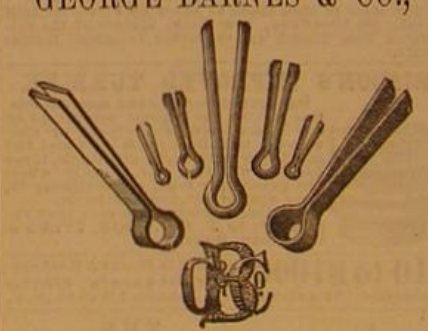
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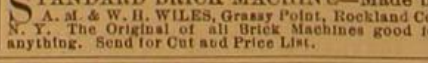
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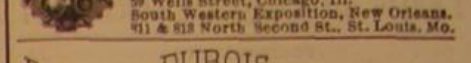
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