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SCIENTIFIC AMERICAN

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

Vol. XXXII.—No. 9.
[NEW SERIES.]

NEW YORK, FEBRUARY 27, 1875.

\$3.20 per Annum,
Postage prepaid.

THE ENGINEERING WORKS THROUGH, UNDER, AND OVER THE BERGEN HILLS, OPPOSITE NEW YORK.

From a point about opposite the central portion of New York city, for a distance of some fifteen miles northward, the west shore of the Hudson river presents an unbroken bluff, hundreds of feet in precipitous height, and to which the name of the Palisades has long since been given. The formation is a narrow ridge, sloping gently inland until it reaches the peninsula included between New York Bay on the east and Newark Bay on the west, where it changes into a series of irregular hills. These no longer line the river bank, but, at about a mile from the shore, rise abruptly from the otherwise level country, forming a rocky spine, which gradually tapers, and finally becomes lost in the waters which bound the southernmost end of the peninsula. The geological nature of the rock is a greenstone trap, bordered in places with, and having beneath it, an argillaceous red sandstone, besides containing, in many localities, deposits of iron pyrites.

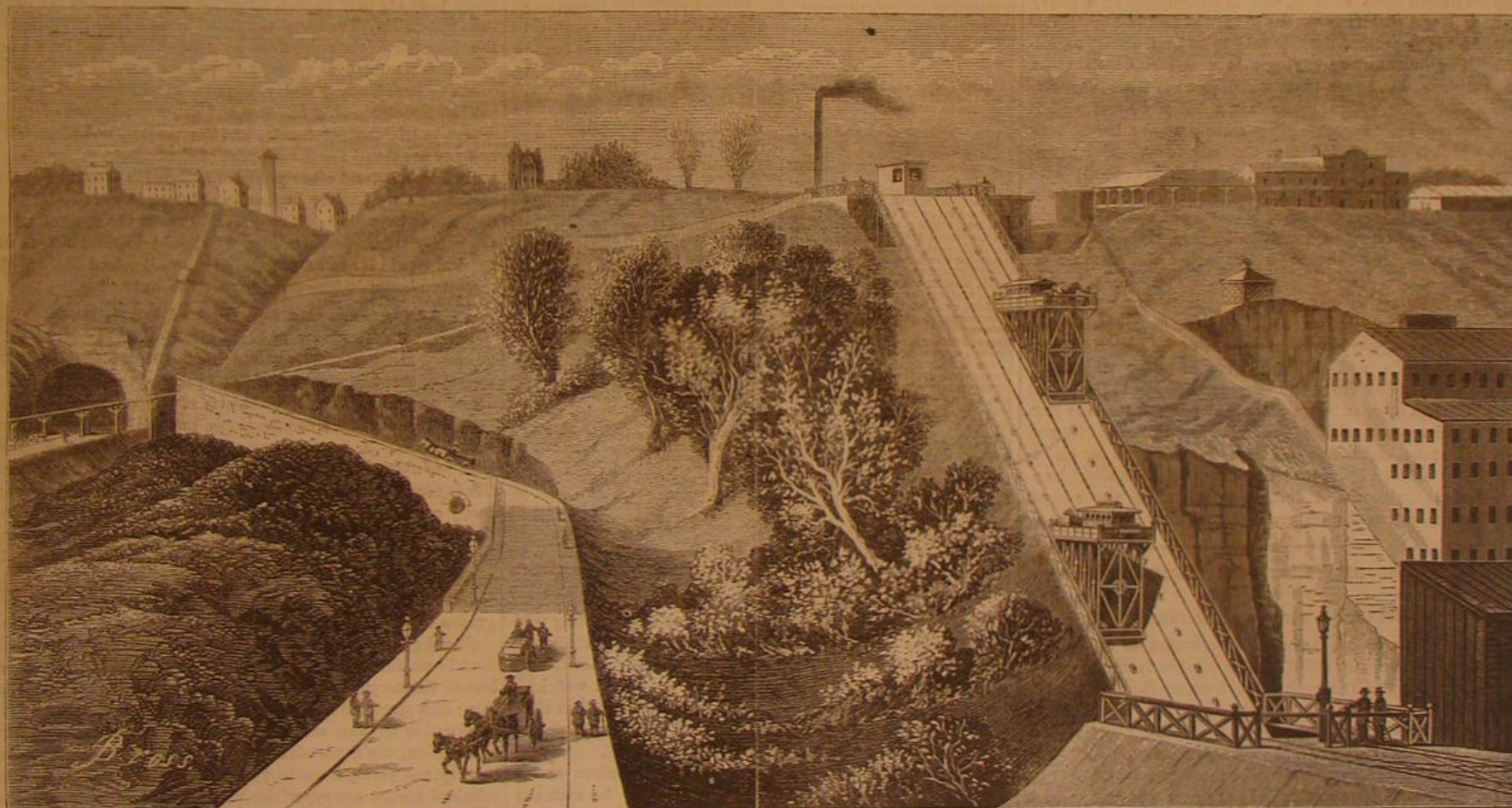
pipes, which, though not coming under any of the above heads, are nevertheless included within the narrow area over which the other operations have been carried on—a space measuring about two miles and a quarter north and south, and varying in width from half to three quarters of a mile.

The means for getting through the ridge, consisting in open cuts, have necessarily been those adopted at the southern point, where the elevation as well as width of the hill is least. Furthest south of all is the cutting of the Newark and New York road, some 3,800 feet in length and 50 feet in depth. The height of the ridge here is 80 feet. Operations were begun in 1867, and completed to a temporary grade of 100 feet to the mile, which, at the present time, is being cut down to 30 feet to the mile. The work necessitated skillful labor, since the excavations in progress are made directly beside the tracks over which the trains are constantly running.

The Pennsylvania Central cut is the oldest passage through the ridge. It is located three quarters of a mile to the north

Delaware, Lackawanna, and Western tunnel, a sketch of which our artist contributes in the annexed illustration, is located about 2,700 feet to the north of that of the Bergen bore. The western ends of the approaches intersect, and this is caused by the Delaware, Lackawanna, and Western tunnel taking nearly a direct east and west course through the ridge, the angle between the two tunnels being forty degrees. The roads, however, do not cross, as the Erie track at the western end dips under that of the other line, lying some 19 feet beneath.

The Delaware, Lackawanna, and Western tunnel is now in progress. When completed, it will be 4,200 feet long, 27 feet wide, and 19½ feet high. It was begun in September, 1873, and work has been simultaneously prosecuted at the bottom of each of the six shafts and at the two approaches. About 1,200 feet are now finished, and it is expected that by the summer of 1876 the entire work will be complete. The character of the excavation presents no extraordinary feature. Trap rock is met everywhere, and the bore will be



THE NEW RAILWAY TUNNEL AND STREET CAR ELEVATOR, JERSEY CITY, OPPOSITE NEW YORK.

On the flat plain, east of the ridge, Jersey City is built. The small adjacent towns which, quite recently, were absorbed within the corporate limits of their larger neighbor, lie to the north and south, spreading over the hills, until their westward growth meets a check in the broad expanse of salt meadows and marshes which extend from the foot of the declivity toward Newark Bay. The great railroads, however, which make Jersey City their terminus—the Delaware, Lackawanna, and Western, the Erie, the Pennsylvania Central, and a number of others which include some of the largest coal and oil transportation lines in the country—find little difficulty in crossing the wide flats which form so serious an obstacle to the enlargement of the city. True, the ground is marshy and soft; and in one instance, we learn that, in building the roads, three heavy piles were driven in one above the other before hard, holding soil was reached; but by dint of immense expanses of trestlework and heavy foundations, comparatively solid road beds have been constructed. The great barrier between New York and the inland traffic of New Jersey and Pennsylvania lies in the huge ridge to which we have above referred. Toward the surmounting of this obstacle an aggregate of engineering skill and of capital has been directed, which, considering the small area upon which such vast operations have been conducted, is perhaps without parallel elsewhere in the world. It is our object, in the following lines, to sketch briefly the results of these labors, which may be classed, first, into means for getting over; second, into means for getting under; and third, into means for getting through the hilly. To these we add short reference to another important engineering work, the Jersey City Reservoir and its conduit

of the Jersey cut, and is a sinuous line is lieu of the direct path of the former. It is, consequently, some hundreds of feet longer. Operations are now in progress for straightening it. A new cut, at an angle to the old one, and near one extremity, was made about a year ago. Save in the magnitude of these works, there is little of especial interest; and owing to their being practically incomplete, no fair estimate of their future aggregate cost can be gathered. A rough calculation, however, based on the material removed, labor, etc., up to the present, gives about a million dollars as the probable outlay for both.

Nearly a mile to the northward, the ridge is entered by the Bergen or Long Dock tunnel. This great work was begun in 1856, and completed in 1860. It crosses the hill diagonally, and is 4,311 feet long, 23 feet high, and 30 feet wide. Eight large shafts, from seventy to ninety feet deep, were sunk from the summit down to its level. The traffic through this passage includes the immense business of the Delaware, Lackawanna, and Western and the Erie railroads. This of late has far exceeded the capacity of the tunnel, since it is not permitted for one train to enter until another preceding it in the same direction has emerged. A delay of at least five minutes is thus caused, and hence but twelve trains per hour on each track can be accommodated. As the tunnel belongs to the Erie, the Delaware, Lackawanna, and Western line is necessarily at a disadvantage, and hence the occasion for the beginning of a second tunnel by the last mentioned company, to which work we shall next allude. The Bergen tunnel, it may here be remarked, is estimated to have cost in the neighborhood of one million dollars.

The eastern or Jersey City approach and opening of the

simply a clean cutting, reinforced with brick arches at the approaches and wherever signs of weakness in the rock may appear. Hand drilling is generally employed, and in the opinion of the contractors is more profitable than the employment of steam machinery for the purpose. The estimated cost of the tunnel is \$800,000.

The means for getting over the ridge are located at about a thousand feet still further north, and consist in the car elevator of the North Hudson County Car Company. This is also represented in the engraving, from which an excellent idea of its appearance may be obtained. Its object is to raise street cars, passengers, horses, and all, from the bottom to the top of the hill, a vertical height of 102 feet 6 inches. The incline is about as one to four, and the entire length of the tracks 480 feet. Of these last there are two, firmly laid upon timbers at 7 feet 10 inches gage. The cars are drawn upon two trucks made of very strong framework, the upper platforms of which are level, while the lower portions are inclined, to fit the slope of the rails. When a truck is either at the bottom or top of the road, its platform is in such a position that the car can be directly driven thereon. The closing of a bar behind the vehicle then causes chocks to rise from the track, which rest against the wheels, holding the car in place and preventing the horses moving it until the bar is once more opened. Between the two trucks extends a heavy steel wire rope, which passes over suitable pulleys at the top of the incline. This acts as a kind of safety cord and, at the same time, causes the weight of one car to counterbalance that of the other, throwing less labor upon the hoisting machinery. The engineer is stationed in a kind of pilot house on the upper platform, beneath which is a

spacious room in which engines and boilers are located. The engines, two in number and of forty horse power each, are horizontal, and are connected directly to pinions which engage in large spur wheels arranged between the two winding drums. The latter are 12 feet in diameter, and to each are brought two 1½ inch steel wire ropes, which serve to hoist and lower the tracks. Inside the engineer's house above are counterpoised levers connecting with the throttle and link, and a treadle operated by the foot, which governs friction and vacuum brakes on the drums. The average time of raising one car, while lowering another, is one minute, though the same can be done with safety in half that interval. The work was begun on July 1, and finished in November 21, 1874. Mr. John P. Endries is the designing engineer, and the Dickson Manufacturing Company, of Scranton, Pa., the builders. The total cost was \$80,000. We understand that it is proposed to construct another and similar elevator further to the north, at a point where the ridge is 230 feet high.

The new distributing reservoir, now in process of construction under the supervision of Mr. J. P. Culver, Chief Engineer of the Jersey City Water Works, is located on the summit of the hill and between the positions of the elevator and the Delaware, Lackawanna, and Western tunnel. For many years past the Bergen reservoir, a small structure holding only a three or four days' supply for the city, has served the purpose of a distributor; but the increasing population has necessitated the present building, of larger accommodations. Work was commenced on the new reservoir in 1870, and will, it is expected, be completed so that a portion of the reservoir can be used during the coming fall. The area of the structure is 27 acres, or 700 feet wide by 1,700 feet long. Its capacity will be 23,000,000 gallons, this being a supply for 23 days. The depth of water will be 25 feet. The receptacle is divided into two portions, either or both of which may be drawn upon at will, and is surrounded by a heavy stone wall and puddle bank, the former 18 feet in height. The cost, up to the present time, is said to be half a million dollars. The means of supplying this reservoir consists in a huge siphon 30,075 feet long, which joins it with the reservoir at Belleville. The siphon has a fall of 29 feet, and is composed of three separate pipes resting upon a trestlework bed, which is constructed over the meadows. The oldest pipe is twenty inches, and the others, which have been placed quite recently, are thirty-six inches, in diameter. One of the latter is of cast iron; the other is worthy of special remark, as it is made of one eighth inch boiler iron, riveted together and covered inside and out with two inches of hydraulic cement.

It is interesting, by way of conclusion, to sum up the aggregate amount which has been spent in overcoming the rocky obstacle which Nature has placed at the very threshold of the metropolis, and through, over, or under which lies the most direct line from the West and South to the great market. The open cuts we placed at one million, the Bergen tunnel another million, the Delaware, Lackawanna, and Western tunnel eight hundred thousand, and the car elevator eighty thousand dollars; total, two millions eight hundred and eighty thousand dollars, or, including the second car elevator, in round numbers three millions of dollars.

SCIENTIFIC AND PRACTICAL INFORMATION.

HETEROPLASTY, A NEW MEDICAL DISCOVERY.

Skin grafting, as we have taken occasion to explain in some detail, is the removal of a piece of skin from the sound part of the body of the patient, or from another individual, and placing the same upon the raw surface of an obstinate ulcer, burn, or other wound. By thus creating centers of eccentric cicatrization on extensively injured surfaces, the rapidity of the healing process can be much accelerated.

Dr. R. J. Lewis, in an extended article on this topic which we transferred to our columns some months ago, alluded to the possibility of obtaining the necessary grafts from limbs amputated for traumatic injuries. This has been repeatedly tried by Dr. Anger, of Paris, and with such remarkable success that the result is considered as certain as if grafts directly obtained from the patient were employed. Dr. Anger, however, proceeds further, and has used, not merely epidermic grafts, but those comprising much thicker layers—dermo-epidermic, he terms them—and finally he is enabled to employ the entire thickness of the skin, and even the subcutaneous cellular tissue. He has successfully transplanted grafts of the last description from 0.3 to 0.6 inch in diameter, obtained from the palmar face of an amputated finger. These were applied to an open ulcer on the leg of the patient and bound in place by diachylon bandages. Three days after the grafts were intimately united with the injured surface and manifestly vascularized. Heteroplasty is the new name given to the operation.

THE CHEMICAL CONSTITUTION OF THE BRAIN.

M. Gobley has recently completed extended investigations on the above subject, from which we adduce the following results: The human cerebral substance contains about 80 per cent of water. Two albuminoid matters are present, one not differing from albumen and soluble in water; the other is insoluble, and for this the investigator proposes the name of "cephaline." The fatty substance of the brain is formed principally of cholesterolin, lecithin, and cerebrin, and also olein and margaric. The organ contains certain salts, some soluble in water and in alcohol, others soluble in water and not in alcohol. During decomposition, the cerebral pulp furnishes acid products, among which are oleic, margaric, phospho-glyceric and phosphoric acids.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS.

One copy, one year, postage included.....\$3 20
One copy, six months, postage included.....1 60

Club Rates.

Ten copies, one year, each \$3 20, postage included.....\$27 00
Over ten copies, same rate each, postage included.....2 70

By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise they will be entered from January 1st, 1875. In case of changing residence state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXII, No. 9. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, FEBRUARY 27, 1875.

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THE GENERATION OF THE WICKED.

It is a fortunate circumstance that vice is ultimately self-destructive. Lust, violence, and debauchery are killing in themselves; and the children of the brutally vicious are very apt to enter upon the struggle for existence weighted with such an inheritance of weakness and disease that their early extinction is all but inevitable. It is a law of nature that the generation of the wicked shall be cut off.

To this beneficent law, however, there are serious exceptions. Certain phases of criminality—as may be seen any morning in our police courts—are not only consistent with but are usually accompanied by abundant animal vigor, capable of indefinite propagation; and the probabilities are that the criminals of future years will be chiefly descended from the sturdy sinners for whose restraint the police systems of to-day are mainly required. The criminal class, like the pauper class, is to a great extent an hereditary caste, representing the uncivilized and largely uncivilizable elements of the community. How to deal with this class, how to turn its perverted forces into useful channels, and make its perpetuation difficult if not impossible, is the great social problem of the day.

Victor Hugo has said that the quickest way to civilize a man is to civilize his grandmother. The saying is worthy of a place among the axioms of social science. Certainly when society neglects the grandmother—as it did in the case of the waif called "Maggie" (referred to in our paper of January 9), to whom Dr. Harris traces such a pestilent brood of human vipers—the succeeding generations are pretty sure to pay a heavy penalty in perpetuated savagery. Probably each one of the small army of criminals, lunatics, drunkards, imbeciles, and the rest, to which she gave being, has cost the country more than would have sufficed for the reclamation of a dozen such grandmothers to be, certainly enough to surround them with conditions which would make it impossible for any one of them to stock a country with criminals and paupers.

It will not take many such cases, it is to be hoped, to rouse the community to an appreciation of the urgent need of greater watchfulness in regard to the development of vagrant children, and all children not subject to wholesome influences. Who can say how many Maggies are skulking about city and country to-day, or cowering in homes of bru-

tal and vice, receiving the training requisite for making them criminals and breeders of criminals? For its own safety, let alone the children's present and future welfare, society is bound to adopt more liberal and thorough measures for removing such heirs of crime and criminal poverty from their corrupting environment, and for training them in ways of industry and morality.

It may be impossible to make much of such unpromising material, nevertheless it is possible to prevent much; and with social as well as with individual disease, prevention is better than cure. Every boy or girl growing up in beggary and lawlessness is the possible ancestor of a line of pariahs as numerous and burdensome as Maggie's have been; and neither prudence nor philanthropy can tolerate the neglect of them. As a matter of justice, too, society has as little right to allow the future to be afflicted with the pernicious fruit of such pernicious stems as it has to stock the fields with poisonous plants, or knowingly to establish the conditions for the development of future pestilences.

How Can Society Help Itself?

Primarily, by civilizing, so far as possible, the naturally uncivilized grandmothers, not forgetting the grandfathers also, by bringing them up in habits of honest industry in useful occupations: not in unnatural masses in prison-like asylums, but in workshops and families. This done rigorously, the criminal class will be largely cut off by conversion into something better. We shall have cause for thankfulness when so much is done. But the time is probably coming when society will see the necessity of taking still more radical measures for the prevention, not only of possible crime, but of possible criminals. In a more immediate and active sense than the words now carry, the generation of the wicked will be cut off.

Nature's processes for effecting this end are, like most other natural processes, very slow and very wasteful; still more, they are very unjust, since the innocent suffer far more than the guilty. The lusty vagabond leads a jolly life, filled to the end with all the enjoyment he is capable of; and leaves behind him a numerous progeny to pay the penalty of his misdeeds in hereditary poverty, impoverished constitutions, depraved tastes, wasting diseases, and other conditions of early defeat in life's engagements, and the morally and physically healthy are taxed for the support of almshouses, prisons, asylums, hospitals, and other places of refuge for them. For the victims, as well as for humanity at large, it were better had they never been born. We do well to make the most of them after they are born—or rather, we should do well did we do so; but would it not be infinitely better all round could their existence be made impossible from the outset?

Advantages of a Diminished Birth Rate.

The rational tendency of high civilization is toward a diminished birth rate. The waste of life that goes on in ruder societies, through wars public and private, through improvidence and unhealthful conditions of living, is immensely lessened in civilized communities, and with it the need of many births. A vastly larger proportion of the children born are able to attain maturity, and the average duration of life is much increased. A low birth rate is therefore perfectly consistent with high national power and progress, and the development of all that makes life desirable; and, as we have said, the tendency of civilization is always to attain such an economical birth rate.

But unfortunately, while the law holds good in the upper grades of civilized society, the lower and more or less uncivilized grades are under no such moral restraint. Improvidence in all things, they are equally so in human life. Careless of the responsibilities of parentage, they breed like vermin; and since society throws around their offspring so far as possible all the sanitary conditions and advantages of civilization, the descendants of the lower half of any community are pretty sure to preponderate numerically. The criminal grades are especially prolific, more than enough so to make up for the destructive influences of crime. The effect upon the future well being of society can scarcely be other than disastrous, unless special effort is made to counteract the evil by preventive as well as by curative means.

The Knife Remedy.

We can only regard it as an illustration of the power of popular prejudice that people, who find nothing to condemn in the extermination of individuals whose murderous nature seems incompatible with public safety, are ready to hold up their hands in horror at the most guarded suggestion of the advisability of making it impossible for lusty savages to inflict upon the community a brood of ill balanced organisms, destined to swell the ranks of vice and crime. Yet society may be driven to adopt just such radical measures in self-defense, driven to make sterility one of the penalties for the grosser forms of criminality.

The effect on the criminal statistics of this city for the next hundred years would be something marvelous, we fancy, were the worst offenders against public peace and morality sent to the island—not as now to recuperate their wasted forces and return in a few weeks to enter more lustily than ever upon their evil courses—but to be made perfectly harmless as regards the future. In this way only, can the stream of tendency which makes for unrighteousness be dried up at its source.

It has been objected that the subjects would be spoiled as human workers, through loss of ambition and energy; but the objection scarcely holds in view of the fact that their representatives in the East have from the earliest times been prized for their serviceableness. Besides, they are of little worth as workers as they are, and the change would rather tend to diminish their rampant beastliness and make them more amenable to civilization. Many an unmanageable

human brute might thus be converted into a quiet toiler, as useful and harmless as the placid creature whose patience under the yoke of labor is proverbial. At any rate, his higher potency for evil would be eliminated. The operation is not an uncommon one for the saving of individual health: How much more justifiable, then, for the protection of the moral health of the community—for the prevention of that worst of social distempers, hereditary crime?

HOW TO RUSH A PATENT THROUGH.

It appears that the best way to get a new patent rushed through and quickly issued is to apply at the presidential mansion. In a recent case—a telegraph contrivance—the President wrote a letter to the Commissioner of Patents, requesting him to take immediate action, for the reason that the invention was needed for use by the government, and had already been adopted on the government lines. Whereupon the Commissioner issued a patent, “quicker,” to use a homely expression, “than you could say Jack.” But we think it will strike most of our readers, as it does ourselves, that the reasons assigned might have been more properly used for postponing instead of hastening the grant of the patent. In the case of a poor inventor, whose application has been long pending, the Patent Office should be as prompt as possible. But with respect to inventions for which the government patronage has already been secured, as in the present case, what possible difference can it make to the government whether the patent is granted today or next month?

All unnecessary interference with the usual order of business at the Patent Office, whether by the President or any other public functionary, is pretty sure to create dissatisfaction, and should be scrupulously avoided. Instead of writing requests to favor the interests of his personal friends, it would be much better if President Grant would indite communications something like the following:

To the Commissioner of Patents:

I am informed that many applications for patents are lying in your Office unexamined, and that, in the class which embraces telegraph apparatus, there are cases filed more than a year ago, which still remain undisposed of. This is a crying shame and ought no longer to be tolerated. No class of individuals has done so much for the benefit of the country as our inventors; and when they apply for patents, every possible endeavor ought to be made by the Patent Office to give them a prompt and favorable hearing.

With the large corps of assistants under your command, numbering, as I understand, about five hundred persons, including one hundred examiners, is it not possible for you to bring up the business now in arrears, and in future have things attended to with more promptitude?

I see by your report for last year that you rejected between five and six thousand applications for patents. It must have required an immense amount of time and labor on the part of your people to hunt up reasons for this enormous mass of adverse decisions.

Do you fully realize that the majority of these five thousand rejected applicants are poor people, and that your rejections, especially if wrong, carry injury and disappointment into that number of families?

For my part, were I Commissioner of Patents, I would not hesitate to grant a hundred doubtful patents rather than take the risk of depriving one of my inventive countrymen of the full benefits which the law intended to give him.

I beg to remind you that the object of the Patent Office, as intimated in the Constitution, is to encourage the progress of the useful arts by the grant of patents to inventors. But if I were to judge, from your great number of rejected cases, I should say that the Patent Office appeared to consider its prime duty to be, to refuse to grant patents.

I have confidence in your ability to remedy the unsatisfactory state of things I have mentioned, and I shall look to you for immediate and effective action. Let us have peace.

U. S. GRANT.

SPONTANEOUS COMBUSTION AT STEAM HEAT.

A correspondent (W. A. S.) sends a piece of charred wood taken from a plank which formed a portion of a box inclosing a steam pipe conveying steam at a pressure of about 80 lbs. per square inch. The wood is as completely charred as if it had been prepared by the ordinary process of burning. It is black, friable, and thoroughly deprived of all its volatile constituents.

This is a simple illustration of what occurs very frequently at temperatures exceeding 300° Fah. The moisture and volatile matters contained in woody fiber are driven off and carbon only is left, at temperatures exceeding 300°, the rapidity of the change increasing as temperatures rise. The precise lower limit of temperature of charring is not known; but when that above given is approached, the change occurs very slowly. As stated in a previous issue of the SCIENTIFIC AMERICAN, a piece of wood has been left in contact with a steam pipe conveying steam, during the cold season, at 50 lbs. pressure, for sixteen years, without exhibiting evidence of serious injury. The temperature there was about 295° Fah. Violette charred wood at 302° Fah., and the temperature of the steam which produced the carbonization referred to by our correspondent was about 325° Fah.

In order that combustion shall occur, it is evidently necessary, not only that the temperature shall be sufficiently high to increase the tendency to ignition, but that it must actually attain the temperature of ignition; and to produce spontaneous combustion in such cases, the temperatures of carbonization and ignition must coincide. In our issue of January 2, we showed, by the graphic representation of the law of decrease of temperature of ignition, with that of carbonization, that it was approximately expressed by a parabola and that, unless some sudden change of law occurs at lower temperatures than those recorded, this coincidence cannot take place, and that, consequently, wet steam at ordinary pressures cannot ignite—although it may char—woods

Our correspondent speaks of this piece as “almost burnt to charcoal.” The expression and the idea represented by it are incorrect. Charring and burning are two quite distinct processes. The one is the expulsion of gaseous constituents from organic matter; the other is the rapid union of any combustible material with oxygen. It does not, by any means, follow from the fact that the wood is charred that there has been any oxidation or true “burning.” Wood becomes charred in the process of burning, usually, merely because the oxygen seizes upon the volatile constituents first, and only takes the carbon when it may not choose between equally available molecules of the two classes of combustible substances. The slow process of carbonization illustrated by the example given by our correspondent, the more rapid process of charring in the usual methods of manufacture of charcoal, and the charring noticed when wood burns in the fire, are all identical, except as to time and completeness. Ignition and combustion are entirely independent processes, and we have no evidence which seems reliable that the gases can take fire at temperatures lower than about 800° Fah., or that charcoal can ignite at less than 600° Fah. We do not think it impossible, or even improbable, that, under peculiar and rarely occurring circumstances, the condensation of inflammable gases within the pores of charcoal, which is a wonderful absorbent, or its saturation with readily oxidizing materials, like the oils, may, by oxidation, be gradually accelerated in rapidity of action, and produce spontaneous ignition and combustion. We have, however, no knowledge of well authenticated instances even of this. Our correspondent will probably find it necessary to actually apply flame to his charcoal board to set it on fire. He will also notice that wood “smokes” before taking fire—an indication that the temperature of carbonization is probably lower than that of ignition.

AN IMPORTANT PATENT OFFICE DECISION.

We published last week a recent decision by the Commissioner of Patents, in which he announced the adoption of a new rule and practice at the Patent Office in respect to old rejected cases. The decision was to the effect that rejected cases of more than two years' standing are not in future, except under certain circumstances, to prevent the grant of new applications for patents. This decision substantially recognizes and adopts the view expressed in the previously rendered decision of the Board of Examiners-in-Chief in the case of Greenleaf and Adams.

The latter decision, in addition to the above dictum, contains another important announcement, to the effect that the Board of Examiners-in-Chief is a tribunal having independent judicial powers. Its decisions are, therefore, binding upon the Commissioner and all persons and actions of the Patent Office, until set aside by a higher tribunal.

This is a very interesting and important adjudication, because, when properly recognized, its tendency is to render the decisions and practice of the Patent Office more uniform and reliable than heretofore. The notion has heretofore prevailed that the Commissioner was the absolute ruler of the Patent Office, and that he might, if he saw fit, set aside any decisions of the Examiners, or of the Board of Examiners-in-Chief. But it now appears that he cannot lawfully do so.

The decision is very ably written, and is so interesting and important that we commence the publication of the text in full on another page.

CHILDREN AND DOGS.

“Dogs is healthy for children” say the old wives, and not without some foundation in fact. The influence of these lively and affectionate playmates of childhood is very happy: so much so that we have sometimes thought that a boy who has never had a pet dog has been cheated out of half the enjoyment and no small part of the moral culture of infancy. But dogs have bad tricks, and, unless properly trained, are apt to be anything but “healthy” for children. They express their affection in a very bad way. We know that it is a common opinion that there is something wonderfully wholesome about a dog's tongue, and that his natural habit of licking the objects of his affection is rather to be encouraged than repressed. Nevertheless one of the first requirements in a dog for a child's pet is that he be trained to emulate prudent humanity and restrain his tongue. It is not “healthy,” whatever the old wives may say. This, setting aside the question of rabies altogether. A much more common affection of dogs is a tape worm, for whose development both men and dogs have to contribute. Its immature or cysticercal stage is spent in the human body, often causing great mischief; then it migrates to the dog, completes its development, and makes provision for a new crop to infest humanity, forming cysts or hollow tumors in various parts of the body. The full grown worm is the smallest tenia known, only about $\frac{1}{16}$ of an inch in length. The embryo is often as small as $\frac{1}{64}$ of an inch; yet, according to Cobbold, death has been caused by a single individual lodged in the brain. At a late meeting of the Australian Microscopical Society, Mr. Sidney Gibbons exhibited specimens recently taken from a human subject, and said there could be no doubt that they were frequently implanted in children as a consequence of allowing dogs to lick their hands and faces. It is a nasty practice at best, and a pet dog's first lesson should be to keep his tongue to himself.

LABOR TROUBLES IN RUSSIA.

The first fruits of emancipation in Russia and in our Southern States have been much the same. Like the freedman, the serf released from practical slavery thinks that freedom means the right to do nothing and go where a vagrant in-

clination may lead him. Serfdom meant involuntary servitude and confinement to his native district, and naturally his undisciplined sense of liberty impels him to do the opposite. So he wanders about, and works only to keep from starving. Under the old system, a pauper peasant was an impossibility; under the new, the lowest poverty is the rule. The effect on the industrial interests of the country is little short of ruinous. Labor cannot be obtained, even where wages are relatively high, as in the fertile provinces of the South and Southeast, without prepayment, sometimes to the extent of eight months' wages, and that without any security that the work will be done. That a contract is in any way binding is quite beyond their moral comprehension. If paid in winter to secure their services in the spring, they are quite as likely as not to be missing when the stipulated time arrives; while those who do report for service are in the habit of deserting at the most critical moments without warning and without cause. Factories are abandoned in the stress of business, though the men have signed regular contracts; and farms are left untilled, unsown, or unreaped, simply because laborers already paid prefer to work for a neighboring proprietor. The money paid in advance cannot be recovered, nor the deserters punished for their treachery. Not that there is no law to reach the case; the trouble is the justices, whose duty it is to regulate such matters and decide in labor disputes, invariably favor the workmen. “The mass is a powerful fellow,” they say, and decline to take any steps to bring themselves into disfavor with the “powerful fellow” who votes them into office. The agricultural development of the country is especially hampered by this lack of trustworthy workmen, and large tracts formerly under cultivation are being turned into grazing land; while the peasantry gain only in poverty and improvidence, living from hand to mouth, and spending the most they earn in vagabondage and brandy. The matter has lately been taken in hand by the Government, and a new commission appointed for the codifying of the laws of contract and other labor regulations. It is hardly to be expected, however, that any speedy amelioration of the trouble will be effected.

HORSE FLESH AS FOOD IN FRANCE.

Though among the last of the people of northern Europe to authorize the sale of horse flesh as food, the French have learned to use it to a greater extent, apparently, than any other nation. It is used in as many ways as beef; and according to a late writer, M. Husson, in the *Economiste Français*, the trade in it is actually more profitable than the ordinary butcher's business.

On the first day of 1874, there were in Paris forty-eight shops for the sale of the flesh of horses, mules, and asses, their customers belonging chiefly to the middle classes—clerks and thrifty workpeople with families. As a rule, the price of the meat is about half that of beef, the best cuts ranging from a franc to a franc and a quarter for the half kilogramme, or from twenty to twenty-five cents a pound. It is in the form of sausage, however, that the largest quantity of this meat is consumed. The tongue, brain, and liver are sold as delicacies, and the fat is converted into “butter.”

In consequence of the increasing taste for horse flesh, the price of worn-out horses has increased enormously of late, those fit for food fetching from twenty-five to thirty dollars: a few years ago they could be had for five or ten dollars.

From unpublished official documents, M. Husson finds that the number of horses, asses, and mules, consumed in Paris during the seven years and a half preceding 1874, was 73,655, more than half of which, however, were eaten during the two sieges. Since the war, the number eaten annually has been from nine to ten thousand. In Munich, Berlin, Vienna, and other German cities, the growing taste for horse flesh is almost equally marked.

Curiosities of Welding.

There has lately been shown in this country a very interesting specimen of blacksmith work. By means of Schierloh's welding compound, it is alleged that, in one example of a bar of Bessemer steel, five different kinds of iron and steel have been perfectly welded, without changing its shape in the least. The bar was rolled into form at Thompson's steel works, in Jersey City, and is $\frac{1}{2}$ by $2\frac{1}{2}$ inches in the cross section.

First, a piece of Bessemer steel, cut from the end of the bar, was welded fast to it again, the heating and welding occupying eight minutes. On the reverse side of the bar a piece of fine cast steel was welded in six minutes. Further along on the bar a piece of blister steel was welded in eight minutes. This same steel cannot be welded with borax, as the high temperature needed with that flux makes it as brittle as cast iron under the hammer. Opposite this a piece of wrought iron was welded in six minutes, and further along on the bar a piece of cast iron was welded in three minutes. This was a piece of the mold board of a plow. The bar, with its additions, was then ground and polished on the edge, so as to show the points at which the welded metals came into contact. No weld was visible on any one of them, and the difference in the metal could only be told by the color after polishing. This solves a great many important problems in iron manufacture, among others the welding of Bessemer scrap.

Annual Report of the Commissioner of Patents.

The annual report of the Commissioner of Patents to Congress has been sent in, and shows that 21,602 applications for patents were made during the year 1874, and 13,590 patents were issued, leaving 8,003 applications, or 37 per cent of the whole, that were either rejected, delayed, incomplete, or for some other reason not patented. We shall give a more full abstract of the report in our next

THE PROPORTIONS OF SEWERS.

At a recent meeting of the Society of Engineers, London, Mr. John Phillips read an interesting paper on the forms and construction of channels for the conveyance of sewage, in which he said:

"The water carriage system consists of a series of drains and sewers laid to various inclinations for the purpose of receiving and carrying away the water we use and the filth we produce in our houses and towns. The efficiency of this system depends, as its name implies, upon the gravitating power of the water to remove not only itself, but the organic and inorganic matters which it receives. And as the water derives the requisite power to do this from the form, the fall, the size, and the construction of the channels in which it runs, it is imperative that by no defect in either of these respects should any of this power be wasted or lost; for the more power the water has the better it raises and holds the matters in suspension and propels them forward, the quicker it carries them with it to the outfalls, the cleaner it keeps the drains and sewers, the freer these are from noxious gases, and the purer is the atmosphere and the healthier are the inhabitants of houses and towns. At different periods various forms have been used for drains and sewers, such as the square, the rectangle, the triangle, the circle, the semi-circle, the oval, the semi-oval, and parts of these combined. But the best form is that of an egg, broad at the large end and narrow at the small end, and this end placed downwards. For by this form the channel imparts to the same quantity of sewage greater velocity and scouring power, the sides and crown offer greater resistance to the pressure of the ground, and the amount of excavation required for its execution is less than any other form. The egg shape and the circle are now employed for large sewers constructed of bricks, and the circle for stoneware pipe sewers and drains."

In the course of the paper, Mr. Phillips described the various sections of sewers in common use, of which we give illustrations, the following being the particulars of each:

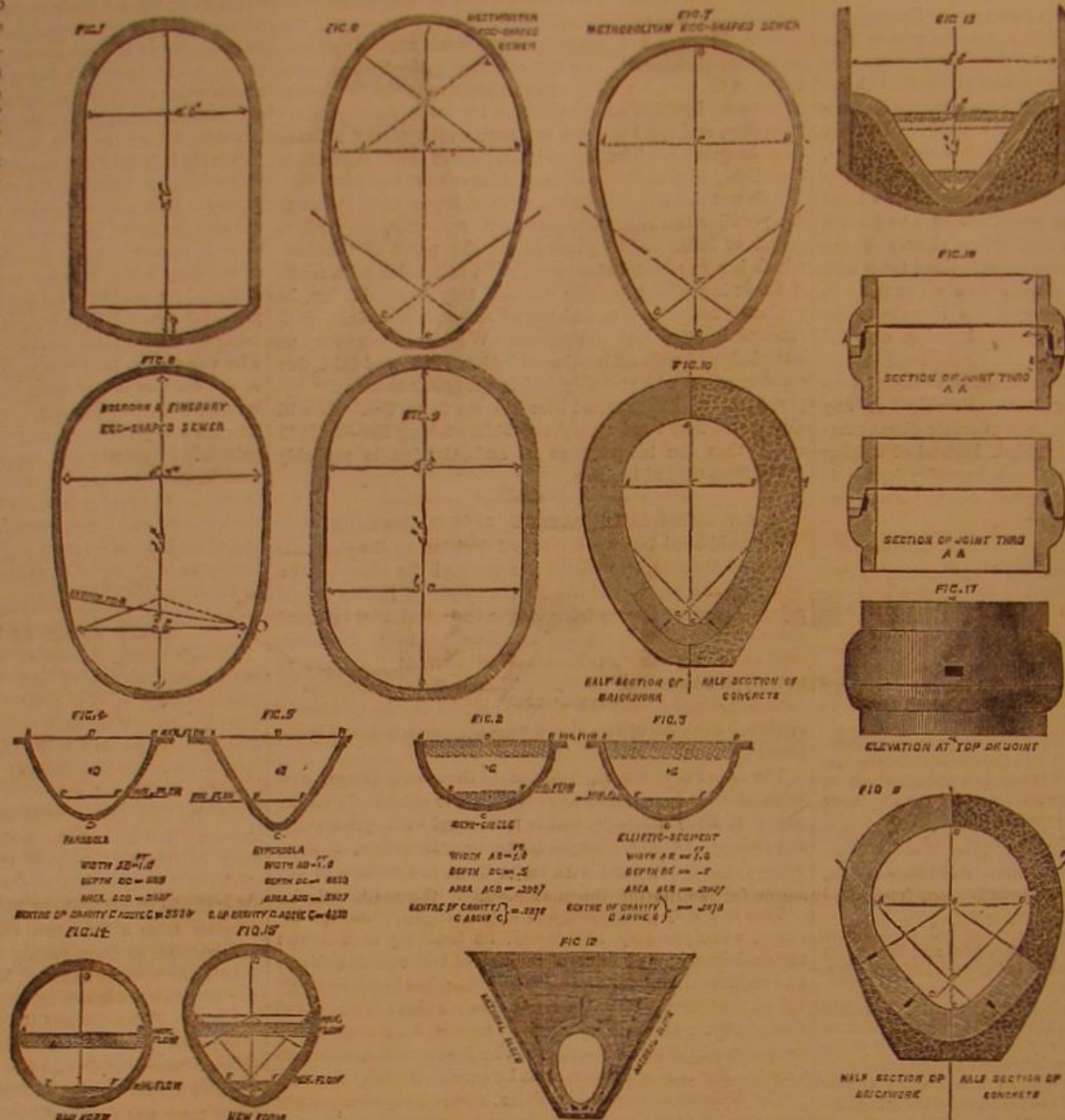
Fig. 1 is a section of two large sized sewers, constructed in Westminster 80 years ago. Little care was bestowed on the masonry of sewers in those days, bricks, mortar, and labor being economized to the utmost extent; and the width and flatness of the bottom of the sewer diffused the flow and destroyed its "scour," from which the carrying power is derived. This led to accumulations of detritus in the sewer, and consequent failure of the gully or branch sewers; and it became necessary to ascertain which form of sewer would best give the required velocity to the liquid, and carry the whole of it to the outfalls. Mr. Phillips, therefore, made experimental channels along the sewers, as shown in A C B, Figs. 2, 3, 4, and 5—Fig. 2 being a semicircle, Fig. 3 an elliptical segment, Fig. 4 a parabola, and Fig. 5 a hyperbola; and he computed the areas, perimeters, and velocities of flow of all of them, the experiments extending over several months. Fig. 5 gave the least tendency to deposit; next in degree came Fig. 4, Fig. 3, and Fig. 2, in the order named. This result was caused by the contraction of the bottom of the channels, deepening the flow, and so giving the stream greater gravitating energy.

As a result of these and other considerations, the author designed an egg-shaped sewer, shown in Fig. 6, to take the place of that in Fig. 1. Twenty miles of this sewer were laid down in 1846 and 1847; it proved to be completely self-cleansing, and a saving of \$7,500 per mile over the cost of the Fig. 1 sewer was effected, the total showing an economy of \$150,000. Its proportions are: $CI=1\frac{1}{2} AB$, $CE=AB$, $CF=\frac{1}{2} AB$, $GH=1\frac{1}{2} AB$, $AJ=\frac{1}{2} AB$, $EK=\frac{1}{2} AB$, $JL=\frac{1}{2} AB$, $KL=\frac{1}{2} AB$. The one shown in Fig. 7 is considered to be a still further improvement, and is now generally adopted in Great Britain; its proportions are: $CD=1\frac{1}{2} AB$, $CE=AB$, $CF=\frac{1}{2} AB$, $GH=1\frac{1}{2} AB$.

Fig. 8 shows a modified form of Fig. 1, and is superior to it for cleansing, strength, and economy; but in all these points it is surpassed by Figs. 6 and 7. It was designed to replace Fig. 9, the defects of which are apparent in consideration of the abovementioned experiments. Fig. 10 was proposed by Mr. Phillips as an improvement on Fig. 7, which latter, however, may still be used where the flow is large; but elsewhere, Fig. 10 must be considered to show many ad-

vantages. Fig. 11 is a modification of Fig. 10, of which the proportions are ascertained as follows: Divide AB into 11 equal parts; then $EC=7\frac{1}{2}$, $CD=13$, $FC=2$, and $GH=21\frac{1}{2}$ such parts.

Fig. 12 shows the manner in which the weight of superincumbent earth bears on a sewer, and demonstrates the necessity of great strength in the crown of the work. Fig. 13 shows a method of improving flat-bottomed sewers by narrowing the channels. Figs. 14 and 15 are old and new forms of auxiliary or branch sewers, the latter having all the advantages aimed at by Mr. Phillips in designing the sewers shown in Figs. 7, 10, etc. Figs. 16 and 17 show methods of



CROSS SECTIONS OF LONDON SEWERS.

making joints in pipe sewers. "Where, from inadequate inclination or body of sewage," says Mr. Phillips, "the velocity of the flow is insufficient to carry away the silt, sand, and other solid substances which are washed into sewers from sculleries, areas, yards, streets, and other places, these materials become embedded and entangled with the excreta, fat, hair, paper, and other matters, and form hard compact masses along the bottom. Wide, flat, and extremely rough surfaces are thus produced, which diffuse the flow, weaken its force, and no flush of water is strong enough to tear it up and remove the accumulation. Hence it is of the first importance to keep detrital substances out of the sewers as much as possible. This may be done by forming catch pits under the sinks and gulleys, and emptying them directly after every rainfall. Where no such appliances are provided or the emptying of them is neglected, detritus gets into the sewers, causing putrifying matters to deposit, and foul gases to generate and escape into the houses and streets where the drains are improperly trapped and are unventilated."

Bohemian Glass Bad for Chemical Analysis.

M. P. Truchot states that glass vessels in which various liquids, and even pure water, are boiled give up by degrees a small quantity of their substance, silica, potash, soda, and lime. The analysis is the more erroneous the longer the boiling is kept up. This, at least, is what results from the use of glasses brought from Germany, and sold at Nancy in 1873 and 1874. This fact may be shown by boiling in a flask pure water mixed with a tincture of red cabbage or sirup of violets, slightly reddened by an acid. After boiling for a few minutes, the liquid turns green. French glasses, with a base of soda, are not sensibly attacked, and therefore do not offer this inconvenience.

A PHYSIOLOGICAL THERMOMETER.—Dr. Edward Seguin proposes a centigrade thermometer in which the zero point shall be marked at $+37^{\circ}$, equal to $+98^{\circ}$ Fah., the nominal temperature of the body. Deviation of the mercury from this point would be understood at once as indicating irregularity in the system, by persons who might not be aware of the temperature as above mentioned.

A Brilliant Light.

Professor John Spiller communicates to the London Photographic Society the following method for a temporary light of great power, useful for photo and other purposes:

"When common saltpeter (nitrate of potassium) is heated to a temperature somewhat beyond the point of fusion, in a hard glass tube or porcelain capsule mounted over a spirit lamp, and small pieces of sulphur are then successively introduced, a deflagration ensues, accompanied by the emission of an exceedingly brilliant white light, which is maintained as long as any of the sulphur remains floating as a molten globule in the fluid nitrate."

"The cost of this light is very trifling, both ingredients being remarkably cheap. One ounce of niter melted, and fed with sulphur at the rate of eight or ten grains at a time will keep up a brilliant light for about ten minutes, at the cost for materials of one cent; but it must be confessed that the wear and tear of apparatus, from the intensity of the heat, adds to the cost of production."

"To guard against fracture or actual perforation of the glass during the course of the experiment, it is necessary to provide a tin tray into which the fluid contents of the flask may drop in case of accident. An ordinary spirit lamp is found to give sufficient heat to melt the niter and start the reaction; when once the light is produced, the spirit lamp may be removed, or the holder supporting the flask turned aside. Short lengths of stout 'combustion tubing,' closed at one end, serve exceedingly well for making the experiment, this kind of glass being so difficultly fusible. If iron capsules be employed, it is only possible to work with the top light, which may, however, be reflected to any required angle; and with porcelain crucibles much of the effect is lost by the partial opacity of the material. In the event of the niter-sulphur light being required to be maintained for a lengthened period, it would, of course, be desirable to provide some kind of chimney to carry off the gaseous products of combustion, or absorb the sulphurous acid with peroxide of manganese."

"With respect to the actinic value of the light, I find that from three to five seconds' exposure, according to the density of the negative, is sufficient to give a collodion transparency at a distance of a foot from the source of light, when produced on a small scale. The maintenance of a constant degree of intensity is, perhaps, one of the points open to future improvement."

"I have tried the use of nitrate of sodium in place of the ordinary saltpeter, and experimented with various metallic sulphides and finely divided metals; but none of these answered so well as the simple attack of sulphur, in the form of roll brimstone, by melted niter. Their spectra also appeared to be more limited. With the chlorate of potassium and sulphur a light of dazzling brilliancy is emitted; but the deflagration is very violent, and white fumes are given off by reason of the greater volatility of the chloride of potassium—a by-product in this reaction."

"In conclusion: I have only to state that no claim of novelty is set up for anything beyond the photographic use of the nitro-sulphur light, the light itself having been shown as a lecture experiment certainly as far back as the year 1847."

A Great Ice Slide.

A correspondent of the SCIENTIFIC AMERICAN, who resides in Norway, states that, in the eastern part of that country, large quantities of ice are gathered and stored in the ordinary manner during winter, for shipment abroad. Last summer a company tried to make the vast glaciers near Eergen supply the ice; to that effect a shoot made of spars was built, starting at an altitude of 2,200 feet, running down to the fjord, the whole length being 8,000 feet; the incline varies from 1 in 3 to 1 in 4 feet. At the lower end, the shoot runs level for a short distance and terminates in a shed, at which the vessels are loaded. The blocks of ice make the run in 4 minutes, although the speed is checked at several places. The average velocity of the ice blocks is 24 miles an hour. The ice is of a fine quality, and the supply is, of course, next to inexhaustible.

By rubbing metallic surfaces with soda amalgam, and pouring on a solution of chloride of gold, gold is taken up by the amalgam; and it is only necessary to drive off the mercury by heat, to obtain a gilded surface that will bear polishing.

NEW CHILIAN ARMOR CLADS.

The Chilean Government two years ago requested Mr. Reed, M. P., of England, to prepare a design for an armor-clad vessel whose tonnage should not be more than about 2,000 tons builders' measurement; to have 9 inch armor at the water line; to have several 12½ ton guns with great command of fire on bow, broadside, and stern; and to have a measured mile speed of from 12½ to 13 knots, with twin screws. To fulfil all these conditions, which were quite unprecedented in a rigged, seagoing ironclad, Mr. Reed prepared a design of a vessel of which the following are the leading features: The length between the perpendiculars is 210 feet, the extreme breadth is 45 feet 9 inches, the depth in hold is 21 feet 8 inches, the tonnage being about 2,032½ tons (builders' measurement). The draft of water forward is 18 feet 8 inches, aft, 19 feet 8 inches, and the mean draft, 19 feet 2 inches. The height of the port sill from the load water line is 7 feet 6 inches. The armor is 9 inches thick at the water line, protecting the engines and boilers, 8 inches thick in wake of the gun slides, and of varying thicknesses elsewhere on the sides and on the athwartship battery bulkheads. The usual amount of taper is given to the thickness of the armor on the belt forward and aft. Behind the armor the teak backing is from 8 to 11 inches in thickness; with the ordinary arrangement of longitudinal girders worked on the two thicknesses of plates behind armor, the latter being supported by 10 inch frames placed vertically on the inside of the plates behind armor.

The armament consists of six 12½ ton guns, manufactured by Sir W. Armstrong and Co. These guns are placed in a central armor-plated battery, arranged as shown in our engraving. The peculiar recessing of the sides of this battery makes it possible for the two fore guns to command a range of 93°, namely, from right ahead to 3° abaft the beam—the two after guns to command a similar range of 93° from right aft to 3° before the beam—while the two middle guns command a range of 85°, extending between 20° from a right-ahead fire to 15° abaft the beam. It can also be easily seen from the sketch referred to that the three guns on either side can be readily combined in a broadside fire, while the four foremost guns can be worked so as to form a powerful combination for firing ahead. Altogether, then, every point in the horizon is commanded by these six guns in a small and compact battery.

The speed of the Almirante Cochrane, the first of two vessels recently completed, at the steam trial, was very nearly 13 knots, and this was easily sustained continuously when a strong breeze was blowing and the sea rough. Under favorable circumstances it is fully expected that the speed would be a little over 13 knots. The engines of the most modern compound type, of 500 nominal horse power, with horizontal cylinders, are manufactured by Messrs. J. Penn & Son, for both ironclads. The weight of the coal carried in the bunkers is 240 tons, and provision for additional coal is made.

These vessels are also supplied with a good spread of canvas, which is distributed, as shown in the engraving. This will allow them to be independent, to a certain extent, of their coals and machinery in going long distances, and they will have all the advantages that nautical men claim for sails to keep vessels out of the trough of the sea in case both engines get disabled. The chances of such an event happening are, however, remote. The chief object in providing the sails in these vessels is no doubt the saving that they effect in the coals; and as the rigging in no way interferes with the range of fire, as it inevitably must in a vessel with turrets, there were several reasons in favor of their adoption.

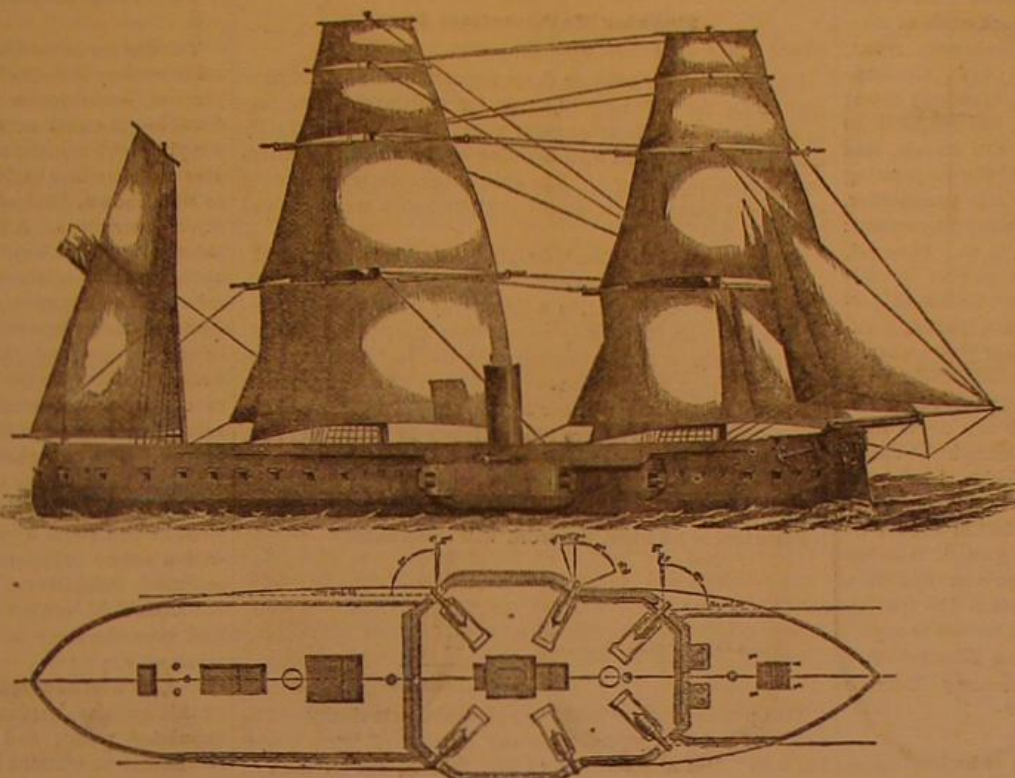
The hull of the vessel is built of iron upon the bracket frame and longitudinal system, and an inner bottom is fitted throughout the whole length of the engine and boiler room, as in the most recent ironclads of the British navy. The main deck outside the battery is plated with three quarters inch plating worked on the beams, the deck planking being worked on top of the plating. This gives protection to the magazines, shell rooms, etc., from a dropping fire.

A very interesting feature in the designs for these armor-clads is, that notwithstanding the double recessed form of the side at the height of the main deck, the top sides along the upper deck are so arranged that they present a fair curved line to the eye, and so improve the appearance of the vessel on deck, very much from what it would have been had the recesses of the main deck not been worked out. On the upper deck bridges, the eye sees only the usual fair sides of an ordinary ship.

All the compartments of the double bottom, says *Engineering*, from whose pages we select the engraving, are made watertight; the athwartship bulkheads are provided with watertight doors, the iron platforms are also made watertight, and pumps, in connection with a system of pipes, are fitted so as to command each and every watertight compartment.

Postal Palaces on Wheels.

Three cars, styled the "Palace Drawing Room Postal Cars of New England," have just been completed at Allston for the Boston and Albany Railroad Company. They are sixty feet in length, the longest on the road, are constructed of the choicest materials, are finished in hard wood in natural colors, and are provided with all the modern improvements ingenuity could suggest. A large and novel lamp, manufactured by the company, and having four burners and four large reflectors, is suspended from the roof of each car, giving ample light. About twenty feet in length of each car is partitioned as a store room for through mails, while the



THE CHILIAN IRONCLAD ALMIRANTE COCHRANE.

remaining space is divided into sections devoted to different purposes. The section in the middle is intended for letter sorting, another section is specially designed as a newspaper department, and still another section is used as a receptacle for bags, and is provided with racks, hooks, and other conveniences for facilitating the making-up of the mails. Each car is provided with water tanks and set bowls, similar to those in palace passenger cars. In the letter department of each car are four hundred and seventy boxes with wire netting bottoms, which prevent accumulation of dust, while the newspaper department of each has twenty-seven boxes, and the whole are labelled with the names of the postal stations and the principal postal routes in the country. When leaving Boston, these cars each require four clerks or route agents; but when returning to Boston, only two clerks are requisite. These cars make runs of four hundred miles a day, but the postal clerks only run half that distance a day.—*Boston Advertiser*.

MR. SETH GREEN'S NEW SPAWN-CARRYING DEVICE.

We mentioned recently a novel invention of the well known pisciculturist, Mr. Seth Green, by which almost any number of fish eggs can be safely transported and hatched in any spare room of a person's house, requiring but a pail of water daily and no special attention. The inventor states that spawn can be carried for a journey of one hundred and thirty days without loss or injury.



The apparatus consists of a simple wooden box, of a convenient size to be carried in the hand by means of the handle above. Its joints are covered with tin. Inside are numerous small trays made of wood, covered below with cotton flannel. The upper tray, shown in the foreground, is provided with a hinged cover of the same materials. The spawn is placed upon the bottom of the trays, together with moss or seaweed, and kept moist. The temperature of the room may

be so regulated that the spawn can be hatched in from fifty to one hundred and fifty days. Brook trout, salmon trout, white fish, and salmon eggs have been transported with success, over long journeys, by this means.

Vegetable Camp Followers.

Since the Franco-Prussian war it appears that a large variety of vegetation, formerly indigenous to Germany, has made its appearance and become acclimatized in French soil. No less than 163 new species have been found, and a remarkable conflict is going on between the natives and the invaders. The former, more robust and better suited to the climate, are defending their right to existence with much greater success than did the owners of the land on which they grow. On the plain of Bellevue, it is stated that, out of the great number of foreign vegetables which sprung up in 1871, hardly two species now remain. It is curious to compare this fact with the opposite condition of affairs in New Zealand and in the Pacific islands, where European plants are crowding out the aborigines, and even the people themselves are unable to hold their own against the stranger race.

The *Geographical Magazine* gives a number of remarkable instances in which vegetables have—as in the case first above noted—followed the movements of armies. Some of these examples are extraordinary and well worthy of more extended botanical investigation than they seem hitherto to have received. In their forays over Europe during the sixteenth and seventeenth centuries, the Turkish armies carried with them oriental vegetation. Up to the present day the ramparts of Pesth and of Vienna are covered with plants of Eastern origin. In 1809 a plant peculiar to the south and center of Europe, the *lepidium draba*, commonly called whitlow grass, was introduced into England, where it was hitherto unknown, by English troops returning from the disastrous expedition to Walcheren Island, on the Dutch coast. A portion of the army was disembarked at Ramsgate, and the straw from their bedding was thrown into an old marl pit belonging to a Mr. Thompson. The plant grew and spread in great profusion over Thanet Island, where, for a long period, it has been known as Thompson grass.

In 1814 the Russian troops carried with them herbs from the banks of the Dnieper and the Don into the valley of the Rhone, and even introduced the vegetation of the steppes into the environs of Paris. Several of these species still exist, perfectly acclimatized.

In 1872 the attention of French scientists was called to the fact that a number of plants, belonging to the Algerian flora and which served as forage for the French army in that colony, had made their appearance about the camps in France. Near Strasbourg, 24 species peculiar to African soil were found in a single bale of hay mown in the vicinity.

The latest contribution to curious information on this subject is found in a recent paper by Sir Bartle Frere, in which he mentions that the date tree, which is found on the coast of Mekron, in Africa, is confined to a narrow region. Inquiry into this leads him to give credence to the tradition that the tree was brought thither by the soldiers of Alexander, after their return from India.

The Middle Park Coal.

Professor E. J. Mallett says it possesses much in common with the recently discovered mineral called *albertite*, a species of solidified petroleum, and also with what is known as *torbanite*. These two varieties are highly valued by gas manufacturers, who mix from five to twenty per cent of these bituminous compounds with less bituminous coal, thereby greatly increasing the yield and quality of the gas. It resembles the former in the large amounts of gas and tarry oil it yields (which may prove as valuable as that derived from albertite), but differs from it in being heavier—the specific gravity of the albertite being 1.090, while this is 1.323—also in yielding no soluble products when treated with bisulphide of carbon, spirits of turpentine, ether, etc. From torbanite it differs in not crackling in the fire, in being much heavier, and in melting and intumescent when heated. Analysis shows it to contain in one hundred parts 6.02 per cent of water and moisture, 39.95 per cent of volatile matter (gas and tarry oil), 54.03 per cent of fixed residue, consisting of coke and ash.

A Collision in Mid-Air.

Land and Water relates a very curious incident of a collision between two wild ducks in full flight. Whilst recently shooting on the dykes in Norfolk, five ducks were flushed out of shot; and while the gentleman who was on the look-out for them was watching their flight, in the hope that they would pitch again, two of them were observed to come into violent collision, one falling to the ground. It was so completely stunned that it was picked up by the gentleman in question, who found it to be a fine mallard, which, on examination, was discovered to have lost one eye, it having been previously destroyed by accident or disease. No doubt the loss of this organ was the cause of the very singular occurrence.

Correspondence.

A Strong Gunpowder.

To the Editor of the Scientific American:

Those who are familiar with the properties of chlorate of potassa know that it cannot be employed as a material in gunpowder, as it explodes under friction. Recent experiments, however, have convinced me that, under certain provisions, the salt may be used. For the experimental purpose the following directions are followed: Three things are employed, namely, chlorate of potassa, gum arabic (prepared in the manner to be described), and charcoal. Take gum arabic pulverized, add to it half its weight of black oxide of manganese; mix thoroughly; place in a glazed stoneware retort, and add strong nitric acid, diluted, and apply heat. Continue the heat until the mixture becomes a thick, tenacious mass; then pour off into shallow porcelain dishes, and evaporate to dryness. A thick, gluey, resin-like mass will remain, and here extreme care should be observed: for if the evaporating heat be in excess, the substance will ignite like gunpowder. When the gum is prepared, mix in the following proportions: Chlorate of potassa, 1 oz.; prepared gum, $\frac{1}{4}$ oz.; charcoal, 170 grains. Heat gently in an oven, and a powder is made which will not ignite under the hammer, as chlorate of potassa will when mixed with sulphur; yet, when ignited, it explodes with more violence than ordinary niter gunpowder.

I remember filling a gun cartridge with it, and discharging it. The hammer was driven back with such force from the recoil that the lock was injured. Whether this arose from some impediment of the bullet's progress through the chamber, or merely from the force of the explosion, I leave for others' consideration.

The manufacture of it appears simple; but it should be remembered that, in the preparation of the gum, if it be too much or not sufficiently evaporated, the powder will be a failure. Whether the above powder will stand the friction produced in grinding in a powder mill, I am unable to say.

Philadelphia, Pa.

ELLSTAGLE.

Cheap Galvanic Battery.

To the Editor of the Scientific American:

I am using a battery much cheaper and (I believe) more permanent than the one described in your paper of January 30. It was set up by an Englishman in my employ, of the name of Baron, two years ago, and I have used this kind of battery ever since. It consists of a cylindrical glass vessel, eight inches deep and about the same in diameter. On the bottom of this vessel, a circular sheet iron plate is placed, with an insulated wire extending from the plate over the top of the jar. This plate is covered to the depth of one or two inches, with sulphate of copper. Another iron plate is suspended above the sulphate of copper, and soft water is poured in until the upper plate is covered, to the depth of one or two inches. Thus made up and the circuit completed, the battery will come up to its power in two or three days; but if needed to work at once, an eighth of an ounce of sulphuric acid should be added. The plates must be arranged horizontally one above another, and both must be of iron. If the upper plate is a quarter of an inch thick, it will last a year. These iron plates work just as well as zinc and copper, and can be had everywhere at a trifling expense.

Philadelphia, Pa.

W. H. S.

Small Steam Engines.

To the Editor of the Scientific American:

The articles concerning the performance of small steam engines, which have appeared in your journal, are particularly interesting, and I hope that further communications on the subject will be published.

Some time ago I tried an experiment with a two horse power engine, in order to ascertain how it compared with the power of a horse. The latter, working in a treadmill attached to a 22 inch circular saw, was two hours in sawing a cord of pine wood, making four cuts and five sticks. The engine attached to the same saw performed the same amount of work in just forty-five minutes; the cylinder was 3 $\frac{1}{2}$ inches in diameter by 6 inches stroke. Steam pressure was 35 to 40 lbs., and the revolutions of engine about 300 a minute. The power was transmitted through a 4 inch belt running from a 19 inch balance wheel on the engine, directly to the pulley on the saw. The horse could stand the work only part of the day at a time; but the engine was good for it every hour in the day and every day in the week.

Waltham, Mass.

GEO. F. SHEDD.

Mill Dams.

To the Editor of the Scientific American:

Allow me to add a few facts to the communication published in your issue of January 23.

A dam of about 120 feet in length, across a small stream which was at times strong and rapid, had originally been built of flattened timbers, laid up in the form of a crib, and filled in with gravel; it thus constituted a bridge, except about 30 feet for waste water, which regularly flowed over. Year after year the gravel would be washed out by the water making its way between the timbers, causing leaks and requiring an annual expense for repairs. In 1819 I removed the timbers on the lower side of the dam, and dug about 3 feet deep to the hard pan for a foundation 8 feet broad, upon which a wall was carried up, 18 feet high, 8 feet thick at bottom, and 4 feet at top, the slope being wholly on the lower side. Immediately against this wall on the upper side, a puddling of clay was carried up, the whole height of the wall, along with the general filling for the bridge and

dam. In this clay puddling, broken stone was laid as in macadamizing a road; the stones were broken on the work itself, so that it was thoroughly pounded together. One year ago last summer, I saw that dam again (54 years after its construction); it was still in good condition, except that the stone had crumbled from the effects of frost and weather.

The point of improvement that I would suggest is the puddling and broken stone upon the upper side of the wall, as an effectual safeguard against leakage from the pond above, and consequent security against undermining from that source.

Canajoharie, N. Y.

J. W.

Singular Mathematical Fact.

To the Editor of the Scientific American:

Under the above heading there appears in the SCIENTIFIC AMERICAN, for February 13, a rule for multiplying numbers by 5. There is nothing singular about it, as it is virtually multiplying by 10 and then dividing by 2, which is equivalent to multiplying by 5. The rule might be more simply and clearly stated thus: Annex a cipher to a number, and divide by 2.

There is no end to these "dodges" for abbreviating arithmetical processes. A convenient one, which I do not recollect to have seen in print, is a short way of squaring numbers ending with 5. It may be concisely stated thus: Multiply the tens (that is, the number with the last figure cut off) by the tens plus one, and annex the figures 25 to the product. Thus, to square the number 25, multiply 2 by 3, and affix 25, making 625. To square 195, multiply 19 by 20, and affix 25, or 38025. Any number of two figures can obviously be squared mentally. Thus $75^2 = 7 \times 8$ (or, really, 70×80) 25 = 5625.

For a longer number, the work will stand thus:

435	615
435	615
172	122
172	61
189225	732125

This process may be readily explained algebraically. The square of $a + 5$ (a representing any number of tens) is $a^2 + 10a + 25$. But $a^2 + 10a = a(a + 10)$; that is, the product of the tens into the tens plus one ten.

When I first learned this rule, many years ago, it did not occur to me that it would often be of use; but I have found since that one does often have occasion to square numbers ending with 5, and the rule has saved me not a little time and figuring.

Cambridge, Mass.

R.

Experiments with Honey.

To the Editor of the Scientific American:

The crystallization or candying of honey has received much study from apiarians; and a remedy has been sought, with no successful results. Light evidently has considerable influence upon this condition of honey, and placing the honey in a cool dark cellar for preservation has been many times recommended.

During the past autumn, I have experimented as follows: I put up six 1 lb. cans of beautiful linden honey, being careful to make it into one homogeneous mass by stirring. It was thrown from the combs by an extractor on July 20, and put into cans on August 1. The cans were placed respectively as follows: one in a dark, dry cellar, one each under shades of red, yellow, green, and blue glass, and the sixth can in full light. On November 8, the honey in the cellar candied to a white. November 22 to December 10, honey under colored shades candied, first in the red, next in the yellow, green, and blue; while the honey in full light remained transparent until January, when it soon candied after exposure to intensely cold weather. From my experience an equal temperature would preserve certain kinds of honey, while other kinds would candy under almost any circumstances.

I think that candied honey, instead of being looked upon with disfavor, should be recognized as evidently pure. I hope, however, that the above experiments will lead others to follow up the light theory with beneficial results.

Hartford, N. Y.

SCIENTIFIC.

A Match under the Microscope.

To the Editor of the Scientific American:

Those of your readers who are fond of investigations with the microscope will find a beautiful object in the head of an ordinary parlor match.

Strike the match, and blow it out as soon as the head has fused sufficiently to cause protuberances to form on it; on that part of the head which took fire first, will be found a white, spongy formation, which, under the microscope and with a bright sunlight on it, has the appearance of diamonds, crystals, snow, frost, ice, silver, and jet, no two matches giving the same combination or arrangement.

Tarboro, N. C.

H. A. WALKER.

A Railroad on the Ice.

To the Editor of the Scientific American:

The invention mentioned on page 85 of your current volume of a railroad on the ice, is a powerful effort of genius, and will do credit to Duluth; but, why use rails? Put a spiked tyre on each driver of the locomotive, remove the bogie, and put in its place a pair of sled runners fitted with steering gear, mount all your cars on runners, and—clear the track!

No rails will be left behind to absorb the heat of the sun and sink through the ice, or to be lost by a sudden thaw, or to be laid and removed. All this expensive track business will be saved. Duluth thought to save the grading, etc., but didn't think far enough. That city can just as easily save the rails and spikes too.

Permit me to thank you for the beautiful and convenient shape in which your paper now comes to hand. Old as it is as a publication, it seems to renew its youth, and to become brighter and better every year.

Washington, D. C.

C. E. T.

The Transportation of Concentrated Sulphuric Acid.

The danger attending the transportation of concentrated acids renders it desirable to manufacture them as near the place of consumption as possible; but this is not always feasible—the acid must be transported. Its power of destroying both organic matter and the metals (except lead), in case a carboy breaks, is well known. Other phenomena, not so well known, have also been noticed, and are worthy of a brief description. A boat plying upon the river Rhine was laden with 600 carboys of sulphuric acid of 66° Baumé, and, owing to some misunderstanding between shipper and receiver, was obliged to remain laden for six or seven months. Some of the carboys were broken, by the rolling of the vessel or other cause, and the acid escaped into the hold of the vessel. Of course the wood work with which the acid came in contact was charred, and the iron nails, etc., were dissolved, endangering the safety of the vessel, which began to leak. The remarkable part of the story is yet to come: The iron work on the deck of the vessel was injured without having been in contact with the acid, and the boatman, who slept in the room where the acid was stored, was attacked with a severe inflammation of the eyes, and suffered from asthmatic difficulty.

Dr. H. Vohl conjectured that, through the action of the acid upon the straw and other packing, and upon the wood-work of the vessel, some volatile organic acids were produced, as well as sulphurous acids. To test the correctness of this surmise, he placed two pounds of cut straw in a large tubulated retort, and poured upon it just enough acid of 66° Baumé to moisten it. Heat was at once produced, the straw was carbonized, and suffocating acid vapors were evolved. No sulphurous acid was detected by the odor. A glass tube was inserted through the tubulus, reaching almost to the mixture; the gases were drawn, by means of an aspirator, through a solution of pure caustic potash, the operation being continued for four hours. An analysis showed that, in addition to small quantities of chlorine and sulphurous acid, a considerable amount of acetic, formic, and metacetic acids had been absorbed by the potash. After the mixture of sulphuric acid and straw had been standing two days, the volatile acid products were examined, and it was then ascertained that the quantity of volatile organic acids had diminished, and that of sulphurous acid had increased. At the end of four days, the quantity of sulphurous acid was sufficient to be detected by the odor.

The same experiments were repeated with basket willow, pine and oak shavings, etc., with similar results. These experiments were all made at the temperature of about 50° Fahr., without artificial heat. There is no doubt that, when concentrated sulphuric acid comes in contact with straw, wood, or other organic matter at ordinary temperature, volatile organic acids and sulphurous acid are developed in considerable quantity. In the case above described, these acid fumes, no doubt, attacked the iron parts of the vessel and made the boatman ill. Hence it is dangerous to sleep in a room where this acid is kept or transported, unless special care is taken to secure good ventilation.

Photographic Parasols and Wearing Apparel.

Among recent applications of photography is the imitation of lace, by photo printing on parasols. The *Photographic News*, speaking of one example, says: Every fiber of the lace was shown with extreme sharpness. So perfect was the result, indeed, that, unless one touched the parasol, it was impossible to believe that the lace was not actually a tangible reality.

The same process is now being further employed for printing handkerchiefs and shirts; and we were fortunate in seeing the other day some examples of what can be done in this delicate fancy printing process. Some handkerchiefs shown us had at the corner two or three butterflies most charmingly impressed, the images having evidently been taken direct from the insects themselves. Other fabrics had sketches, evidently reproductions from woodcuts and engravings, obtained and printed by a photo-mechanical process, all of them being of a most delicate nature, such as could hardly be secured from blocks on lithographic stones. Photographic portraits of various kinds were also to be seen impressed upon fabrics in the same way; but these, perhaps, can scarcely be called novelties, neither was the result so successful as in the case of the other objects we have mentioned. The prints were undoubtedly all produced by fatty ink, and would, no doubt, be very permanently printed upon the fabric. This method is much simpler and more satisfactory than printing in the ordinary way by silversalts; for very great care has to be exercised in the latter case, and failures are far from unfrequent, the dressing in the fabric being most difficult to remove and apt to discolor the silver print. Moreover, there are the troublesome operations of salting and albumenizing, and flattening the stuff, which is by no means an easy proceeding, any more than the examination of the print in the pressure frame. This photo-mechanical printing upon fabrics is certainly an art to be cultivated.

PRACTICAL MECHANISM.

NUMBER XVIII.

BY JOSHUA ROSE.

MOVEMENT OF THE PISTON AND THE CRANK.

To resume, then, we find that, under a maximum of steam lap, the valve permits, as before stated, the steam to exhaust too early in the stroke, and that, to remedy this defect, we have no alternative but to add lap on the exhaust side of the valve. To do this, however, would reduce the exhaust opening of the cylinder exhaust port; hence some alteration in the proportions of the openings is necessary to enable us to accomplish our end, which alteration is in making the cylinder exhaust port more than twice the width of the steam port, since exhaust lap can only be usefully employed under such conditions. In order to show the benefits due to exhaust lap, we will again alter our engine, giving the steam side of the valve an additional one sixteenth of an inch of lap, and placing seven sixteenths of lap on the exhaust side; hence our next experimental engine will have the following dimensions: Steam ports seven eighths of an inch wide, ribs (or bridges) each five eighths of an inch wide, cylinder exhaust port two and one quarter inches wide, exhaust port of valve two and five eighths inches wide, steam lap fifteen sixteenths of an inch, exhaust lap seven sixteenths, travel of valve three and nine sixteenth inches, eccentric rod twenty-three and three quarters inches long.

The only disadvantage arising from these alterations will be that, in consequence of widening the cylinder exhaust port, we have thrown the steam ports wider apart, and have hence had to widen the valve, and therefore to increase the area of the back of the valve upon which the steam acts, pressing the valve to its seat; so that we have proportionately increased the friction due to moving the valve under its pressure; unless the valve is balanced, in which case the increase of area makes no appreciable difference. We have, on the other hand, shortened the length of the steam passages to the amount to which we have widened the cylinder exhaust port, and gained several other important advantages, as the following tables of movements disclose:

TABLE NO. 15.—FRONT STROKE.

Piston moved inches	Port open inch	Piston moved inches	Port open inch
1	5-8	7	7-16
2	3-4	8	1-4
3	3-4	9 1-8	closed, and expansion begins
4	3-4		
5	11-16	11 3-4	closed, but expansion ends
6	5-8 bare	12	exhaust port open 9-16 inch

TABLE NO. 16.—BACK STROKE.

Piston moved inches	Port open inch	Piston moved inches	Port open inch
1	3-4	6	7-16
2	7-8	7	1-4
3	7-8	8	closed, and expansion begins
4	3-4		
5	5-8	11 1/2	closed, but expansion ends
		12	exhaust port open 5-8 inch

In the table No. 11 given in our last, we find that the widening of the cylinder exhaust port and the addition of lap on the exhaust side of the valve has retained the steam in the cylinder during three eighths of an inch more of the piston movement in the front stroke, and during one half of an inch more in the back stroke than was previously the case; and further, that we have used the steam expansively during half an inch more of the front and during seven eighths of an inch more of the back stroke than in our last engine, the steam supply in the front stroke having been cut off a trifle earlier and the expansive steam retained longer in the cylinder. In the back stroke, however, the steam supply is cut off five eighths of an inch earlier in the stroke and the expansive steam exhausted half an inch later in the stroke, so that the back stroke has been benefited far more, by the alteration, than has the front stroke.

We shall find, however, on examination that the average width of the port opening for the admission of steam has been slightly reduced; this, however, is not of great consequence, since the ports have (as before stated) a larger area than they require when in operation as steam ports; so that, if the exhaust is found to be as free as before, the last alteration of our engine will have been beneficial in every respect.

TABLE NO. 17.—EXHAUST OF STEAM AT FRONT END.

Piston moved inches	Exhaust A. (Fig. 54.) open inch	Cylinder Exhaust B. (Fig. 54.) open inch
11 7-8	1-8	1 15-16
12	9-16	1 9-16
Return stroke		
1	7-8	3-4
2	7-8	5-8
3	7-8	5-8
4	7-8	3-4
5	7-8	7-8
6	7-8	1 1-16
7	7-8	1 1-4
8	5-8	1 1-2
9	5-16	1 13-16
9 3-4		closed, and steam cushions.

In order to obtain the average exhaust opening during the stroke, we must of course, at each inch of piston movement, take the port opening of A or B (as the case may be),

which is the smallest; commencing, then, when the piston is at the end of the stroke, a calculation will give us eleven sixteenths of an inch as the average exhaust opening in our last table, against ten sixteenths as the average exhaust shown in table No. 13.

TABLE NO. 18.—EXHAUST OF STEAM IN BACK END.

Piston moved inches	Exhaust A. (Fig. 54.) open inch	Exhaust B. (Fig. 54.) open inch
11 3-4	1-8 full	1 7-8
12	5-8 barely	1 7-16 full
1	7-8	7-8
2	7-8	3-4
3	7-8	3-4
4	7-8	3-4
5	7-8	13-16
6	7-8	7-8
7	7-8	1 1-16
8	13-16	1 1-4 full
9	1-2	1 9-16
10	3-16	1 7-8
10 9-16		closed, and steam cushions.

The average exhaust of the above is one hundred and thirteen one hundred and sixtieths of an inch against the average of one hundred and sixteen one hundred and sixtieths of an inch, shown in table No. 14, which shows a slight loss in our last experiment; this is, however, an apparent and not a real loss, for the reason that, in our last experiment, the steam was cut off earlier in the stroke, so that the quantity of steam to be exhausted was less than in the former instance; hence the exhaust opening, in our last experiment, when considered with relation to the quantity of steam required to pass through it in a given time, becomes greater than was formerly the case. It will also be observed that the exhaust in our last experiment is (in both strokes) more free during the early part of the stroke, that is to say, from the first to the fifth inch of the piston movement, than was the case in our previous experiment, which is a gain of great value, since it is during that part of the stroke that the exhaust opening is at its least, from the partial closure of the cylinder exhaust port.

In the front stroke, at the nine and three quarters inches, and in the back stroke, at the ten and nine sixteenths inches of piston movement, the exhaust is closed so that whatever steam, on the exhaust side of the piston, remains in the cylinder at those points is compressed by the advancing piston, and acts as a cushion to reverse the motion of the reciprocating parts of the engine, easily and without noise (in the same manner as the same end is obtained by giving lead to the valve). It is the lap on the exhaust side of the valve which causes this partial closure and compression of the exhaust steam (which is commonly called cushioning on exhaust lap), and which effects a saving of steam, inasmuch as it may be so proportioned as to enclose and compress sufficient steam to just fill the steam passages with steam at full pressure by the time the piston has arrived at the end of its stroke; so that, when the valve opens, no steam will be required from the steam chest to fill such passages, and the valve need not therefore be given any lead, which, in turn, leads to another advantage, inasmuch as, to take the lead off the valve, we must set the eccentric back so that its throw line will be more nearly at a right angle to the center line of the crank, and the variation in the valve movement (explained in Fig. 53 and its accompanying remarks) will be less. By taking the lead off the eccentric, we however decrease the opening of the steam port during the first two inches of the piston movement, which is a decided disadvantage, even though the average opening of the steam port remains the same in either case, because the closure of the port of the valve is proportionately delayed.

The extreme limit to which the addition of steam lap, the widening of the cylinder exhaust port, and the addition of exhaust lap may be usefully employed is governed by, first, the exhaust opening becoming diminished when the piston is at the end of the stroke and during the latter part of the exhaust; secondly, by the increased pressure of the valve to its seat (already referred to); thirdly, by a proportionate increase in the travel; and fourthly, by the point in the stroke at which the exhaust lap will close the exhaust port, and thus shut in and compress a portion of the steam, on the exhaust side of the piston, in the cylinder: it being evident that, if the quantity of steam so enclosed be excessive, the piston will compress it to such an extent as to make its pressure, by the time the piston has arrived at the end of the stroke, greater than is the pressure of the steam in the steam chest, and of course very much greater than the pressure of the steam on the steam side of the piston (which has decreased in consequence of its expansion), thus entailing a serious back pressure, and causing the steam compressed in the steam passage to be forced back into the steam chest so soon as the valve opens. It is obvious, however, that if the valve has any lead on it, this back pressure will be less than if there were no lead, because the steam would be forced back into the steam chest earlier, and therefore before it was compressed to so great a degree; but in either case sufficient exhaust lap to cause such steam to be forced by the piston back into the steam chest would entail a loss of power from back pressure, and place a severe strain on some of the parts of the engine, as already explained in our remarks on excessive lead.

To illustrate these points let us alter our engine as follows: Steam ports seven eighths of an inch wide, ribs five eighths of an inch wide, cylinder exhaust port two and three quarters inches wide, steam lap one and one eighth inches, exhaust lap three quarters of an inch.

These alterations necessitate that the valve travel be increased from three and nine sixteenths inches to four inches,

causing an increase in the distance traveled by the valve, and therefore in the power employed in moving it, of over 12 per cent (unless the valve be balanced).

The valve will now be eight instead of seven and one eighth inches wide as before, causing it to be pressed to its seat with over 12 per cent more pressure than before. The exhaust opening will be diminished as follows (those points in the stroke here omitted not being affected by the change)

TABLE NO. 19.—EXHAUST AT FRONT END.

Piston moved inches	Exhaust open inch	Loss inch
12	1-2	1-16
Piston returned		
7	5-8	1-4
8	5-16	5-16
9	exhaust closed, cushioning begins	

TABLE NO. 20.—EXHAUST AT BACK END.

Piston moved inches	Exhaust open inch	Loss inch
12	3-8	1-4
Piston returned		
7	3-4	1-8
8	9-16	1-4
9	1-4	1-4
9 7-8	exhaust closed, cushioning begins.	

Here, then, we have a large decrease in the exhaust openings, and have cushioned on exhaust lap three quarters of an inch earlier in the front stroke and eleven sixteenths of an inch earlier in the back stroke: the other alterations being that the expansion of our new engine will begin at eight and three quarters inches of the front and at seven and five eighths inches of the back stroke, that is to say, the steam has been used expansively during five eighths of an inch more of the piston movement during the front, and during five eighths of an inch more of the back stroke than was the case previous to the last alteration made in our engine. The effect of such a movement would be to place an amount of back pressure (due to cushioning on the exhaust side to an excessive degree) so great as to force the valve off its seat and produce a serious strain upon the engine, and to produce a back pressure during the earlier part of the exhaust by cramping it.

Exhaust lap, sufficient to prevent the exhaust from taking place too early in the stroke, is shown by our tables to be in every way desirable; but when it is employed to cushion, or, in other words, to answer the purpose of lead, great care must be taken as to its proportion, which must, in all cases, depend upon the pressure of the steam used, and the speed at which the piston travels. With high pressures and speeds, a minimum only of exhaust lap is permissible. Another effect of exhaust lap is to take some of the lead off the eccentric, and to that extent to correct the irregularity in the points of cut-off, expansion, etc.

It will be observed that the variation in the point of cut-off at one end, as compared to the other end of the stroke, becomes greater in proportion to the increase of steam lap; and there is no way of remedying this defect except we produce still greater evils in other directions. Were we to equalize those points of cut-off by giving different amounts of steam and exhaust lap at one, as compared to the other, end of the valve, we should increase the variation in the steam and exhaust openings, and cushion at widely differing points in the stroke; so that, when we have proportioned the steam lap to cut-off at about three quarters of the stroke, and the exhaust lap so as to leave the exhaust port open (when the piston is at the end of the stroke) to the amount of about two thirds of the full width of the steam port, we have obtained all the benefits due to the employment of either of them, nor can we alter the value to accomplish a gain in any direction without entailing a loss in another.

If the cylinder exhaust port is twice the width of the steam port, and no exhaust lap is employed, the valve may have steam lap to about the width of the steam port; but if the cylinder exhaust port is made more than twice the width of the steam port, a proportionate amount of steam and exhaust lap may be added. For locomotives, common proportions are: Steam ports one and one quarter inches wide, rib one inch, cylinder exhaust port two and one half inches, steam lap one inch, lead of valve three sixteenths of an inch, travel of valve four and one half inches, exhaust lap being dispensed with, except it be sufficient to just prevent communication between the steam ports when the valve is in the middle of its travel.

Actinic Light.

The *Athenaeum* says: "When the vapor of bisulphide of carbon is mixed with nitric oxide gas, the mixture, on ignition, burns with an intensely luminous flame of high actinic power, but of only momentary duration. MM. Delachanel and Marnet have, however, recently succeeded in producing a lamp in which this gaseous mixture may be conveniently burnt, and thus applied to photographic purposes. The nitric oxide is generated by the action of iron on a mixture with vapor of bisulphide of carbon; the mixed gases are burnt in a kind of Bunsen's burner, the products of combustion being rapidly carried off by a chimney. For the purposes of the photographer, this new flame is said to be superior to that of the magnesium lamp, while it is estimated to have twice the chemical power of the oxyhydrogen flame, and three times that of the electric light.

An interesting phenomenon is now observed in Cadunk, Lily and Lake ponds, at Southington, Conn. Decomposition of vegetable matter on the bottom is producing carburetted hydrogen gas, which may be ignited at this season by applying a match at holes made in the ice.

RE-SAWING BAND SAW

The annexed illustration represents a new and improved band saw, designed exclusively for re-sawing. After several years spent in experiments and trials, to construct a machine for the above purpose, Messrs. First & Prybil, of 461 to 467 West 40th street, New York city, a well known firm manufacturing band saws and other woodworking machinery, have succeeded in getting a machine giving full satisfaction, and they have at present several of them in operation.

The capacity of the machine, shown in the engraving, the manufacturers state, is from 12,000 to 16,000 feet of lumber per day. The height of the machine is 10 feet; the wheels are 5 feet in diameter; the weight is between 4,000 and 5,000 lbs. The saw kerf made is from $\frac{1}{4}$ to $\frac{3}{8}$ inch thick, and its sawing space is 30 inches, taking in timber 18 inches thick.

As lumber has become costly, it will be seen that it is of great advantage to use a thin blade; the saving of power is also considerable. On hard lumber, the saving amounts to more than the sawing costs. The general construction will be readily understood from the engraving.

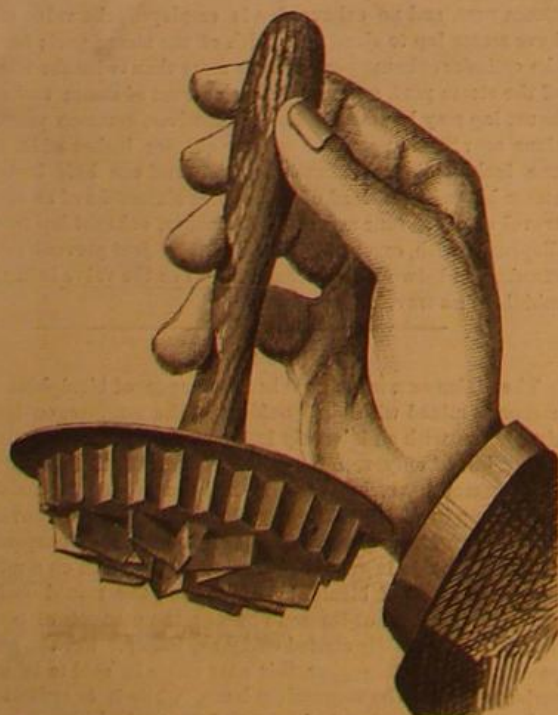
Further particulars may be obtained by addressing the manufacturers as above. On page 141 will be found an advertisement of this machine, and a copy of the manufacturers' correspondence with the Managers of the American Institute.

On the Motive Power of Diatoms.

Professor Leidy, in some remarks on the moving power of diatoms, desmids, and other algae, stated that, while the cause of motion remains unknown, some of the uses are obvious. The power is considerable, and enables these minute organisms, when mingled with mud, readily to extricate themselves and rise to the surface, where they may receive the influence of light and air. In examining the surface mud of a shallow rain water pool, in a recent excavation in brick clay, he found little else but an abundance of minute diatoms. He was not sufficiently familiar with the diatoms to name the species, but it resembled *navicula radiosa*. The little diatoms were very active, gliding hither and thither, and knocking the quartz and grains about. Noticing the latter, he made some comparative measurements, and found that the naviculae would move grains of sand as much as twenty-five times their own superficial area, and probably fifty times their own bulk and weight, or perhaps more.

A NEW PIE MARKER.

The form of this device is plainly shown in the annexed engraving. The stamping portion may be made of any desired shape and of any suitable material. Its object is to give an ornamental appearance to pies, cake, or butter, and it will be found a handy little device for the purposes.

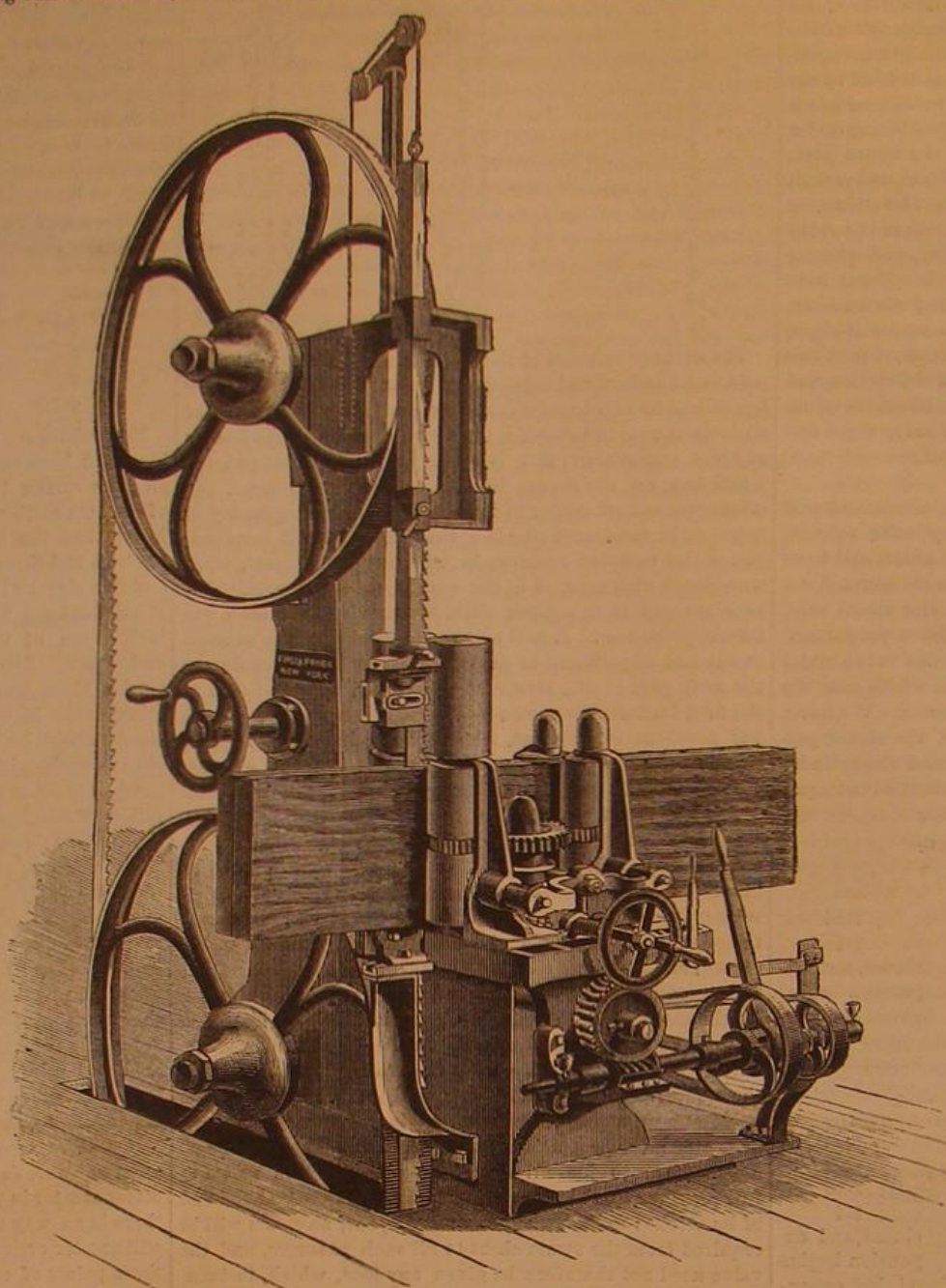


It was patented December 23, 1873, through the Scientific American Patent Agency, to Mr. Thomas S. Macomber, of Hamilton, N. Y., who may be addressed for further particulars.

Look well to the little things, and the larger ones will take care of themselves.

Electrical Resistance of Various Metals.

M. Benoit has measured with great precision the electrical resistance of various metals at temperatures from 0° to 800°. He employed both the method of the differential galvanometer and of the Wheatstone's bridge, and for each metal has measured several specimens. The mean of these is given in the following table, the second column giving the resistance of a wire, 39.37 inches long and having a cross sec-



RE-SAWING BAND SAW.

tion of 0.03 inches, in ohms, and column three the same quantity in Siemens units. Column four gives the resistance compared with silver:

Metal.	Ohms.	Siemens.	
Silver, A.	0154	0161	100
Copper, A.	0171	0179	90
Silver, A.(1)....	0193	0201	80
Gold, A.	0217	0227	71
Aluminum, A.	0309	0324	49.7
Magnesium, H.	0423	0443	36.4
Zinc, A., at 350°....	0565	0591	27.5
Zinc, H.	0594	0621	25.9
Cadmium, H.	0685	0716	22.5
Brass, A. (2)....	0691	0723	22.3
Steel, A.	1099	1149	14
Tin.	1161	1214	13.3
Aluminum bronze, A. (3)....	1189	1243	13
Iron, A.	1216	1272	12.7
Palladium, A.	1384	1447	11.1
Platinum, A.	1575	1647	9.77
Thallium.	1831	1914	8.41
Lead.	1985	2075	7.60
German silver, A. (4)....	2654	2775	5.80
Mercury.	9564	10000	1.61

A, annealed; H, hardened; (1) silver 75; (2) copper 64.2; zinc 33.1; lead 9.4; tin 0.4; (3) copper 90; aluminum 10; (4) copper 60, nickel 35, zinc 25.

These results, which are all taken at 0°, agree closely with those obtained by other observers. M. Benoit has extended his observations to a range of temperature much greater than those previously employed for this purpose. He wound the wire around a clay pipe inclosed in a muffle, and immersed the whole in a bath of water, mercury, sulphur, or cadmium, which was kept at the boiling point by a Perret furnace. Constant temperatures of 100°, 360°, 440°, and 800° were thus obtained. Various temperatures below 360° were also obtained by a mercury bath. The measures were also corrected for expansion. Plates annexed to his memoir, presented to the Faculty of Sciences of Paris, show the results graphically. They show that the resistance increases regularly for all metals like tin, lead, and zinc up to their points of fusion. This increase, however, differs for different metals. We notice that tin, thallium, cadmium, zinc, lead, are found together in the upper part of the plate; at 200° to 230°, their resistance has doubled. Below them are iron and steel; for

the last, the resistance doubles at 180°, quadruples at 430°, and at 800° is about nine times that at 0°. Palladium and platinum, on the other hand, increase much less, and only double their resistance at 400° to 450°. Gold, copper, and silver form an intermediate group. In general, the conductivity decreases more rapidly in a metal the lower its point of fusion. Iron and steel are exceptions to this rule. In alloys the variation is always less than in their constituents, and this is especially the case with German silver.

A Curious Artificial Fish.

A Spaniard named Fernandez, says a contemporary, has constructed at San Francisco a submarine propeller, eleven feet long, four feet deep, and four feet wide, and resembling a monitor in its general shape. A forward hatchway opens into a cistern which will hold forty gallons of water, introduced and expelled by means of a force pump inside the boat and under control of the operator. The water passes in both instances through a hole perforated amidships under the keel. When the operator desires to sink his vessel he fills the cistern with water, and when he wishes to ascend he empties it. By means of complex machinery, he is enabled to steer his vessel in any direction, and with remarkable rapidity. The hexagonal manhead or trunk, which looks like the turret on a monitor, is three feet long and from one to two feet wide. It is closed over with a hatch cover, held down inside by two iron claws, which are secured by iron rods. A slight pressure on these rods in a given direction instantly loosens the claws and the hatch cover springs open. In this way the inventor purposes escaping from his boat, should anything go wrong with the machinery. The manhead has five small apertures for light, four of the six sides and the top having windows of French plate glass. On either end of the manhead, extending upward several feet, are two wrought iron rods, intended to facilitate the escape of the operator in danger, who uses them to force himself from his place. To the aft rod is connected a contrivance which makes the upper section airtight, and the operator, can, by it, expel the foul air.

IMPROVED AWNING.

The device herewith illustrated serves, when raised in suitable position, as an awning for the exterior of a store; and when lowered, may be used as a single large shutter. The construction and arrangement, as will be seen from the following description, are necessarily suited to both purposes.

To a large inner section, which is hinged directly to the building, a smaller outer section is similarly attached. Both sections are composed of a framework, the pieces of which are set at right angles, so as to form square or rectangular air chambers. The frame is covered with sheet iron, tin, or similar suitable material. When both sections are let down, as indicated by the dotted lines, the device forms a shutter which closes the entire front of the store. When raised at



an inclination to serve as an awning, the outer section is allowed to swing from its hinges for the purposes of a sign.

The invention is simple and convenient, and, doubtless, will be found an economical substitute for the appliances which it is designed to replace. Patented December 1, 1874, to Martin Stonehocker, of Streator, La Salle county, Ill., to whom letters for further information may be addressed.

Manufacture of Extract of Indigo.

To make what is generally called sour extract of indigo, mix 5 lbs. of best Bengal indigo in 30 lbs. of strong oil of vitriol. Let it stand five days; then put it in a tub and add 40 gallons of boiling water to it; then filter while hot through strong felt cloth. The filters are usually made this way: A frame like a table top, 8 yards long, 2 yards wide. This frame is divided into four filters. Pieces of wood across are put on the top and made to fit the holes (the shape of bowls, with small holes perforated in them); then the felt cloth is put on the top, and the liquid is put on the filter and filtered through. The sediment at the top is used to color pottery molds; that which runs through is put in a tub, and 40 lbs. of common salt added. Digest for six hours; then put on the filters again for four or five days. That which drains through runs away into the sewers; that on the top of the filters is the extract. For these proportions the extract should weigh 80 lbs. This is sour extract of indigo of commerce.

FREE EXTRACT.—To make free extract of indigo, put 100 lbs. of the sour extract in a tub, 12 gallons of water as well. Neutralise the acid in the extract with strong soda ash liquor until it is free from any sour taste; then put on the filters for six days. It should weigh 100 lbs. when it comes off. That is free extract of indigo of commerce.—*Chemical News.*

PUBLIC BUILDINGS IN BRUSSELS.

The Belgian capital contains, without doubt, more fine public buildings than any other city of its size; and its bright appearance, and the general aspect of brilliance and gaiety of its inhabitants, have gained for it the name of "the miniature Paris." A new boulevard, which traverses the city, is now completed; and the principal building situated on it, the new Exchange, was opened last year with a grand ball, at which the King and Queen and other celebrities were present, in all some 8,500 persons, so that, although the floor of the great hall occupies some 4,000 superficial yards, the dancers were much cramped for room. M. Léon Suys is the architect of the building, which was begun in 1868. It is 300 feet long by 150 wide; it is rectangular shaped, and its principal façades open on the Boulevard Central and the Rue du Midi. The style is mixed, the architect has united the types of various ages, iron is found in complete harmony with stone, and the result is a splendid hall of commerce, a saloon which can at any time be converted into a theater, one of the most capacious concert rooms on the Continent, and a trophy of almost dramatic elegance. The sculptural ornamentation is very rich. The frontispiece of the great peristyle represents the city of Brussels, surrounded by groups of allegorical figures—Industry, Agriculture, Peace, Navigation, Painting, Free Trade, etc. Many other groups to sculpture decorate the outside of the building, which is

surrounded by a large dome, culminating in a gilt spire. The immense cupola, says *Harpers' Weekly*, from which we extract the engraving, is supported by twelve Corinthian columns in reddish gray stucco, while the galleries rest on columns imitating dark red porphyry. The floor is a masterpiece of mosaic work, executed by Italians. The sun burners, by which this magnificent structure is lighted, are composed of 1,400 jets of gas.

Solders and Soldering.

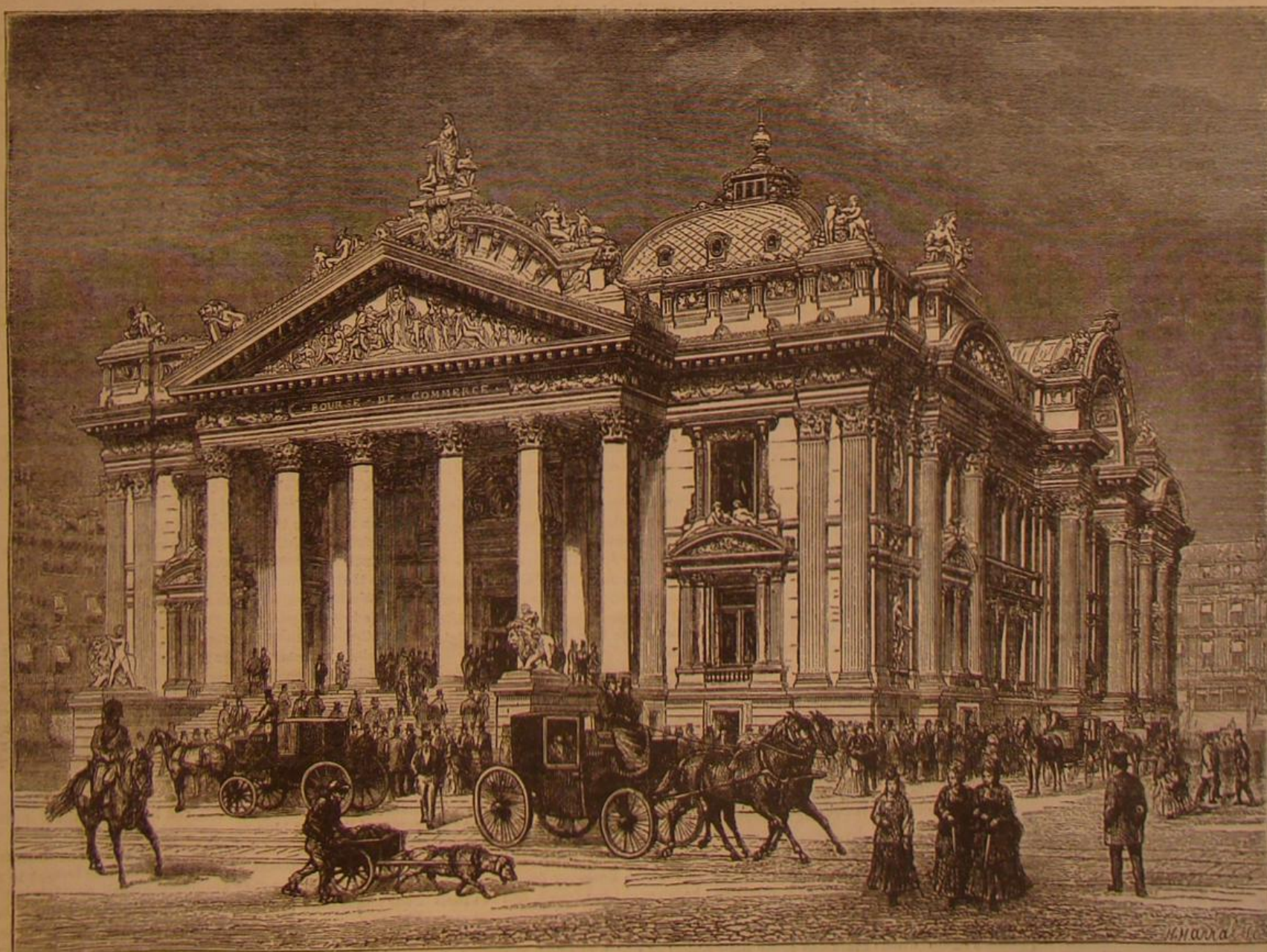
Continuing our remarks on this subject (see page 112), we have now to speak of hard solders and of the methods employed to solder other metals than tin, lead, and zinc. Probably the most important of these methods is that known as brazing, that is, the process employed for uniting pieces of iron, steel, copper, etc., by means of a solder consisting of brass, or an alloy of copper and zinc in different proportions. This solder is technically termed strong or hard solder. In workshop parlance, this is denominated spelter, a name which in commerce is used to designate the bars or ingots of cast zinc, as received by the metal merchant. Although this use of one name to indicate two very different things is at times confusing to the tyro, there is little fear that he will be misunderstood in the workshop or by tradesmen if he asks for his hard solder under the name of spelter. It is of far more importance, however, to remember that, for some kind of work, commercial spelter is not so well suited as other brasses; for it ordinarily consists of equal weights of zinc and copper, and in certain cases it is advisable to use a harder solder than is obtained by these proportions. The admixture of copper and zinc produces a series of alloys differing considerably in their qualities; and when tin is introduced, the increase or decrease of the zinc and tin produces a compound metal, the properties of which are widely different according to the relative quantities of the ingredients used in its production. Spelter when home made is best prepared by melting the copper and zinc in separate crucibles, the copper being in a crucible large enough to hold the zinc as well. When both metals are thoroughly melted, the zinc is poured into the copper crucible, the two being stirred well, so as to ensure thorough admixture, when the alloy is poured out on to a bundle of birch twigs or pieces of coarse basket work, supported over a tub of water, the object being to obtain the solder in form of fine grains with an irregular crystallization. If, when taken from the water, the spelter is not sufficiently uniform in size of grain, it is sifted through a sieve, and the large particles are crushed in a cast iron mortar or any suitable appliance, and again passed through the sieve, for fineness and uniformity of size are essential to the accomplishment of some examples of brazing in a thoroughly satisfactory manner. The manufacturers of the hard solder, however, usually cast it into ingots, delaying the cooling in order to develop as much as possible the crystallization, which

is found to facilitate the subsequent crushing and sifting of the spelter. The flux used in nearly all the operations performed with hard solder is borax—the borate of soda—which not only prevents the surfaces of the metals from becoming oxidized, but also exercises the remarkable property of dissolving any oxide already there. In some cases the flux can be dispensed with, but the pieces to be joined must be filed perfectly bright and clean, and care taken to melt the solder as quickly as possible when heat is once applied. The handiest way is, however, to dissolve the borax in water and add the solder, forming a paste which can be easily spread on the surfaces of shapes to which the drier powder would not readily adhere. For many jobs, however, it will be sufficient to merely crush the borax, which contains in its uncalcined state a considerable quantity of water; and for others it will be best to use merely a solution of borax.

The ordinary proportions of the constituents of hard solder are usually stated to be:

	Copper.	Zinc.	Tin.
Hardest.....	3	1	—
Hard (spelter).....	1	1	—
Soft.....	4	3	1

and softer still is no longer a brass, but an alloy of tin and antimony (2 to 1). By the rough and ready processes of the manufactories, however, these proportions are probably never very accurately observed; and a variation of a few parts per cent is, perhaps, of little moment, when copper and zinc alone enter into the alloy. Thus, for solder for iron, the zinc may be present in the proportion of from 33 to 50 per cent, though the harder solder (that with least zinc) is to be preferred. For soldering brass and copper, the ordinary spelter will answer for common work; but where, as in the case of, say, microscope tubes, it is desirable that the solder should be as nearly as possible of the same color as the brass, the proportions of zinc must be increased or decreased, according to the paleness or yellowness of the metal to be soldered. In a similar manner, it is often advantageous or advisable to study the hardness of the solder, and to keep the zinc as low as possible to secure fusibility, without running the risk of damaging the article to be soldered. Thus for brazing tubes of pure copper, the zinc may be as little as 25 per cent, or even less; or a solder composed of copper 7, zinc 3, and tin 2, may be employed. For uniting brass tubes, that are to be afterward bent and hammered over the soldered portions, an alloy of brass 77.5, zinc 22.5, will be found to yield better results than other hard solders; but if the tubes are thin, and have to be soldered to flanges or pieces of stouter substance, it will be advisable to add a little tin—from 2 to 5 parts—in place of a similar quantity of zinc. Where, however, a large amount of work has to be done with the same kind of brass, the very best solder that can be had is to take the scraps of the metal itself, and add zinc in the proportion



THE NEW BOURSE AT BRUSSELS, BELGIUM.

of 20 per cent, thus producing an alloy whose fusion point is sufficiently removed from that of the metal to be soldered to avoid risk of damage; and yet it approaches so closely to it as to insure perfect union of the solder and the brass. A fine, hard solder, for joining small and thin pieces of copper or brass, consists of copper 80.5, zinc 9.5, tin 4. It is a light yellow in color, and is easily reduced to a fine grain, resembling filings; but it speedily oxidizes when heated, and should be well mixed with borax, unless it is completely surrounded by the fire. A solder for pure copper is made by mixing lead and copper, in proportions varying from 16 to 25 parts of the former to 100 of the latter. These are prepared by first melting the copper, and then the lead in a separate crucible. Add the lead as soon as melted, stir quickly, and pour out, either into ingot molds or on the bundle of birch twigs over the water tub. These solders can be used without borax, for brazing copper.

Solders for gold necessarily vary with the quality of the gold they are required to join. For 18-carat and upwards, the usual solder consists of gold (18-carat) 9 parts, silver 5, copper 5, and is best when made from filings of the components, melted together. Gold solder, termed one fourth, consists of gold 3, alloy 1; one third, of gold 2, alloy 1; and one half, of gold 1, alloy 1. The alloy is generally composed of 2 parts of silver to 1 of copper; but in one half solder the silver and copper are in equal proportions. A solder for the commoner articles of gold is made by fusing gold 3 parts, silver 2, copper 1, together, and then adding $\frac{1}{2}$ a part of zinc. Stir and cool immediately. This solder will flow at a comparatively low temperature. A soft gold solder is composed of gold 4, silver 1, copper 1. A solder for articles of 12 to 16 carats is made of gold 24 parts, silver 9, copper 6, and brass 3, the latter being a more convenient way of adding a small quantity of zinc than by putting that metal in its uncombined state into the crucible containing the molten metals. The brass, however, should be added when the others are melted.

A hard solder for silver consists of silver 66, copper 23, zinc 10; and being more fusible than "middling hard" solders for copper, it does well for brazing the finer articles in brass and steel. Silver solders are composed of 5, 3, and 2 parts of silver to 1 of brass, and are called respectively one sixth, one fourth, one third. The alloys should be melted several times in order to secure homogeneity, and are best when they are subsequently laminated into thin strips, which are granulated into spangles ready for mixing with the borax. A white solder for silver is made of equal parts of silver and tin. If an article of silver is to undergo several soldering operations, it will be necessary to employ the richer or less fusible solders, first, so as to avoid displacement in the subsequent applications of heat. There are other silver solders which are found useful in certain kinds of work. One of these is generally used for plated ware, and consists of silver 2 parts, bronze 1; another of silver 4, bronze 3, and arsenic 0.25; or equal parts of silver, bronze, and arsenic may be used. A solder consisting of silver 2, Dutch gold 1, and arsenic 0.5, is also found valuable; but in all these, the arsenic must be added after the fusion of the other metals. The button is to be drawn out under the hammer, or laminated and cut into shreds or spangles for more complete incorporation with the borax. A solder for German silver is easily made by melting scraps of the metal to be soldered, and adding an equal weight of molten zinc to them in the crucible; but this alloy is more ductile the smaller the proportion of zinc is. For general purposes, however, 5 German silver to 4 zinc will be found best. This should be cast into plates, cut into pieces, and pulverized.

For articles of aluminum bronze, three solders may be tried; but the proportions vary with the nature of the work and the number of operations the article has to undergo. A hard solder for aluminum bronze is expensive, containing about 88 parts of gold, 6 of silver, and 6 of copper; a "middling hard," about 54 gold, 28 silver, and 18 copper; and a "soft," 14 parts of gold, 57 silver, 15 copper, and 14 brass—the latter being added for the sake of the zinc it contains.

For soldering platinum, pure gold is generally used, but sometimes about a half per cent of an alloy of platinum and iridium is added to it.

It should be remembered that all solders deteriorate by remelting; and though waste scraps may be added to a new melting, if the work is of a particular kind, care should be taken that none of the scrap metal has been previously remelted. In some cases it is necessary to remelt alloys several times, in order to secure homogeneity; but when once that result has been obtained, further remelting will only tend to destroy the properties of the solder. In a future number we will give a few details of the process known as autogenous soldering, or, in shop parlance, burning, which, in certain cases gives a superior appearance to that obtained by soldering, and, under special circumstances, is the only suitable method of uniting metallic surfaces.—*English Mechanic.*

Magnetic Railway Rails.

M. Heyl, engineer of one of the German railways, in a recent report upon the special section under his charge, calls attention to the development of magnetism in the rails. He says: "I have observed that all the rails are transformed at their extremities, after they have been placed in position a few days, into powerful magnets, capable of attracting and of retaining a key or even a heavier piece of metallic iron. These rails preserve their magnetism even after they have been removed, but they lose it gradually. When in position, however, the magnetism is latent, only becoming free when the chairs are removed and disappearing again when they are replaced. Hence it is necessary to assume that two

opposite poles come together at each junction, and that each rail is a magnet, the poles being alternately reversed throughout the line. This production of magnetism in the rails examined is undoubtedly attributable to the running of the trains, and to the shocks, friction, etc., thereby produced. The hypothesis of electric currents, induced or direct, must be rejected, since it is negated by experiments upon the subject made with suitable apparatus. Although the interest attaching to the fact above stated is at present purely scientific, it is not impossible, says the *Franklin Journal*, that the magnetism thus developed may exercise an influence actually beneficial upon the stability of the roadway, increasing the adherence to the rails and the friction. It is possible, also, that the magnetic currents may be stronger at the moment of the passage of the trains, than either before or after. If this be so, the observations may acquire a still higher practical importance.

Pneumatic Tubes in London.

In addition to one line of $4\frac{1}{2}$ feet pneumatic tubes for the transmission of large packages, mail bags, etc., there is in London an extensive system of small tubes in operation, for the sending of telegraph messages. The small tubes are from $1\frac{1}{4}$ to $2\frac{1}{4}$ inches in diameter, are under the control of the Post Office department, they are divided into some twenty sections, and their aggregate length at the present time exceeds seventeen and a half miles. The messages are enclosed in carriers, which are driven through the tubes by an air exhaust or air pressure, produced by six air pumps worked by three fifty horse engines, located at the central station. Where the length of the tube does not exceed one mile, the carrier goes through in about 3 minutes; but longer tubes require much more proportionate time.

Iron pipes, as well as lead, have been tried; but the result of experience is greatly in favor of lead. No deterioration is experienced in the lead pipes, and they are easy to maintain. With the iron pipes, however, the case is different; oxidation of the iron takes place, and the interior becoming rough, the carriers are rapidly destroyed. The maintenance of an iron pipe is therefore found to be very expensive.

Provided due care is exercised in the construction of the work, interruptions of the service are of very rare occurrence. When the carriers occasionally stick fast in the pipes and cannot be moved either by compressing or exhausting the air, it is necessary to flood the pipe with water, and so force the carrier past the obstruction by an increased pressure.

All tubes are now fitted with a small pipe, by which water may be admitted if necessary.

The lead tubes are manufactured in as long lengths as possible, the $2\frac{1}{4}$ inch tubes being in lengths of about 29 feet.

Each length is laid in a wooden trough as soon as manufactured, so that it may be handled without fear of bending.

A tightly fitting polished steel "mandril," attached to a strong chain, is then drawn through the entire length of the pipe. This operation insures the pipe being smooth, cylindrical, and uniform throughout. It is necessary that the mandril should be lubricated with soft soap, so that it may not injure the pipe in passing through it.

When laid, the leaden tubes are protected by being inclosed in ordinary cast iron pipes, so that the sinking of the ground, etc., may not injure them.

The process of laying and jointing the tubes is as follows:

The leaden tubes, drawn and smoothed as already explained, are delivered from the wooden troughs to the trench prepared to receive them.

The iron pipes are then drawn over the lead, leaving enough of the leaden pipe projecting to enable a "plumber's joint" to be made.

A strong chain is then passed through the length of tube to be joined on, and a polished iron mandril, similar to the one before mentioned, being heated and attached to this chain, is pushed half its length into the end of the pipe.

The new length of tube is then forced over the projecting end of the mandril, and the leaden tubes (the ends of which have been already cut flat by an apparatus made for the purpose) then butt perfectly together, and a plumber's joint is made in the usual manner. By this means the tube is perfectly airtight; and the mandril keeps the surface of the tube under the joint as smooth as at any other part of its length.

After the soldering process has been completed, the mandril is drawn out by the chain attached to it; the next length is drawn on, and the process repeated.

Where it is necessary to deviate from the straight line it is essential that the tubes be laid in a circular arc, whose radius shall not be less than 12 feet. The same care is necessary in entering the various stations, otherwise undue friction will arise, and curves would be introduced which might cause the carrier to stick fast.

Snail Culture in France.

Frogs, horses, and snails—the first are an odd but toothsome dainty, which epicures, in this country as well as elsewhere, dearly prize; but horses, and especially snails—these are articles of diet which the enlightened American republic has yet to be educated to relish. Hippophagy, we have repeatedly explained, is as common in Paris, or nearly so, as the eating of beef; and the worn-out steed finds his way to the abattoir as readily as the milkless cow or stall fed ox. Hence, as a mere *bonne bouche* he has palled on the Gallic taste, educated by swollen geese livers or decayed salmon roes; a new dainty has been sought for, found, and the basis of the new industry which the production has developed is snails. There is nothing peculiar about the mollusc. It is the every-day slimy little object of which one finds thousands in gardens, vineyards, and woods. Switzerland and the prov-

inces of Burgundy and Provence are the places of its cultivation. Throngs of women and children scour the country, collecting the snails in immense numbers, and depositing them in little tracts of land, enclosed with simply a trail of sawdust. This last the snail despises; he cannot cross it, and avoids its vicinity as a matter of preference. Therefore, for his confinement it is as good as a stone wall. After incarceration for two or three days, he is permitted to starve, and then the plot is laid out in patches of turf intersected by paths of sand. Above boards are hung to serve as shelter for the snails, which instinctively gather in large groups. The food provided consists in aromatic plants, such as mint, or lettuce and fragments of vegetables. This is fed to them three times a day in enormous quantities. At the end of eight days, the snails become quite obese, and besides have attained a very succulent flavor. Then comes another period of starvation for several days, after which transmission to market follows.

Fourmands, it is said, prefer the snail when taken wild, so long as the capture is made at a particular period. After the eggs are laid in May, the molluscs conceal themselves under stones to avoid the autumn frosts. There they become perfectly free from excretions, and, drawing themselves into their shells, close up for the winter. It is when they are collected in this state that their flavor is said to be best.

Waste of Stock.

We quote the following from our excellent cotemporary *The Carriage Monthly*; it contains, not only good advice to carriage manufacturers, but hints equally applicable to nearly all branches of trade:

In all manufacturing operations there is a liability of waste to a greater or less extent, and the profits of business are increased or diminished with the care and judgment exercised in the use of the materials employed in the articles manufactured. It is the same whether the article which we consume is high or low priced. To the carriage manufacturer this item of waste is a serious thing, calling for the greatest scrutiny upon his part. He has four departments to look after, a practical man to only one; if he be a smith or a painter, he can see where to save in his branch much better than in the branches he is not familiar with, and he has, therefore, to trust to his employee, or foreman of the department. Where is the greatest waste, may be asked: is it in the wood shop, paint shop, or trimming shop? The waste may be larger in quantity in the first named, as in this department much waste arises from want either of skill or care, or both, in selecting planks or panels, from which to cut pieces for a given purpose. The lumber itself may not be in such a shape as to cut to advantage, or in such position that a proper selection cannot be made without great waste of time. Pieces left after cutting from a board or plank, which are not wanted at that time, are thrown to one side or in the waste corner, to be cut up for firewood; and when small pieces are wanted for a given purpose, a whole plank or board is cut into, and thereby possibly spoiled for larger work to which it was adapted. The person who has the marking out of the wood work should have a place for small pieces, so that, when required, they can be easily procured without waste of time. Small savings help to make large profits. In the smith department, a great saving can be made, as in coal: using care, in cleaning off the forge, to select all the good coal from the cinders. In separating the scraps of iron, keep each class of iron scrap by itself. The care of loose screws, bolts, nuts, rivets, washers, etc., (which, in a factory running a half dozen fires, would, in the course of a year, make a very startling amount) greatly adds to the profits.

We come now to the paint shop, where the materials are very expensive and deteriorate very fast. In this department it is to be found the greatest waste; the employee seems to give no thought that every ounce of paint wasted is so much money out of his employer's pocket. How often is the most expensive paint thrown away? A spoke, or we may say a wheel, has been repaired and painted over, and is to be striped with a carmine stripe; color is mixed up, which, in quantity, is sufficient to stripe a dozen wheels; when the wheel is striped, the color is laid on the shelf or bench, where it soon becomes dry and unfit for use, and it finds its place in the slush tub. Did you ever take a thought as to how many dollars that slush tub costs you? It is a mixture of all kinds of paints, from the expensive carmine to the cheapest venetian red; also, there is varnish of every grade, japan, oil, turpentine, and time. Can you form an estimate of its cost? I tell you not; if you could, it would startle you; you would not believe that hundreds of dollars are wasted yearly in this tub. We now stop and look at the trimming shop, for there is waste here as well as in the other departments. We see cloth piled up on the shelves, varying in price, and leather of all kinds necessary. You may say there is no waste here; look under the bench; we see pieces of top and dash leather thrown together, pieces of cloth thrown in any place except the bench. These pieces can often be used up to advantage. P. Aste, in his articles on buggy tops, tells us where to put our pieces of enameled leather; other pieces can be used for curtain straps; and of what cannot be used in the shop, part can find a ready sale to the manufacturers of infants' and children's shoes, and the other can be used by the manufacturers of Prussian blue.

These facts are worthy of the thoughts of the manufacturer, and the foreman of each department. Look well to the small pieces, for they are like the small opening in the hour glass; but a grain of sand passes at a time, yet it is but a short time ere the last grain has passed through. We may not notice the small drippings from a barrel; yet if allowed to drip, it will soon be empty. It is not what we waste to-day, but what we waste every day that absorbs our vitals.

John H. Plank, Bloomfield, Iowa.—This invention consists in combining a lever with the socket plates which receive the feet of the sewing machine legs. Said lever is pivoted and otherwise so arranged that, by a movement thereof, the casters of one end of the socket may be lifted off the floor and the support of the machine transferred to the legs, to hold the machine firmly against shifting about while being used.

Business and Personal.

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

Dry steam dries green lumber in 2 days, and is the only Cheap House Furnace. H. G. Balkley, Cleveland, O.

Agricultural Implements, Farm Machinery, Seeds, Fertilizers, R. H. Allen & Co., 189 & 191 Water St., N.Y.

Magic Lanterns, Stereopticons of all sizes and prices, for Parlor Entertainment and Public Exhibitions. Pays well on small investment. Catalogues free. McAllister, Man'g. Optician, 49 Nassau St., N.Y.

Wanted, two sets Flour Mill Machinery, second hand; 300 Cotton Spindles; Shingle Mill. Isaac E. Sharp, Evening Shade, Ark.

Wanted—Parties to manufacture a first class Sectional Safety Boiler. Terms liberal. Profits large. Address S. T. Russell, Springfield, Ohio.

Wanted—A party with large capital to manufacture patent articles in great demand. Address N. Hotz, 150 Calver St., Brooklyn, E. D., N.Y.

Piano and Organ Wire Work of all kinds, Valve and Key Pins, Iron and Brass Finishing Nails, &c. &c. The Hendey Machine Co., Wolcottville, Conn.

Model Engine Wanted—Address "Engine," Worcester, Mass.

Agents Wanted—See Illustration, page 330, December 19, 1874, of this paper; or address G. E. Coppen, P. O. Box 686, Evansville, Ind.

Manufacturers and Dealers in Cotton Mill Machinery will please send Address to R. O. Kupee, Bank of Clarksville, Clarksville, Tennessee.

Wanted—Men of Capital to build a Manufacturing Town. Address John A. Hall, Jonesboro' Jefferson Co., Ala., A. & C. R. R.

This is an advertising age. Every man who is up to the times takes care that the world knows it. A trade candle is not hidden under a bushel, but placed upon a hill. Business is found to increase in direct ratio with the amount of money judiciously expended in letting the public know where you are and what you have got to sell. The great difficulty is to know when, where, and how to do it. This led to the establishment of advertising agencies, of which the most extensive and reliable is that of Geo. P. Rowell & Co., of New York, which has met with a success unparalleled in the history of similar undertakings. They are the largest customers the newspapers of the United States have, and have so managed to simplify and arrange the advertising system as to secure the greatest amount of publicity, for the lowest amount of money. More than five thousand American periodicals are received regularly, and kept on file at their office, which is located in the New York Times' building, 41 Park Row, and we are informed that their corps of assistants outnumber the combined force of any four similar establishments now in existence. Visitors to New York will find their office a capital place to find news from home, for it must be a secluded spot which is not represented by a paper on their extensive files, which are always open to free inspection. (Davenport [Iowa] Democrat.)

Wanted—A middle aged Baptist Lady, competent to instruct five small children; and, when not thus engaged, to assist in household duties. Address, with recommendations, R. A. Douglas, Bennettsville, S. C.

A New Thing!—I will furnish any Machine, and Driving Power, or a complete set of Machinery for any kind of Mill or Factory, at the Manufacturer's lowest prices; set it up, if wanted. Send on your order. Address P. H. Walt, Sandy Hill, N.Y. Parties wishing me to represent them will forward circulars, &c.

Wanted—Machine for testing tensile Strength of Bar Iron. William Morehouse, Buffalo, N.Y.

Send to Atlas Works, Indianapolis, Ind., for a Photograph of their 20 inch Engine Lathe.

For Sale—2 H. P. Baxter. Little used. \$300. Also Boat Engines. W. J. Sanderson, Syracuse, N.Y.

Wash Stands, New Styles, Marble Tops, can be used in any situation. Prices very low. Send for a catalogue. Bailey, Farrell & Co., Pittsburgh, Pa.

Mould Maker Wanted—Competent to act as foreman in a Glass Works Mould Shop. Also, a good Vice Hand. Address P. O. Box 1155, Pittsburgh, Pa.

Wanted—To Manufacture a few Specialties of Light Metallic Goods—Sheet Metals preferred. Address R. Woodman, 30 Sudbury St., Boston, Mass.

Patent for Sale—On a Small Household Article. Address B. W. Story, Smithville, Burlington Co., N.J.

File-cutting Machines. C. Vogel, Fort Lee, N.J.

Grindstones—4,000 tons. Berea Stone Co., Berea, O.

Diamond Carbon, of all sizes and shapes, for drilling rock, sawing stone, and turning emery wheels, also Glaziers' Diamonds. J. Dickinson, 64 Nassau St., N.Y.

Send for Circular of a very Superior Boiler Feed Pump. D. Frisbie & Co., New Haven, Conn.

The Whitmore Engine, 4, 5 and 10 H. P. Vertical Tubular Boilers, all sizes—at reduced prices. Lovegrove & Co., Philadelphia, Pa.

Every Metal Worker should have a Universal Hand Planer. Address J. E. Sutterlin, 60 Duane St., New York.

Petroleum Gas Works—J. D. Patton, Trevorton, Northumberland County, Pa. References: Sunbury (Pa.) Gas Light Co.; Mahanoy City (Pa.) Gas Light Co.; Ashland (Pa.) Gas Light Co.; Philadelphia & Reading R.R. Co.; Reading, Pa.; Bloomsburg (Pa.) Gas Light Co.; Shamokin (Pa.) Gas Light Co.; Shenandoah (Pa.) Gas Light Co.; Col. W. B. Murphy, Trenton, N.J.

Engines, 2 to 8 H. P. N. Twiss, New Haven, Ct.

Baltimore Steel Hoe Works, Manufacturers of the "Lockwood Hoe." Send for Sample and Price List.

Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven, Conn.

For small size 8 screw Cutting Engine Lathes and Drill Lathes, address Star Tool Co., Providence, R. I.

Inventors of Electrical and Telegraphic arrangements are invited to communicate with the Electro-Magnetic Mfg. Co., 36 Broad St., P. O. Box 1894, New York.

Genuine Concord Axes—Brown, Fisherville, N.H.

Spinning Rings of a Superior Quality—Whittinsville Spinning Ring Co., Whittinsville, Mass. Send for sample and price list.

Faught's Patent Round Braided Belting—The Best thing out—Manufactured only by C. W. Army, 301 & 303 Cherry St., Philadelphia, Pa. Send for Circular.

Temples and Officines. Draper, Hopedale, Mass.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Mechanical Expert in Patent Cases. T. D. Stetson, 139 Broadway, New York.

All Fruit-can Tools, Ferracute, Bridgeton, N. J.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 479 Grand Street New York.

Fairy Electric Engines, with battery complete, \$4; without battery, \$1. Electro-Magnetic Manufacturing Co., 36 Broad St., P. O. Box 1894, New York.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price \$4, with good battery. F. C. Beach & Co., 383 Broadway, New York, Makers. Send for free illustrated Catalogue.

For best Processes, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

Duy Boul's Paneling, Moulding, and Dove-tailing Machine. Send for circular and sample of work. B. C. Mach'y Co., Battle Creek, Mich., Box 227.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

For Sale—One "Cottrell & Babcock" Water Wheel Regulator, in good order—by D. Arthur Brown & Co., Fisherville, N. H.

For Surface Planers, small size, and for Box Corner Grooving Machines, send to A. Davis, Lowell, Mass.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

Price only \$3.50.—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., 383 Broadway, New York.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, &c.

Notes & Queries

L. D. will find a recipe for polishing furniture on p. 11, vol. 31.—C. T. R. will find directions for coating iron with black enamel on p. 208, vol. 26.—W. H. and O. R. should consult a physician.—D. can utilize the tin on tinned plate scrap by the process described on p. 319, vol. 31.—A. M. C. can temper gun springs by the method detailed on p. 10, vol. 25.—C. P. McE. will find a recipe for japanning on tin on p. 75, vol. 32.—W. D. G. will find a recipe for bronze on iron on p. 283, vol. 31.—C. H. S. can whiten ivory by the process detailed on p. 10, vol. 32. The theory of power by the crank is explained on p. 112, vol. 31.—W. S. will find an explanation of two lines approaching each other and never meeting on p. 138, vol. 31.—H. W. M. can make composition molds by following the directions on p. 58, vol. 24. Cement for cracks in cast iron is described on p. 409, vol. 31.—B. will find a description of the manufacture of sulphurous acid on p. 111, vol. 29.—B. McD. will find a recipe for indelible ink on p. 129, vol. 28.—F. J. H. will find directions for stuffing animals on p. 350, vol. 30.—W. H. will find directions for silvering glass by Draper's process on p. 267, vol. 31.—C. A. G. will find an explanation of sailing faster than the wind on p. 132, vol. 29.—J. C. C. will find directions for putting a black finish on gun work on p. 208, vol. 28.—C. E. D. G. will find a description of a gaslight machine on p. 379, vol. 30.—W. N. H. will find a recipe for a cement for rubber on p. 235, vol. 30.—W. H. S. will find a formula for a red indelible ink on p. 129, vol. 28, and for a black, on p. 112, vol. 27.—Q. R. N. will find directions for etching on glass on p. 409, vol. 31.—J. H. will find directions for bronzing cast iron on p. 283, vol. 41.

(1) O. S. asks: Will sawdust, placed under a printing press or other machinery, absorb the waste oil, produce combustion? A. There will be some danger of such a result; but the occurrence is not very frequent, and can be prevented by ordinary care.

(2) J. W. W. asks: Does the hydraulic or water ram waste more water with a fall of three or four feet than it will elevate to a height of 12 feet? A. Generally, yes.

1. Can the blaze from a kerosene, alcohol, or common oil lamp exist in a receiver of compressed air of 30 lbs. per square inch, the air escaping and fresh air being supplied all the time? A. Yes. 2. How much will air expand by heating? A. About $\frac{1}{3}$ of its volume at 32° Fah. for each degree Fah. that its temperature is increased.

(3) C. asks: 1. Which is the right name for the coal that is called sometimes candle coal and sometimes canal coal? A. The coal was originally called candle coal, and canal coal and canal coal are corruptions of this name. The term canal has obtained such general currency that it would be thought singular to speak of candle coal, and yet that this is the proper name is evident from the fact that it was first so called because the coal burnt with a clear, long, yellow flame, like a candle. It is a very compact coal, with an even texture and a smooth, clean, and nearly dull surface and conchoidal fracture. The dull luster gives it the aspect often of being impure, when not so. The proportion of bitumen is large, as may be seen from the following analyses: The canal coal of Boghead, Scotland, has 66 per cent bituminous matters, 31 per cent fixed carbon, and 3 per cent ash. That of Breckenridge, Ky., has from 56 to 72 per cent bituminous matters, 28 to 44 per cent fixed carbon, and 7 to 12 per cent ash. Ultimate analyses, to determine the proportion of the elements, the ashes excluded, have given, for the Boghead canal coal, carbon 80.49 per cent, hydrogen 11.24 per cent, oxygen 6.73 per cent, nitrogen 0.87 per cent; for the Breckenridge, carbon 82.36, hydrogen 7.81, oxygen 7.65, and nitrogen 2.75 per cent.

(4) R. H. H. asks: I am building a jig saw to run by foot power. Can I use a cylinder with a piston and piston head above the saw to lift it, using air for a spring in the cylinder? I want to run the saw at 600 1/2 inch strokes per minute. A. You can run it in the way you propose. It is doubtful whether you will be able to attain that speed by force applied to a treadle. We shall be glad to hear from you again when you have completed the machine.

(5) E. M. asks: 1. How many pounds of steam will it take to make one horse power? A. It

varies from 15 to 200, according to the kind of engine. 2. Would thick glass be strong enough to make a small steam cylinder, to see how it operates? A. Yes.

(6) B. H. R. asks: Is there any difficulty in putting a circular one horse power upon the ground, and running into a second story to turn a printing press? A. Ordinarily, no.

(7) W. F. S. says: I use steam heating and water pipes. My boiler has not been running or had a fire under it for some two or three weeks, and the shop has had no fire in it for several days of severe cold weather. The water in the pipes was frozen, but did not burst a pipe or start a leak anywhere until I had steam around the shop long enough to materially affect the temperature. Why should the pipes not burst till the room became warm? I supposed that I square inch of water, if it were frozen, would require considerably more room. Is this so? A. This is a very common occurrence. There is often air in the pipe, that allows the water to expand in freezing. When heat is applied, however, some of the ice melts, and the water, expanding rapidly as its temperature is raised, encounters resistance from the ice, and so bursts the pipe. More frequently, however, the pipes do burst during the cold weather, and are held together, or prevented from leaking, by the ice that is formed. When the latter melts, however, the leaks are at once disclosed.

(8) J. H. W. asks: 1. What is your opinion in regard to blast pipes under boiler furnaces? Do they materially affect the burning out of the boilers? A. No. 2. Would their use result in a saving of fuel? A. Generally, no; except that, by the use of the blast, an inferior quality of coal can often be employed.

(9) W. H. asks: How can I remove dirt and grease from my hands without injuring the flesh? A. Oil answers in many cases, supplemented by a vigorous application of soap and water, and, in some cases, sand or corn meal; but there are doubtless peculiarities of flesh that render it impossible to give a method which is generally applicable. We do not doubt, however, that we have many readers who can furnish valuable information on this subject, and we hope to hear from them.

(10) J. W. F. says: I am thinking of building a boat 63 feet long with 15 feet beam, to draw from 5 feet light to 6 1/2 feet loaded. I was thinking of putting in an engine 18 inches diameter by 15 inches stroke, with a screw of 66 inches diameter and 11 feet pitch. Boiler (locomotive) is to be 4 feet 6 inches diameter, with a fire box 4 feet 4 inches by 3 feet 10 inches, with 55 tubes, 3 inches diameter and 10 feet long, using steam at 80 lbs. The boat's lines are pretty fine. What speed will this engine drive her? A. If the boiler steams well, the boat should go from 15 to 16 miles an hour. For a speed of 10 or 12 miles an hour, use an engine 12x12.

(11) T. D. says: I have a steam pump with a hole cut in the piston rod a quarter of an inch deep; the hole was cut in by the catarract. The rod is of brass. When that hole passes through the stuffing box, the steam comes out. Can you tell me what I can fill the hole up with? A. Screw in a plug, and finish off the surface.

(12) F. H. D. asks: 1. Why is it that small drive wheels are used for climbing steep grades or drawing heavy loads, and what advantage has a small wheel over a large one? A. With a small wheel the tractive force is greater, for the same pressure on the piston; but the locomotive does not move as fast for same piston speed as the one with larger driving wheels. 2. Is a wheel more liable to slip when the crank goes under the axle than when it goes over the axle. A. No.

(13) W. H. S. asks: In your reply to W. B. C. you say "the silver being extracted from the pig lead and not from the ore." By what process is this accomplished without burning the lead, as some do, since both have very nearly the same specific gravity? A. This method essentially consists in a concentration process, based upon the phenomenon that, when a certain quantity of lead that contains silver is melted in iron cauldrons, and the fluid is allowed to cool uniformly, there ensues a formation of small octahedral crystals, which are a great deal poorer in silver than the metal originally taken; while the portion of the metal remaining fluid is found to contain an increased quantity of silver. It is clear, therefore, that, if the crystals first obtained are again melted and cooled uniformly, another concentration will be obtained, and that the operation can be repeated until a lead is obtained rich enough in silver to admit of undergoing a refining process. In all cases, however, the quantity of lead operated upon is always large, generally 200 cwts., to cause the cooling to proceed slowly. 2. Is the method as practised at Swansea in Wales a secret, or is it adopted in this country? A. We are not familiar with the process you speak of.

(14) G. W. B. says: In our coal stoves, there is a hard substance adhering to the fire-brick, apparently the result of impurities in the coals. What is this substance, and can it be removed by any better method than by the use of the cold chisel? A. No doubt you are right as to its being composed of impurities. By cleaning it out at short intervals, so that the quantity will not be great at a time, it can readily be removed.

(15) L. E. F. asks: What colors take best in photography? A. Blue takes very light, in some cases appearing as if, in the original object, the blue portions were really white. Yellows, reds, orange, and various shades of green take dark.

What is the best position to lie in during sleep? A. Physicians frequently recommend the left side, as the position in which the organs of the body are least liable to cause discomfort by pressure upon one another.

(16) M. T. says: The natural oil in rosewood or satinwood often renders it difficult to

unite them with glue. Cannot a strong acid or alkali, being first applied to the wood or united with the glue, be made to destroy the effect of the oil and cause the wood to unite more readily? A. Try the action of a warm solution of potash, applied for a short time and carefully wiped off.

The water in my well has a singular effect on tea, causing it to turn to a wine red color shortly after steeping. It first turns in streaks or clouds of red; and before the meal is finished the beverage "giveth its color in the cup" and causes a lack of relish for it. Our pump has a cucumber wood pipe. Can you gratify our curiosity by an explanation? A. We cannot give you any satisfactory answer without having first made an examination of the water. Send us a quantity of your water and a sample of the tea, and we will endeavor to solve the problem for you.

(17) E. L. asks: What do licenses for steamboats and their engineers cost, and how long do they last? A. The license for the boat costs \$25, license for engineer \$5; they are renewable once a year.

(18) M. T. K. asks: How can I make petroleum and gas tar unite? A. Try dissolving the tar in the petroleum with the aid of benzole and moderate heating.

(19) H. A. S. asks: 1. At what speed should a 3/4 inch band saw on 16 inch pulleys run, using two horse power? A. It is quite common to run such saws at a speed of 5,000 feet a minute. 2. Would it be safe to run this saw on such small pulleys? A. Your pulleys are too small.

(20) A. R. asks: Is mica, as used for stove lights, found in its natural state in sheets? A. Mica is found in large crystals, made up of a great number of fine sheets. The stove mica is made by simply dividing the crystals so as to obtain the sheets of the required thickness.

(21) W. J. C. asks: 1. Will a properly constructed thermometer inserted in the steam dome of a boiler indicate whether the steam is dry? The vapor evolved from a fluid being always of the temperature of the fluid itself, so long as it remains in contact with it, I am led to doubt whether a thermometer would show any difference between steam dry and steam containing particles of water in mechanical suspension. A. The thermometer would not show any difference unless the steam were superheated. 2. If the dryness of steam cannot be thus indicated, how can it be determined? A. For a method of determining the amount of water in the steam, see p. 257, vol. 31.

(22) J. P. E. asks: 1. Can a silver plate be set in a man's skull where there is a hole broken in it? A. Yes. 2. Can a silver bridge be put in a man's broken nose? A. Yes.

(23) A. M. asks: 1. Where is ice formed, at bottom or on top of water? A. On top. 2. Will ice under any natural circumstances sink to bottom, in water? A. No.

(24) J. E. H. says: We have a double steam pump of the following dimensions: 7 inch plunger, 12 inch stroke, and 12 inch steam cylinders. It is used to pump water through a 4 inch pipe into a reservoir about 50 feet above the level of the pump. If a stopcock were put in the pipe near the reservoir, and near the stopcock a fire plug, would the pump force water through 1,000 feet of hose with sufficient force and to a sufficient height to extinguish fires, part of our town being 100 feet above the level of the pump? A. It would probably be necessary to increase the steam pressure.

(25) C. C. W. says: 1. I understand that there is a train run from London to Liverpool, the card time of which is an average of 47 miles per hour, including stops. Is this practicable? A. It may be practicable, but we do not think that it is done. 2. I understand that an English locomotive has made the extraordinary time of 82 miles per hour, drawing 5 coaches. Is that possible? A. There is such a report, but it is not well authenticated. 3. What is the best hour's run ever made by a locomotive? A. The best of which we have knowledge was about 63 miles an hour.

(26) W. McB. asks: 1. How many cubic feet of hydrogen gas (manufactured from zinc and acid or vitriol) are required to raise a weight of 1 lb. to a height of 10 feet? A. You must first state whether you wish to know the ascensional force of a bulk of hydrogen, sufficient to raise the weight mentioned, or the mechanical force equivalent to the heat given out in burning a certain number of cubic feet. 2. What are the proportions of zinc and acid to make gas with, and what is the best way of generating the gas? A. The zinc is used in any quantity that is convenient, and a mixture of oil of vitriol 4 parts, water 4 parts, poured upon it, in a suitable bottle provided with a cork and an exit tube.

(27) J. H. P. asks: I have air slaked lime and pure carbolic acid. How can I impregnate the lime with the acid so as to make an effective insect-repelling mixture for garden vegetables? A. This compound may be obtained by digesting your lime in the acid. It is a very unstable salt, easily decomposed.

(28) N. Y. asks: 1. Can the nerve of a tooth be killed? A. Yes. 2. How long will the tooth last after the nerve is destroyed? A. If the tooth is properly filled after the operation, it will last, in most cases, a very long time.

(29) J. McL. asks: What acid will eat zinc the quickest and bite the sharpest? A. Sulphuric acid, diluted with from 3 to 5 parts of water.

(30) L. K. D. asks: Is there anything that will make plaster harder than it is when dry after being mixed with water? A. Use a strong solution of alum instead of pure water.

(31) H. B. P. asks: How can I plate with gold, silver, and nickel upon steel and nickel silver without first using a coppering solution? A. Iron and steel must first be electroplated with copper

(32) C. W. asks: Will you please tell me how to detect impurities and adulterations in linseed oil? A. The purity of the fixed oils may be determined approximately, and the admixture of cheaper oils detected, (1) by observing the peculiar color of the oil when gently heated by a spirit lamp in a small porcelain or platinum capsule. The color evolved will resemble that of the plant or animal from which it is obtained. In this way linseed oil, whale oil, train oil, or rape oil may be detected even when used to adulterate another oil.

(2) By mixing concentrated sulphuric acid with oil (1 or 2 parts acid to 100 oil) the temperature rises and the mixture becomes colored. If a plate of white glass be placed on a sheet of white paper, and 10 or 15 drops of oil be placed on the glass and a small drop of acid be added, a color will be produced which varies with the oil employed. With rape oil a greenish blue ring forms at a certain distance from the acid, while towards the center light yellow brown streaks may be observed. Olive oil instantly becomes pale yellow, and afterwards yellowish green. In linseed oil, a beautiful dark brownish red web is formed, gradually changing into brownish black. Tallow oil or oleic acid becomes brown. It seldom occurs that a better oil is used to adulterate an inferior one. Oil of almonds, olive, and codfish oil will, therefore, never be used to adulterate rape oil, but probably train, or perhaps linseed, and sometimes poppy oil. If we are led, therefore, by the odor to infer an adulteration, for instance, for train oil, which occurs most frequently, it is only necessary to place from 10 to 15 drops of rape oil, the purity of which is undoubted, together with as much train oil, and an equal quantity of the oil whose purity is suspected, and add to each of them a drop of sulphuric acid. From the color produced an inference may be formed of the purity of the oil; and by the different tinges of color the extent of adulteration may be detected. (3) By the oleometer, indicating the specific gravity of oil in such a way that pure rape seed oil is indicated by 37° to 38°, hemp oil from 30° to 31°. There are various other tests; that by the capillary meter indicates the quantity of the oil which falls from a certain sized point under given circumstances, etc.

(33) G. M. R. says: A daily journal gives the following test to be applied to quartz, to determine its auriferous character: "After being well ground and calcined, it should be treated with a bath of iodine or bromine water, and allowed to digest in it for some time. Then a piece of filter paper should be soaked in the solution, dried, and burned to ashes in a muffle. If gold is present, the ash is purple. One pennyweight of gold to the ton may thus be detected." Please give me details of the preparation of the iodine or bromine water. A. The solution of iodine or bromine is readily obtained by placing a small quantity of either iodine or bromine in a bottle with a quantity of pure water, and shaking. The color of solution, if bromine has been used, will be orange yellow. The bromine is more soluble in water than the iodine, which is very slightly soluble. Both the solutions dissolve gold, to form either iodide or bromide of gold. These are readily decomposed upon application of heat, and give the characteristic color mentioned in the test.

(34) T. H. W. asks: 1. How can I keep my zinc in a lead and zinc battery from getting covered with a black substance? A. You cannot help its turning black, except by covering it with mercury. 2. Does the substance have any effect on the strength of the battery? A. No.

(35) G. S. P. asks: How can I arrange a magneto-electric machine that is used in medical purposes so as to have a negative and a positive pole? A. One pole is negative and the other positive. You cannot have a current with both poles positive.

(36) J. E. G. asks: What size of copper wire will do to convey the same amount of electricity as the common telegraph wire? A. Copper is six times as good a conductor as iron, and therefore a copper wire one sixth as large would conduct as much electricity as the iron wire now used.

(37) W. C. C. asks: How can I construct a safe and cheap kerosene lamp for blowpipe soldering purposes? A. For this purpose a small lamp of glass is best. The top should be composed of a small brass disk (about 3/4 inch in diameter) through which the wick tube passes. The disk should be supported by a metal frame, into which it fits loosely, in such a manner that, while in its normal position, it prevents the air from entering the lamp; it also acts as a safety valve, making it impossible for an explosion of any kind to occur. The lamp should be furnished with a brass cup which screws over the top, thus rendering it portable, prevents the spilling of the liquid in case the lamp is overturned, and also deters evaporation when not in use. This, we believe, is the simplest and best form of lamp for this purpose.

(38) F. asks: Does it make any difference, in an induction coil, which way the wires of the coarse helix run, in respect to the fine helix? Should the two helices be wound in the same direction, or in different directions? A. It makes no difference, which way you wind them.

(39) W. T. B. asks: How can I dissolve sulphur in water, so as to make a strong permanent solution? A. Free sulphur is insoluble in water under any condition. Many of its compounds, however, are soluble, some extremely so. The affinity existing between sulphuric acid (which is a compound of sulphur with oxygen) and water is so great that, by its absorption of the aqueous vapor from the air, when freely exposed, it soon doubles its own volume. The ordinary "sulphur water," as obtained from what are known as sulphur springs, is simply a solution in water of gaseous sulphuretted hydrogen, which, as its name denotes, is a compound of sulphur with hydrogen. This gas may be artificially obtained, cheaply and in large quantities, by the action of dilute oil of vitriol on sulphide of iron. A solution of the gas is easily obtained by passing it through water.

(40) C. A. M. asks: How should the electromagnet of a small telegraph be constructed? A. Wind copper wire, insulated with silk, around a core of soft iron.

(41) F. H. M. asks: 1. Is there any way in which silver can be applied to plastered molding other than as leaf? A. We do not know of any other method. 2. What is the best mixture for lacquering silver to make it like gold? A. Amber 8 ozs., gum lac 2 ozs., drying linseed oil 8 ozs., essence of turpentine 16 ozs. Dissolve separately the gum lac, and then add the amber, prepared and pulverized, with the linseed oil and essence, very warm. When the whole has lost a part of its heat, mix in relative proportions tincture of annatto, of terra merita, gum guttae, and dragon's blood. This varnish, when applied to white metals, gives them a beautiful gold color. 3. Can bronze be burnished? A. No. 4. Can leaf be applied on a French polished surface? A. No. 5. Which plaster is best for moldings? A. What kind of moldings?

(42) H. E. N. says: I have a galvanic belt, warranted to cure neuralgia, etc., and I want to find out what the actual electric or galvanic intensity is, if it has any. How can I arrive at it? A. Attach its two poles to a tangent galvanometer and note the deflection. Then connect the cell of a Daniell battery to the same galvanometer. The deflection of the galvanic belt will be to the deflection of a Daniell cell as its intensity is to that of a Daniell cell.

(43) W. E. P. asks: 1. What are the properties of crude petroleum? A. The name petroleum (rock oil) is applied to certain bituminous fluids found in the earth. Solid bitumen or asphalt differs but little in chemical composition from petroleum, both being compounds of hydrogen and carbon. Many varieties of petroleum, and perhaps all, become thick by exposure to the air, and finally solid, resembling asphaltum. The fluid petroleum has been collected in Burmah for at least fifteen centuries. It is used by the inhabitants for light and fuel. In this country petroleum is not, as many suppose, a new discovery. Years ago springs of it were known in many localities, but its use was very limited. No method for purifying it was known, so that it was looked upon as valueless, and several wells bored for salt water were abandoned on account of the oil rendering the water impure. In 1861 it was purified, and introduced extensively as an illuminating oil, to take the place of burning fluids (camphine and alcohol), the price of which was greatly enhanced, and which, by the explosive qualities of their vapors, were causing many severe accidents. The trade increased, new wells were bored; and some of them yielded several hundred barrels per day, making possessors at once wealthy. Petroleum was probably formed by a slow decomposition of organic substances under the earth's surface. Some geologists suppose petroleum to be due to the subterranean distillation of remains of sea plants and marine animals, and that the petroleum is forced upwards by water, always present in the bored wells. It is found in cavities and in crevices, and through the substance of the rock. Petroleum is much lighter than water, of a green or black color, with a peculiar and, to most persons, unpleasant odor. It is commercially divided into two kinds, the heavy or lubricating oil, and the light oil; the former is more dense, and sometimes of the consistency of thin molasses. It is used, without preparation, for lubricating machinery, for which it is admirably suited. The light oil, before it can be used, is submitted to several purifying processes, the most important of which is distillation. 2. What is the simplest method of ascertaining the degree of fire test of refined petroleum? A. Burning oil is sometimes adulterated with benzine or heavy oil. To detect the former, pour a few ounces into a small tin cup, and put it on a stove or over a lamp, placing the bulb of a thermometer in the oil. Then as the temperature rises, try with a lighted taper when the oil gives off inflammable vapor; if this be below 100° or 110° Fahr., the oil is dangerous to use, as its vapor, becoming mixed with air in the lamp, may take fire and explode. The adulteration with heavy oil is shown by the dimness of the flame after having burned for some time, accompanied by the charring of the wick. 3. Can kerosene oil be adulterated? How are the adulterations to be detected? A. Yes; it is largely adulterated with the lighter oils, such as benzine, etc., which may be readily detected by the process as described above.

(44) R. R. B. asks: 1. What are the cheapest and best ingredients for making paste in large quantities, for paperhangers' and paper bag manufacturers' use? I want a paste free from lumps and as adhesive as possible; how should the ingredients be mixed, what quantity of each should be used in each barrel, and what should be its consistency before and after cooking? A. The following has been highly recommended; for besides possessing the merit of cheapness, it has the advantage of preventing the paper from separating or peeling off. It may be prepared by first softening 15 lbs. of finely powdered bole in water, and then draining off the surplus water from the mass. One and a quarter pounds of glue are next to be boiled into glue water; and the bole and two pounds of gypsum are then stirred in, and the whole mass forced through a sieve by means of a brush. This is afterward diluted with water to the condition of a thin paste or dressing, when it is ready for use. This paste is not only much cheaper than ordinary flour paste, but it has the advantage of adhering better to whitewashed surfaces, especially to walls that have been coated over several times, and from which the coating has not been carefully removed. In some cases, it is advisable, when putting fine paper on old walls, to coat them by means of this paste with a ground paper, and to apply the paperhanging itself to this with ordinary paste.

(45) A. B. H. asks: 1. Is hot air lighter than cold? A. Yes. 2. Are noxious gases lighter, or heavier than pure air? A. Some are lighter, some

are heavier than air. For the most part, however, they are heavier.

1. Does coal slack by exposure to air in a damp place, and does slackening injure it? A. By exposure to the air and damp, the coal loses some of its valuable ingredients, and is injured. 2. Does freezing coal injure it? A. It is also somewhat disintegrated and injured by freezing weather.

(46) G. B. says: I have been trying to electrolyze according to the directions given to C. A. C. in your issue of February 6, but my deposit is so brittle that I can hardly get it off the wax whole, and there are minute holes in the work. What is the trouble? A. Too much battery.

(47) W. A. B. asks: Does the zinc rod in the Leclanché battery require to be amalgamated? A. No.

(48) A. W. M. says: In Baker's work on the steam engine, p. 35, I find the following formula for the graduation of the lever of the safety valve:

$$D = \frac{\pi r^2 P' - \frac{1}{2} L w}{W} \quad \pi r^2 = \text{area of valve, } L = \text{distance of}$$

the center of valve to fulcrum, P' = the pressure of steam on boiler, L = length of lever, w = weight of lever, W = weight of ball. I have just put in a set of new boilers. The area of the valve is 5.41189 inches, $L = 3.125$, $P' = 80$ lbs., length of lever 20 inches, weight of lever 8 1/2 lbs., and weight of ball 83 lbs. $D = \frac{\pi r^2 P' - \frac{1}{2} L w}{W} = \frac{5.41189 \times 80 - 80 \times 3.125 \times 8.5}{83}$

$= 14 \frac{1}{10}$. $D = 14 \frac{1}{10}$ inches from fulcrum to place where the weight should be placed on lever to carry 80 lbs. steam. But when we fired up, we were surprised to find that, instead of placing the weight at 14 1/10 inches from the fulcrum, we had to place it 19 inches; we therefore conclude that the formula is incorrect. Can you explain this? A. The formula is approximately correct, and answers pretty well for ordinary cases. We think it likely that you have made a mistake in estimating the area of the valve, or that your steam gage is incorrect. You will find an experimental method described on p. 273, vol. 31.

(49) W. L. L. says: I wish to make a telescope with a 15 inch objective, hollow, to be filled with liquid. What is the best filling? A. Only two kinds of objectives repay the labor bestowed on making them, the achromatic objective and the silvered glass reflector, mounted either according to Newton's or to Cassegrain's form.

(50) W. H. S. asks: What is the proportion between the object and diagonal reflectors in the Newtonian telescope, the focus being six times the diameter? A. Minor axis of elliptical plane mirror is one fifth the aperture of the speculum. The focus should be nearly twelve times the aperture.

(51) R. W. K. says: You state that a generally useful application of paraffin is for the lining of casks and wooden vessels, to prevent absorption of their contents by the wood, or their escape through the pores. The diminishing evaporation being of great importance to the vineyard districts of Virginia, I applied at some of the largest establishments in Philadelphia, and found that such an application of paraffin was an entire novelty to them. Would it not be expensive? A. It is successfully used in coating smaller vessels; its application to larger is a matter only of expense and proper appliances.

(52) J. F. D. asks: What is the best method of bleaching rosin? A. We do not know of any such process.

(53) E. F. asks: Can any simple ingredient be used to throw down the foreign matter in very hard water? A. This may be accomplished either by boiling the water before using, or by the addition of the proper quantity of lime water, which will precipitate or carry down with it the excess of carbonate of lime.

(54) U. H. asks: 1. Can I gold plate steel pens with the Tom Thumb battery? A. Yes. 2. Must I plate the pens with copper first? A. It is not necessary.

How can I mend rubber hose? A. See p. 203, vol. 30.

What is the freezing point of mercury? A. Mercury solidifies at -39° Fahr., and is then soft and malleable; but if reduced to a much lower temperature, it becomes brittle. It boils at about 662° Fahr., and slowly volatilizes at all temperatures above 40°.

(55) W. L. B. says: Rain water 6 ozs., carmine 24 grains, aqua ammonia 240 drops, and gum arabic water 30 drops make red ink which has an offensive smell. What will remove the smell of the ammonia without spoiling the ink? A. Use a smaller proportion of ammonia.

You give a recipe for white gunpowder. Are the parts by weight? A. Yes.

(56) W. C. R. asks: I. If I take a glass tube, say 6 inches long and 1/4 inch in diameter, and fill it about half full of the heads of the old sulphur (blue headed) matches, with half an inch of stick to each head, and then seal the two ends of the tube over a blowpipe without igniting the matches, after which I heat the body of the tube hot enough to consume the wood: What gases will I have in the tube? A. The gases will be vapor of sulphur, a small amount of sulphurous acid, water, and pyroligneous acid arising from the destructive distillation of the wood. 2. Will they be of disagreeable odor, or injurious when inhaled? A. They will be both disagreeable and injurious.

(57) M. J. S. says: We have a well forty feet deep, consisting of a three inch pipe driven into the earth, through which the water is drawn. The soil at the bottom of the well is a white sand, and the water drawn therefrom is clear as crystal; but on being heated it becomes red, and precipitates a red sediment, which retains its color when dry. Why is this? A. The water contains iron in solution, existing probably as bicarbonate of iron.

Upon boiling, the carbonic acid is driven off and the iron precipitated as red oxide, which remains as an insoluble body.

(58) J. G. asks: What impurities does sheet zinc contain, and how may they be removed so as to leave it comparatively pure? A. Commercial zinc is always more or less contaminated with arsenic, cadmium, lead, iron, and carbon. The black residue remaining when zinc is dissolved in acid (often mistaken for a carburet of zinc) is a mixture in various proportions of iron, lead, and carbon. The more impure the zinc, the more readily it is dissolved in acids; but by careful distillation zinc may be almost entirely freed from any foreign metals.

In a Leclanché cell (1 quart), how often do the contents of the porous cup and of the outer jar require changing? A. This depends altogether upon the use that is made of it, or in other words, the number of times daily or monthly it is brought into requisition. The outer solution simply needs to be kept saturated with sal ammoniac, and water to replenish that lost by evaporation. This battery cannot be used on closed circuit, because of its rapid polarization.

(59) L. W. R. asks: 1. What is the difference in the combination of a portrait and a landscape lens for photography? A. The portrait lens is constructed to work rapidly; the front pair consists of a crown double convex and flint plano-concave, the back pair a flint negative meniscus and crown double convex, of longer focus than the front pair. The view tube is a single pair, a double convex crown and a double concave flint. 2. Why are two sets of lenses used in a camera tube? A. For wider angle of aperture. 3. Can good landscape and portrait photography be done with an achromatic object glass of a telescope? A. No. For experiment, put a view tube in its own focallength inside focus of objective. 4. Does a lens of short or long focal length make any difference for either kind of work? A. A lens works the slower the longer its focus is. 5. How is a telescope fixed for viewing the sun? A. Claret and apple green siccant glasses are superposed inside the eyepiece cap, or the image is received on a Bristol board.

(60) J. E. N. asks: 1. What is the best composition for covering the insulated wires for an induction coil? A. Cover both wires with silk. 2. Is a bobbin 6 inches long by 3 1/4 inches in diameter, with a 1/2 inch cylinder (for the wire rods), a well proportioned one? A. Yes. 3. Which gives the best results with a weak battery, a coil of two wires (of the same size) wound side by side, or a coil of fine over a coarser wire? A. Use No. 40 for the secondary and No. 16 for the primary. 4. Are the induced and the inducing coils wound in the same direction (in the coil of one wire over the other)? A. Yes. 5. In what proportion of each can the induced be increased without increasing the inducing coil? A. Almost any extent. 6. About what quantity of each (by weight) of wire will be required for the above sized bobbin? A. Use a few turns of the coarse wire and a thousand turns of the fine wire. 7. Can iron covered wire be used in place of copper in any part? A. Not to good advantage. 8. What work on electricity is recommended? A. De la Rive, Wood, Jenkins, Harris, Ferguson, and Thomson are all good.

(61) W. R. H. asks: 1. How can I best solder platinum foil to brass and make a good electrical connection? A. Use pulverized rosin and good solder. 2. Will powdered peroxide of manganese act as well as the coarsely pulverized for the Leclanché battery? A. Use the coarse in preference.

(62) F. B. S. says: 1. I have a small battery made on the Daniell principle, using zinc and sulphate of copper, but it is not constant. What can I do to keep it more uniform? A. Probably the water needs changing in the porous cups. When it becomes supersaturated with sulphate of zinc, crystals form on the zinc and stop the action. You can use nitrate of copper instead of sulphate if you wish, but sulphate is cheaper and better. 2. How can I make an induction coil? A. An induction coil is made by winding a helix of coarse insulated copper wire, and surrounding it by a helix of fine insulated copper wire. The battery is connected with the coarse wire coil and the shocks are obtained from the fine wire coil, when the circuit of the coarse wire coil, which is called the primary circuit, is broken and closed. The fine wire coil is called the secondary circuit, and receives its electrical effects by induction from the primary circuit.

(63) W. E. D. asks: How can I make a battery suitable for plating, and how one that will run a small telegraph instrument? I have a glass jar that will hold about 2 quarts, and wish to make it into as powerful a battery as I can. A. Put a plate of copper in the bottom of your jar and attach a copper wire to it which is insulated above the junction with gutta percha. Put a couple pounds of sulphate of copper (blue vitriol) on the copper plate. Suspend a disk of zinc in the jar near the top and fill the jar with water. Connect the upper end of the copper wire with the zinc disk, and leave it so for 48 hours, and your battery will then be ready for use. If you need more power, make a second cell in the same way and connect the copper plate of one with the zinc disk of the other. One cell of this kind has a force of one volt, two cells two volts, and so on. This is called the gravity or Calland battery, and is one of the best and most constant in use.

(64) W. S. S. asks: Is there a chemical process by which steel can be case-hardened without heating or springing it? A. We do not know of any.

(65) J. H. B. says: I have a little engine of 1 inch bore by 2 1/4 inches stroke. I had some trouble with the valve, but your article on "Practical Mechanism," by Joshua Rose (a couple of weeks ago) corrected the mistake. I now run with steam 20 lbs. pressure at the rate of about 800 revolutions a minute.

(66) E. B. K. says, in reply to J. C. M., who had trouble with pipes connected to his boiler in under side: The trouble was that there was no connection with the steam. If one end of the pipe were connected with the steam, the steam generated would escape to the boiler and form a vacuum, and the water would follow. The size of the pipe makes no difference. It will not do to pump through such pipes.

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

C. H. W. Jr.—It is a fragment of a small hexagonal crystal of rock crystal or quartz.—G. H. M.—It is a decomposed muscovite, which is a variety of mica, and consists of a hydrated silicate of alumina, with a small percentage of oxide of iron and about 10 per cent of alkali. Numerous specimens of this mineral have been forwarded of late, probably on the supposition that the bright yellow scales owe their color to the presence of gold. This mistake was made with sad consequences by the first settlers at Jamestown, Va., who, instead of devoting themselves to cutting down the forest, collected a shipload of similar material and sent it to England, where it was pronounced worthless.—D. K.—No. 1 is borate or variegated copper ore, composed of sulphur 25 per cent, copper 63 per cent, and iron 12 per cent. No. 2 is epidote, and consists of 37 per cent of silica, 23 per cent of alumina, 14 per cent of oxide of iron, 23 per cent of magnesia, and 3 per cent of water.—T. M. T.—It is a mixture of augite, epidote, and quartz. If it contains any tin ore, it is not perceptible to the eye, and a piece much larger than the microscopic fragment you send would be necessary to determine this fact. It has no value, apparently, as an ore.—N. H. S.—We have tried your specimen for manganese, and find it present, although in what quantity we cannot say from a preliminary examination. The cost of an assay is \$10; and if there is a deposit of the mineral, it is worth the assay.—G. McL.—The pill is probably a proprietary article; it has all the indications of being for sweetening the breath only.—J. K.—No. 1 is marcasite, and is composed of 46 per cent of iron and 54 of sulphur. It is not valuable as an iron ore. No. 2 is a clay slate, containing oxide of iron, but not in sufficient quantity to render it valuable. No. 3 is an impure stearite or soapstone. In large blocks, it is used in lining the interior of blast furnaces. No. 4 is a yellow oxide of iron, mixed with clay and a large amount of silica. It is an inferior iron ore.—Y. and K.—The specimen contains gold, of the variety known in works on mineralogy as "fool's gold," or iron pyrites. It is full of cubical crystals—slightly decomposed—of iron pyrites, which is a compound of sulphur and iron.—P. C.—The white particles are not sulphur, but sulphate of iron arising from the decomposition of pyrites. The vitriol has probably been made in the same manner, and a larger specimen would be needed for analysis.—An unlabeled mineral of a bright metallic luster, slight yellow tint, broken on the side with a fibrous fracture, and having an appearance at the ends of having undergone fusion, has been received. It is sulphuret of iron.

J. & J. T. ask: What is the proper speed for the periphery of a bolting reel?—J. H. asks: How can I dye skins of muskrat, fox, etc., black?—R. M. asks: How can I prepare Prussian blue for stenciling, to be used, moistened with water, with a brush?—R. S. asks: What is a hit and miss valve?—J. C. C. asks: 1. How can ginger ale with a round, full, aromatic body be made? 2. What are the component parts of the Belfast ginger ale?—T. W. B. asks: If four men can pack a bale of cotton weighing 500 lbs. on an iron screw 4 inches in diameter and 1½ inches pitch in the thread to the round, with levers 15 feet long, how much can four men pack with a wood screw 22 inches diameter and 7 inches pitch in the thread to the round, with levers 20 feet long? The incline on the wood screw is as 7 to 60, and the incline on the iron screw is as 1½ to 12½, that is, the incline on both is nearly the same, but the rise on one is 7 inches to the round, and on the other 1½ inches to the round.

COMMUNICATIONS RECEIVED.

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

On Boiler Explosions. By W. H.
On a Mysterious Fire. By J. B. G.
On a Magnetic Engine. By H. L. C.
On Lubricating Cylinders. By J. H. S., and by C. T. S.
On an Optical Phenomenon. By C. E. F.
On Nitro-Glycerin as a Motor. By C. T.
On Amalgam Fillings. By F. H. H.
On a Man-Eating Tree. By K. L.
On Ants. By J. S.

Also enquiries and answers from the following:

D. O.—M. P. C.—J. B. E.—J. E. B.—W. C. T.—A. F. A. F. O.—G. C. S.—B. C. L.—J. S. B.—J. W.—R.—F. J. D.—J. F. F.—B. C. & Co.—D. F. S.—W. B. R.—E. E.—S. A. H.—P. E. V. H.—J. M. R.—W. H. S.—H. L. F. M.—B. J. J.—C. H. B.—W. M. H.—R. G. 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 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: "Who sells eccentric grinding mills? Who sells a gold plating liquid? Who sells match-

making machines? Who deals in fossils? Who makes pocket door locks? Who buys old coins?" 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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DESIGNS PATENTED.

8,019.—CLOCK FRAME, ETC.—H. J. Davies, Brooklyn, N. Y.
8,020.—COOK STOVE.—L. W. Harwood et al., Troy, N. Y.
8,021 to 8,024.—OIL CLOTH.—C. T. Meyer et al., Bergen, N. J.
8,025, 8,026.—COOK RANGES.—N. S. Vedder et al., Troy, N. Y.
8,027 to 8,033.—CARPETS.—J. T. Webster, Philadelphia, Pa.
8,034.—BOAS.—G. H. Prindle, Philadelphia, Pa.
8,035.—COOK STOVE.—N. S. Vedder et al., Troy, N. Y.

TRADE MARKS REGISTERED.

2,195.—WASHING SODA.—Fischer & Co., New York city.
2,196.—DRUGS.—E. Fougere & Co., New York city.
2,197.—CARPET TACKS.—F. F. McNair, Nunda, N. Y.
2,198.—JEANS.—Naumkeag Cotton Co., Salem, Mass.
2,199.—HAMS.—C. D. Sabin, New York city.
2,200.—WOOL.—J. H. Smith, Philadelphia, Pa.
2,201.—MINERAL WATERS.—H. A. Benjamin, San Francisco, Cal.
2,202.—BRAIDS.—H. N. Daggett, Attleborough, Mass.
2,203.—SILKS, ETC.—Passavant & Co., New York city.
2,204.—SOAPS.—Strunz et al., Pittsburgh, Pa.
2,205.—SPRING BEDS.—Tucker Man. Co., Boston, Mass.
2,206.—KNITTED GOODS.—Troy Hosiery Co., Troy, N. Y.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,
JANUARY 25 TO JANUARY 28, 1874.

4,307.—H. H. Rhodes, San José, Santa Clara county, Cal., U. S. Improvements in railroad car axles, called "Rhodes' Railroad Car Axle." Jan. 25, 1875.
4,308.—W. Gooding, Detroit City, C. Spalding and A. Winchester, Windsor, Essex county, Ont. Improvements on apparatus for elevating and conveying coal, called "The Shipping Coal Elevator." Jan. 25, 1875.
4,309.—A. J. O'Day, Elk Rapids, Antrim county, Mich., U. S. Improvements in ore crushing and rock breaking machines, called "O'Day's Improved Ore Crusher." Jan. 25, 1875.
4,310.—G. M. Holmes, Gardener, Kennebec county, Me., U. S. Improvements on mechanism for planing the cogs of bevel gear wheels, called "Holmes' Gear Wheel." Jan. 25, 1875.
4,311.—Wm. Hamilton, Fallsburg, Sullivan county, N. Y., U. S. Improvements in machine for making animal shoes, called "Hamilton's Machine for Making Animal Shoes." Jan. 25, 1875.
4,312.—J. Prince, Rock Island, Stanstead county, P. Q. Improvements on an apparatus for cooling milk, called "Prince's Improved Milk Vat Pan." Jan. 25, 1875.
4,313.—D. Allard, St. Albans, Franklin county, Vt., U. S. Improvements on smoke stacks, called "Allard's Smoke Stack." Jan. 25, 1875.
4,314.—C. E. Moyer, Berlin, Waterloo county, Ont. Improvements on shoe lasts, called "Moyer's Improved Patent Felt Shoe Last." Jan. 26, 1875.
4,315.—J. K. Feick, Berlin, Waterloo county, Ont. 1st extension of No.

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Various Arts and Trades.

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Brown.—Five Hundred and Seven Mechanical Movements. By H. T. Brown. 12mo. \$1.00.

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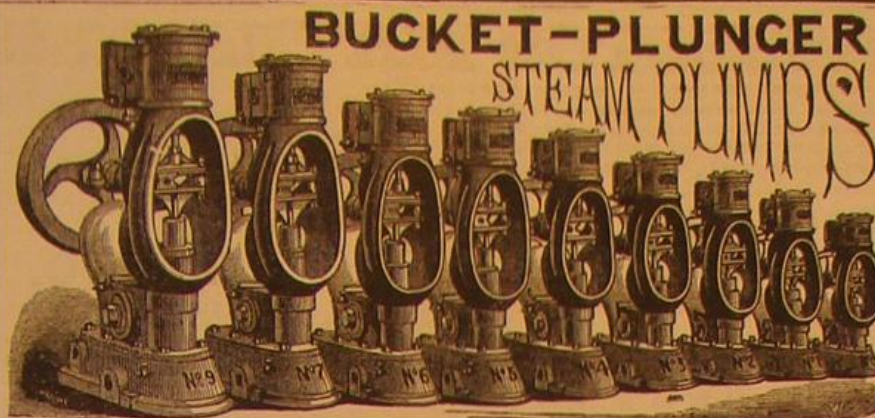


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At a meeting of the Trustees of the Public Library of Kentucky, Jan. 16, 1875, it was resolved that C. M. Briggs, Esq., who under the late Hon. Thos. E. Bramlette was the real business manager of the gift concerts already given in aid of the Public Library of Kentucky, be and he is hereby authorized to take the place made vacant by the death of said Bramlette, in the management of the affairs of the fifth and last gift concert, and that the drawing announced for February 27, 1875, shall positively and unequivocally take place on that day without any further postponement or delay on any account whatever.

R. T. DURRETT, Pres.

JOHN S. CAIN, Secretary.

Hereafter all communications relating to the 5th Concert should be addressed to the undersigned, and I pledge myself that the drawing shall come off February 27th or that every dollar paid for tickets shall be returned.

C. M. BRIGGS, Agent and Manager, Room 4, Public Library Building, Louisville, Ky.

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CHASING SCREW THREADS.

The operation here illustrated is that of chasing, or, in other words, cutting threads or screws, in the lathe, by hand, which is the most delicate operation performed in a hand lathe, and requires skill of the very nicest kind. In the early days of steam engineering, when screw-cutting lathes were unknown, good hands at chasing were eagerly sought. At that time, many large engineering firms in England used threads of a particular depth and angle, unlike those used by others, to the end that the machinery manufactured by each firm could not be sent elsewhere for repairs. Among these private threads, the "Maudsley" and the "Sharp" threads attained most prominence. They were deeper than those now in use, and have been superseded by the Whitworth or standard thread of to-day.

Thomas Maudsley, the founder of the celebrated engineering firm now known as Maudsley, Sons, and Field, had, as far back as 1830, a remarkably efficient screw room, as it was then termed, conducted under the supervision of Mr. Sheriff, who was probably the most expert chasing hand of his time. In Maudsley's private model room, screw cutting by hand was then carried to a high degree of perfection. Among the eminent men who served their apprenticeship in this room were Sir Joseph Whitworth, James Nasmyth, and George and John Rennie. Among its productions was a model of the (at that time) monster (160 horse) marine engine built for the English man of war *Dee*. This model, which was displayed at the London Exhibition of 1851, had many hand-cut threads in it with a pitch of 100 to the inch, their fit being so perfect as to enable them to sustain very severe strains. The teeth of such a chaser are so fine that, to the ordinary machinist's eye, it would be taken for a scraper, nor would the error be perceived until the tool was applied to the work.

The first operation in chasing an outside or male thread is to start the thread, that is, to cut on the work a shallow spiral groove; this is accomplished by running the lathe at a fast speed, and passing the point of a graver or V tool, under a moderate pressure, along the end of the work, the heel of the tool being pressed firmly against the rest, which should be placed as close to the work as possible. This part of the operation requires a great deal of practice, to enable the operator to strike the thread at the correct pitch and true at the first attempt. Beginners will find it an excellent plan to leave about three eighths of an inch in length, of the end of the work to be chased, a sixteenth of an inch larger in diameter than the required finished size, so that, if the first few attempts to strike the correct pitch fail, the marks may be turned out without reducing the work below the required diameter. When a correct pitch is struck, the chaser may be applied, as shown in our engraving, and, while pressed lightly against the work, moved along the rest as nearly at the proper speed as can be judged, and the teeth will find the groove and travel along it. The chaser should be held so that its hind teeth press the hardest against the work, which will keep them in the starting groove, and act as a guide, while the front teeth extend the groove, carrying the thread forward to the requisite length. It is highly important to keep the rest free from the burrs made by the

heel of the graver or other tool; otherwise the edge of the chaser will strike against them, and, being retarded in its course, will cause the thread to become "drunken." The leading bottom edge of the chaser should also be rounded off to enable it to glide over such obstructions on the face of the rest. If the metal upon which a thread is to be chased have seams in it, the starting groove should be cut as deep as possible, so as to keep the thread true. The front tooth should come even with the edge of the chaser, so that it will be a full tooth, and the tops of the teeth should stand at an acute rather than at a right angle to the left hand side

caused by the cannon shot striking the target; and it being observed that the fracture nearly always occurred across the section above referred to, the clearance grooves were made with a hollow curve, which obviated the defect. In this connection we may also remark that threads whose tops and bottoms are rounded are much stronger than are those whose angles terminate in a point or angular corner (a fact also demonstrated on the trial above referred to); hence those cut by hand are, in this respect, superior to those cut by the lathe.

Inside or female threads, that is to say, threads cut in the bore of anything, are cut by hand with an inside chaser, which cannot, under any circumstance, have rake upon the top face of the teeth, as the latter necessarily cut at a distance from the lathe rest; and were they made to cut freely, they would rip in, and more power would be required to hold them than can be sustained by the hands of the operator. It is a good plan to bore a small hole in the top of the lathe rest, into which a small pin may be placed to act as a fulcrum, against which the back of the chaser can be pressed to force the teeth into the cut. Inside or female threads are started by pressing the chaser teeth lightly against the bore of the work, and moving it forward at the same time, the thread being started (if a right hand one) at the outer end of the bore, which is rounded slightly off so that the chaser shall not catch. Much experience is required to enable the operator to judge the exact speed of chaser movement required for any particular pitch of thread.

Beginners should always stop the lathe and examine an inside thread as soon as it is struck, for it is an

CUTTING SCREW THREADS WITH A HAND CHASER.

of the (right hand) chaser, to the end that, when its teeth are parallel with the length of the work, the body of the chaser will lean to the right, and therefore stand well clear of the lathe dog or driver.

The following rules apply to outside or male chasers: For wrought iron or steel, the teeth should be hollow in their length, and should have top rake. For cast iron, the top face of the teeth should be level, or they will cut too freely and rip the threads. For brass, the teeth should be ground at an angle of which the points of the teeth are the lowest. The cutting edge of the chaser should be above the horizontal center of the work; and the body of the chaser should be held as nearly horizontal as will permit the teeth to cut, otherwise the positive or negative rake of the teeth will cause them to cut a thread deeper than themselves.

At the termination of the thread, it is necessary to cut a recess as deep as the thread, in order to give the chaser clearance, and prevent it from ripping into the shoulder, which would form the termination of the thread in the absence of a recess. It is a very common practice to cut this groove or recess with a V tool or graver point, instead of with a round nosed tool, thus producing a recess having a conical instead of a curved outline: the result being to very seriously impair the strength of the bolt, and cause it, under severe strains, to fracture across the section of the bottom of the groove.

In a series of experiments made a few years ago, by the English government, upon targets representing ship's armor, the bolts were found to be unable to withstand the shock

easy matter to cut a double female thread in consequence of moving the chaser too fast, nor will the error be discovered until the thread is finished and the male thread applied, which will not, in that case, enter.

Double threads are those in which the distance from one thread to another is one half only of the actual pitch of the thread. Their nature may be more clearly understood by supposing a thread of five to the inch to be started by a tool in a screw-cutting lathe, and then supposing the tool point to be moved laterally so as to cut another groove, to the same depth, in the center of the spaces between the thread first cut. If a chaser having ten teeth to the inch be then employed to finish the thread, we shall have a double thread possessing all the elements of distance from one thread to another, depth, angle, and strength of a thread of ten to the inch, although the pitch will actually be that of five to the inch.

Double male threads, to be cut by hand, can be most easily started by the chaser, moving it twice as fast as would be required for a single thread, rounding off the corner of the bolt end and taking care to cut principally with the hindmost teeth.

Taps and all other work requiring great accuracy in the depth and angle of the thread should be finished by a chaser, the work (if of wrought iron or steel) being freely supplied with oil until the finishing cuts are taken, when soapy water should be substituted, which will cause the chaser to cut clean and smooth, and give neatness and finish to the threads of the tap.



Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS.

One copy, one year, postage included.....\$3 20
One copy, six months, postage included..... 1 60

Club Rates:

Ten copies, one year, each \$2 70, postage included.....\$27 00
Over ten copies, same rate each, postage included..... 2 70

By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise they will be entered from January 1st, 1875. In case of changing residence state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXII, No 10. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, MARCH 6, 1875.

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REPORT OF THE COMMISSIONER OF PATENTS.

The annual report for the year 1874, which has recently been published, presents a very satisfactory statement of the transactions of the Office during that time, and of its present condition. There have been 13,599 patents issued, which exceeds the number for any other year except that of 1869. There have been some extraordinary expenditures, but the revenues have been sufficient to meet all these, leaving a balance of \$58,989.76.

The *Official Gazette*, which among other things has superseded the annual Patent Office reports, has the advantage over its predecessor of furnishing from week to week a brief description of the patents which have been issued during the week then ended, setting forth at least the titles, claims, and drawings of such patents, instead of delaying till the end of the year, and several months, and sometimes a year or two, longer, before such information used to be communicated to the public. A charge of six dollars a year must, however, be met by those who would avail themselves of this information instead of receiving it gratuitously, as was formerly done through the annual reports.

A very great improvement has recently been introduced by placing the illustrations in each case in immediate proximity with the respective descriptions and claims. This was done in 1853, but for some reason was afterwards discontinued and a different rule substituted. It is much superior in point of convenience.

We are promised a general index of all the patents issued from 1790 to 1873 inclusive. This index is to consist of two sets of three volumes each: the one of these sets containing an alphabetical list of the names of all the patentees, and the other an index of the subject matter of all the patents that have been issued. These will be of great service. The aggregate cost of both sets, being forty dollars, will, however, probably prevent their being widely disseminated except in some of our principal libraries.

The Commissioner suggests the propriety of making the *Official Gazette* to a considerable extent a business paper by rendering it a medium for advertising. If there are no political objections to such a course, we see none other of sufficient importance to prevent its being adopted. The precedent of thus rendering one of the bureaus of the Interior

Department not only a publishing house, but also a competitor for advertising patronage, will probably not be long continued without exciting formidable objections to the proposed practice.

In the necessity of a thorough and systematic revision of the patent law, as set forth in the report, we heartily concur, and trust that such a measure will not long escape the attention of Congress. The present law is full of incongruities and imperfections, which loudly call for the hand of thorough reformation. It is in many important respects far more objectionable than the law which it superseded.

But with regard to the Commissioner's idea of providing for an appeal in cases of the allowance of a patent as well as in those of rejections, we see a very grave objection. How would such an arrangement be successfully conducted? The same rule should be made applicable to all cases. Every patent that is allowed by an examiner should be brought before another tribunal for revision. A double examination would thus become necessary in all cases. If the examiners are fit for their positions this is superfluous; and if they are not it would be pernicious. The wrongful granting of a patent is less harmful than the wrongful refusing of one. If it be said that the examiners who review the first decisions should be men of more ability and experience than they who make those decisions, then we say, discontinue the latter and let the better examiners decide in the first instance.

Practically the present arrangement is in substance the same as the Commissioner proposes in all doubtful cases. The first examinations are usually made by the assistant examiners. If there is any doubt as to the patentability of the subject matter of the application, a rejection is usually the result. A second examination is then called for, which brings the matter before the principal examiner. If the Commissioner, will establish the rule that no patent shall be allowed to issue until the matter is presented to the principal examiner for his approval, he will have what he desires, and without any additional complication or expense. No Patent will in that case issue without a review of the decision of the Officer who makes the first examination, whether the patent be allowed or rejected.

The importance of rendering a patent unimpeachable was long since brought to the attention of Congress by a former Commissioner as will be seen by reference to the Patent Office report for the year 1855. Whether any such plan is practicable, without entailing more injury than benefit, is a matter of no little doubt, but one which is well worthy of serious consideration by the law-making power.

As to the wisdom or efficacy of the competitive examination of candidates for appointment or promotion, we have very grave doubts. A man of superficial abilities will generally, on such an examination, far outshine another of far more sterling and useful qualities. A fresh graduate from a college, with no experience and perhaps but little common sense, would often, on such an examination, surpass the most experienced and useful examiner to be found in the Office. Nothing but a thorough trial, or the exercise of a very sound discretion on the part of the appointing power, will lead to a wise conclusion in such cases. We do not think that such a conclusion can generally be reached through a competitive examination.

PROGRESS AND PROSPECTS OF SOLAR CHEMISTRY.

Several important circumstances unite to give unusual interest to the solar eclipse to occur in April next. The progress of solar chemistry has brought investigators face to face with problems of universal reach and significance, for the solution of which the four minutes of obscuration will be more valuable than as many years of laboratory work. A new instrument, the siderostat, destined, it is thought, to effect a great revolution in astronomical observation, will immensely increase the efficiency of spectrum photography; and the conditions under which the eclipse will be visible promise better opportunities for the observation of totality than can be enjoyed again before the close of the current century, or, more precisely, April 16, 1893. In not one of the four total eclipses which occur in the meantime—1878, 1882, 1886, 1887—or in that of 1900, will the duration of totality be so great, or the central line of the eclipse present stations so favorable for observation. A glance at the grander results accomplished during recent eclipses—following chiefly an elaborate review of the work in a late issue of the *London Times*—may help to make clear the grounds on which the expectations of the present are based.

Between the eclipse of 1860—during which photography decided the long vexed question of the origin and place of the strange red prominences seen round the dark body of the moon at the moment that the sun's disk is covered—and the eclipse of 1868, the spectroscope had revealed the approximate composition of the sun's atmosphere, taken as a whole. The great point to be determined in 1868 was not simply the place and shape of the prominences, but their material. The result is well known, namely, that they consisted of glowing gas, or a mixture of such gases, shot to immense heights through the solar atmosphere.

Almost simultaneously with this discovery, it was found that the prominences could be studied spectroscopically independently of eclipses; and observers were not long in finding out that, outside the bright round face of the sun, was an envelope of glowing hydrogen—the chromosphere—into which magnesium and sodium, and, more rarely, iron and other heavy metals, were injected from below, in the form of a vapor. It was further ascertained that the gases and vapors were not all mixed up together, but that the lightest, such as hydrogen, magnesium, and sodium, were generally at top; and that, as the others were shot up from time to

time, some more frequently than others, the heavier were, as a rule, located lower down in the solar atmosphere than the other.

During the eclipse of 1869, the results of previous observations were confirmed; the halo of light outside the prominence envelope was photographed, and it was established that an unknown gaseous element extended beyond the hydrogen, hitherto accounted the lightest form of matter. The green line, by which this substance is distinguished, has not as yet been identified with that of any terrestrial element.

Great preparations were made for the observation of the great eclipse, 1870; but the weather was bad, and, though results of considerable value were obtained, nothing strikingly important was decided. Better fortune awaited the observers of the eclipse of 1871. The corona was photographed, under nearly the same instrumental conditions, from three different places, and the similarity of the pictures proved, beyond all doubt, that part of the corona was a solar appendage. Evidence was obtained, making it extremely probable that the light of the outer parts of the true solar corona—the coronal atmosphere, as Janssen proposed to call it—was stronger in the violet and ultra violet parts of the spectrum than elsewhere. And it was further established that, for some distance above the hydrogen envelope, as seen without an eclipse, less bright hydrogen existed. The inference was that the chromosphere—or lower atmosphere of the sun—consisted of brighter hydrogen and other vapors.

Since 1871 the spectroscopic study of the chromosphere has been carried on vigorously under the clear sky of Italy, and the clearer sky of our mountain observatory in the Far West. Through this thin atmosphere, 9,000 feet above the sea, Professor Young has been able to study a much more complicated chromosphere than appears to observers lower down. Among other things, he has found that, along with magnesium, there frequently appears the vapor of the metal calcium, the principal characteristic lines of which can be seen only under the most perfect atmospheric conditions. In the meantime, extensive laboratory researches have been undertaken for the elucidation of the phenomena observed in the chromosphere. It has been proved that, in the case of any one metal present in the sun, the metal behaves exactly the same in the sun's atmosphere as it does when driven into vapor by the passage of the electric current between the carbon poles of an electric lamp, thus making it possible to interpret many appearances in the chromosphere, which would otherwise be inexplicable: as for instance, the almost complete spectra of hydrogen, the metals of the alkalis and alkaline earths, and the metals of the iron class, while such metals as zinc and lead show only a few lines. The metals of the tungsten, antimony, silver, and gold classes show no traces of existence in the sun's atmosphere; nor do the metalloids, such as oxygen, carbon, nitrogen, sulphur, and the like, which make up more than half of the parts of our planet, so far as known. It would appear, however, that the presence of the latter may be inferred. In fact, it has been claimed that we have, in the solar system, exactly such a record as we should expect if this large class of bodies existed in a comparatively cool part of the atmosphere, at a height above the hotter lower strata. It is also claimed that granting this, it is possible to explain the various classes of stars by supposing that, as a star grows older and colder, the metalloids are enabled to exist lower down in the atmosphere, and thus to change the character of the spectra of stars bright and hot into that associated with those which are dim and possibly colder; until at last the metaloidal rain, so to speak, falling on the metals below, gives the material of a future crust.

Associated with these chemical questions are physical questions of the greatest interest, the solution of which will help to make clear the development of our Universe from nebulae to suns and worlds. How far the coming eclipse will further the inquiry remains to be seen. It is confidently expected that the result to be accomplished will be the "fruit and crown" of the work begun in 1860, and carried on with so much zeal by all civilized governments since that time.

The course of the central line of this eclipse is mainly a sea track, yet, in its passage from the Nicobar islands, in the Bay of Bengal, to Siam, it crosses several points that will afford good stations for observation. At Kaikul, in the island of Camorta, totality will continue four minutes twenty-seven seconds. On Bentinck Island, the maximum duration of totality will be four minutes seventeen seconds; at Mergui, four minutes six seconds; at Tenasserim, three minutes fifty-seven seconds; near Bangkok, Siam, to which point astronomers have been invited by the King, the total eclipse will last three minutes fifty-four seconds.

AN IMMENSE TELEGRAPHING ESTABLISHMENT.

The Western Union Telegraph Company moved into their new building, at the corner of Broadway and Dey street, in this city, on the first of February. Moving a large business of any kind from one place to another is usually a troublesome affair, but the peculiarities connected with this business rendered the moving a matter of more than ordinary complication. A merchant can send the fixtures and goods to the new store, and only loses the time required for rearranging them. The telegraph company, however, must continue sending messages from one building as long as it is occupied, and on moving to new quarters must find everything ready for carrying on the work. The wires cannot be shifted from the old building to the new, but a new set must be provided, and a considerable number of new instruments must be in position before any of the old ones can be taken down. So we find that the most of the apparatus and arrangements in the new quarters of the company are also new. We made an examination of the building, a few days after its occu-

pation, and found so much to please and interest us that we propose to give a short description of it to our readers.

The messages are received and delivered in the basement, and the operating room is in the seventh story. When a message is delivered to a receiving clerk, he puts it into a pasteboard cylinder, drops the latter into a pipe, the upper part of which is connected with an exhaust blower, and the message is sent to the operating room without much loss of time. When an operator in the room above receives a dispatch from abroad, he writes it out and delivers it to a clerk to copy. It is then put into an envelope and addressed, and dropped through a tube to the basement, where it is given to a boy for delivery to the person for whom it is intended. These arrangements seem to work very satisfactorily, and interested us exceedingly. The operating room, however, excited our greatest admiration, and it seems to have been designed to please the eye as well as for the efficient performance of the work. Nearly 400 wires are brought into this room and connected with the instruments, which are generally operated by sound; though there are a few printing instruments, in addition to those of the Gold and Stock Telegraph Company. The batteries are on the sixth story, occupying the greater part of this floor, and give the visitor, who knows the effects that can be produced with even a few cells, a very vivid idea of the company's business. Any one who gets up to this height in the building should continue his ascent until he stands on the roof surmounting the clock tower, for the sake of the magnificent view. Standing in this position, the beholder seems to be almost on a level with the spire of Trinity church, and the city and its environs present somewhat the appearance of an enormous map.

On retracing his steps, the visitor will do well to take a trip in the water balance elevator, and notice how smoothly and quickly it works. The principle by which the car is moved is exceedingly simple. It is balanced over a large pulley by an iron bucket which is connected to it by a rope. If water be admitted in the bucket, it descends and raises the elevator car; if the water is let out, the car descends, and can be held at any point of its path, by the application of a friction clutch. In this brief sketch, we have merely glanced at the prominent features peculiar to the building, which, in design and construction, will bear comparison with the many other elegant structures in New York, and is an ornament to that part of the city in which it is located.

A NEW STYLE OF BOOK-MAKING NEEDED.

There are few books which have more than a temporary life or a temporary value. Like the daily newspaper, nine books out of every ten, perhaps ninety-nine in the hundred, serve a present purpose, are read and thrown aside. This leaving out of the account the great mass of books which have no purpose and are never read. Even of standard books in science or literature, new editions are constantly superseding the old, and though the work itself be immortal, the individual copies have but a brief existence. Today the book stores are full of the "latest edition;" tomorrow you will find a copy only in out-of-the-way places, or on the shelves of second-hand dealers. In a short time the fireplace or the paper mill have made an end of all but the struggling copies in unused libraries. Not one copy in a million is worn out by use, yet most books are printed and bound as though they were to be used for ever.

The direct consequence is that a man who has to read, say a hundred books a year—and he will have to do something like that to keep up with the drift of thought in its various departments—such a man will have to pay for a hundred bindings which he does not want, a hundred packets of thick paper which he has no use for, and an uncertain but certainly large bill of charges for carriage, handling, and the like, which might for the most part be avoided. A secondary consequence is that few men can afford to buy many books, and those who do buy have to stand the excessive cost of small editions.

It is no doubt more satisfactory to the booksellers to handle a few books at a large price than a multitude of cheap ones, the profit being the same, and naturally they favor that method of publishing. Nevertheless we believe that the successful book maker of the future will print for the million as well as for the few, and be the gainer by it. We believe, too, that any responsible firm which should enter at once upon the work of printing good books, especially scientific books, so that they could be sold for a quarter the price now asked for books of the kind, would achieve a splendid success. But they would have to print editions of a hundred thousand.

The book publisher prints an edition of a thousand copies, say of Helmholtz's "Essays," charges two dollars or two and a half a copy, and loses money. The magazine publisher puts into a pamphlet a greater amount of matter at an immensely greater cost, taking illustrations and all into account, prints fifty or seventy-five thousand copies, and makes a profit, selling them at one tenth the price of the book. Printed on thin yet clean white paper, on type the size of that of this page, the book could be sold in like quantity, unbound, for the price of the magazine, and at a greater profit, the first cost being so much less.

We have taken an extreme case, a book not calculated to be very popular, believing that the market for even such books might be indefinitely increased were they offered cheap enough. A work like Draper's "Conflict of Religion and Science" would outsell any magazine at the same price.

Of course an enterprise of this sort would have to be conducted with great discretion—as every new venture must—and possibly with a preliminary outlay like that involved in starting a successful magazine. The first issue might

not pay at once, nor the second, nor the third. It would take time to convince the public of the real existence of the enterprise, and to prove itself worthy of confidence; this done, its success would be morally certain.

The comparative failure of several excellent series of nominally cheap scientific publications is no ground for doubting the success of a more liberal scheme such as we have suggested. The little pamphlets in question have really been very dear. Containing not a tenth as much matter as a Harper's or Scribner's Magazine—chiefly reprint matter at that—their price has been twenty-five cents. Printed on heavy toned paper and prettily covered, they were undoubtedly worth twenty-five cents as things go; but the mass of readers have no money to spare for such luxuries. At ten cents a copy, the pamphlets would find thousands of buyers where they now find a hundred.

Said a prominent publisher to the writer not long ago: "The book business has seen its best days. Men do not read books any longer, they read the papers and magazines." In view of this change of habit in the reading world, the proper thing for the book makers to do is to change their habits accordingly. To a limited extent, high-priced, handsomely bound books will always be called for, but not by the multitude. To reach the masses, the book makers will have to meet the publishers of periodicals on their own grounds, and give an equal amount of matter for the same price, and give it when it is wanted.

To the objection that newspapers and magazines have their advertising pages to help them, it need only be said that a book in pamphlet form will carry advertisements just as well as a magazine; and with as large a circulation assured, the advertising pages would be just as valuable.

WHAT ARE BACTERIA?

Truly a question of Life and Death! In their microscopic field of existence, the great battle of biology, the problem of life's beginning, must be decided. So, too, one of the greatest problems of pathogenesis hinges on their origin and effects. Are they or are they not the cause of endemic and so-called "specific" contagious diseases?—a class of diseases which have been aptly described as distinguishing one country from another, one year from another; which have formed epochs in history, and, as Niebuhr has shown, have influenced not only the fall of cities such as Athens and Florence, but of empires; which decimate armies and disable fleets; take the lives of criminals which justice has not condemned; redouble the dangers of crowded hospitals; infest the habitations of the poor, and strike the artisan in his strength down from comfort to helpless poverty; carry away the infant from the mother's breast, the old man at the end of life, and fall with excessive fatality on strong men in their prime and vigor.

What are bacteria?

Four answers have been given to this question. Ehrenberg's, that they are animal organisms of the lowest grade having an individuality of their own; Hallier's, that they are of the nature of spores, produced from and destined to develop into some of the simpler microscopic fungi; Cohn's, that they represent the free-swimming stage in the existence of certain algae; Bastian's, that they are the first and most common developmental phase of newly evolved living matter, capable, either singly or in combination, of developing into many different kinds of living things.

Ehrenberg's view is quite obsolete. They are not animals, nor are all agreed that they are vegetables. For these and other doubtful organisms of the lowest rank, Haeckel has proposed a new kingdom—the *protista*, intermediates between and connecting the animal and vegetable kingdoms, and from the modification of which both animals and plants have been derived. Barring the last clause, the proposition bids fair to be generally adopted, as it relegates to a sort of no-man's land a group of organisms in which animal and vegetable characteristics are so united that they cannot be classed with either animals or vegetables.

All that is positively known of the origin of these organisms is that they speedily make their appearance in all infusions of organic substances exposed to light and air, and under other conditions not so clearly understood. The smallest—usually globular—specks, ranging between a one-hundred-thousandth and a one-twenty-thousandth of an inch in diameter, have been variously denominated monads, microzymes, and plastide particles. According to Bastian, who adopts the last name, they are merely temporary and initial forms of many organizations which may afterward present distinct characteristics of their own; though some of them, through default of necessary conditions, may never actually develop into higher modes of being. From those which do continue their development, he holds, bacteria and other forms, which others have thought specific, are produced by a direct process of growth and development. In size and character, these bacteria and others differ according to the degree of putrescibility of the solution in which they appear, the amount of heat to which it has been exposed, and other modifying conditions. From this point of view, a rigid specific classification is uncalled for and impossible.

According to Hallier's view, the smallest living specks of living matter—he calls them micrococci—are minute particles of plasma or naked matter produced by the repeated subdivision of the nuclei of fungus spores, or by the breaking-up of the protoplasmic contents of the larger reproductive cells of certain fungi. When introduced into a fluid capable of undergoing alcoholic fermentation, these micrococci, he says, develop into cryptococci, bodies resembling ordinary yeast cells; in an acid fluid, or one which becomes acid through fermentation, the micrococci assume the elongated forms commonly called bacteria, but which he names

anthrococci. The first and the last named multiply by fission, while the cryptococci increase by a process of budding. By an elongated growth, the anthrococci are described as developing into distinct fungi of the oidium type.

Thus, determined by the nature of the fluid in which they grow, micrococci are said to develop either at once into *torula* cells from which a perfect fungus may result, or into *bacteria*, which develop into segmented filaments and thence into distinct fungi of a different type. The various fungi so developed are supposed by Hallier to be capable of reproducing micrococci, as already described, and so completing the circle of life: an hypothesis which seems to have no other foundation than a desire to escape the necessity of admitting the origin of micrococci *de novo*.

Cohn classifies more extensively. By his latest scheme bacteria are divided into four groups and six genera, as follows:

I. Sphero-bacteria		Genus 1	Micrococcus
II. Micro-bacteria		"	2 Bacterium
III. Desmo-bacteria		"	3 Bacillus
		"	4 Vibrio
IV. Spiro-bacteria		"	5 Spirillum
		"	6 Spirochæta

The first group appears to correspond with the micrococci of Hallier and the plastide particles of Bastian. They are exceedingly minute darkish or colored granules, frequently presenting the appearance of beaded chains. The whole group is divided by Cohn into three sections—the chromogens, the micrococci of pigmentation; the zymogens, those of ferment; and the pathogens, those of contagion. The chromogens have been the means of producing miracles, by causing bread to exude blood under "supernatural" circumstances, as in the instances described by Rivolta. Among the pathogen micrococci are *m. vaccina*, observed by Chauveau and Sanderson in vaccine lymph; the *m. diphthericus*, to which diphtheria is attributed, and *m. septicus*, found in the milky eruptions of typhus, pyæmia, and some other diseases. Lebert mentions also small pox, septicæmia, mycosis intestinalis, and puerperal infectious diseases, as characterized by the presence of members of this group.

The true bacteria Cohn divides into two species, *b. termo* and *b. lineola*. The first are the "dumb bell" bacteria, so called from their shape. Their length is about one nine-thousandth to one twelve-thousandth of an inch, and they move with a slowly vacillating motion. These Cohn regards as essentially the ferment of putrefaction, and is doubtful whether putrefactive changes can take place without them. *b. lineola* are rod-shaped and somewhat larger. They move with a somewhat stronger and more rapid to-and-fro motion. Lebert says they are constantly present in malignant pustule. They are regarded as essentially the ferment of sour milk.

The desmo-bacteria, or linked rods, as their name implies, are divided into two genera—*bacillus*, with transversely lined filaments, and *vibrio*, with filaments cylindrical and curved. The first Cohn divides into three species: (1.) *B. subtilis*, a slender, supple thread found in stale boiled milk; length one five-hundredth of an inch. It has a pausing motion, like that of a fish forcing its way through reeds. (2.) *B. anthracis*, an immovable, oblong, highly refractive body found in the blood of animals having carbuncle; length one ten-thousandth to one two-hundredth of an inch. It is occasionally found in chains of two or three links, and is remarkable for being unaffected by water, alcohol, ether, acetic, nitric, or phosphoric acid, soda, potassa, or ammonia. Sulphuric acid readily destroys it. (3.) *B. ulna*, which is distinguished from (1) by the greater thickness of its filaments and by its rigidity; length one six-hundred-and-fiftieth of an inch. It is found in the stale infusion of boiled egg. The vibrios are distinguished from the bacilli by their rotary motion. *V. rugula*, a curved, flexible thread one twenty-five-hundredth to one twelve-hundredth of an inch long, is found in the evacuations of cholera, diarrhoea, etc. Its rotation is slow. *V. serpens* is distinguished by the greater number and regularity of its curves, by the rigidity of its filament, and its more rapid motion; length about one two-thousandth of an inch.

The last group embraces the corkscrew bacteria. The three species of spirilla are distinguished chiefly by their relative size, the great regularity and closeness of their curves, and their uniform corkscrew motion. Lebert associates spiral bacteria with relapsing fever.

Whether bacteria are really responsible for the various maladies attributed to them is a question which involves too many considerations to be discussed in this connection.

The Diamond Drill in Dentistry.

At a recent meeting of the First Judicial District Dental Society, W. G. A. Bonwill recommended the diamond drill for the permanent separation of the incisors. The shape is pyramidal. It makes about five thousand revolutions per minute, and, in consequence of its extreme rapidity, causes not the least pain, even when cutting upon the most delicate enamel. Working so rapidly and perfectly, it will cut through or over the surface of the poorest fillings, without disturbing them in the least.

What Two Dollars Did.

W. J. Sanderson, of Syracuse, says that a two-line advertisement, which he put in the SCIENTIFIC AMERICAN a few weeks ago, brought him replies from all parts of the country, repaying him a hundredfold.

THE imperfections of the diamond, and in fact of all gems, are made visible by putting them into oil of cassia, when the slightest flaw will be seen.

IMPROVED LADY'S WORK TABLE.

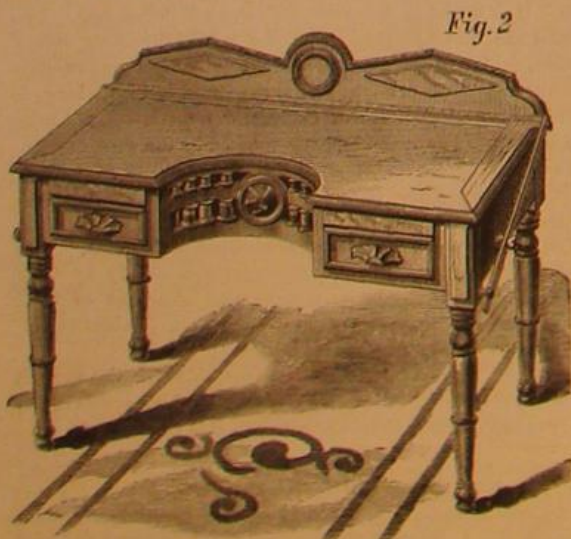
The accompanying illustrations represent a new lady's work table, patented to Mr. C. R. Snyder, December 1, 1874. The lid of the table, as shown in Fig. 1, is readily convertible into a lap board by the side arms turning on a pivot, and resting, when down, on pins in the table legs. The legs of the lap board serve as supports for the table lid when up, and are then folded under, out of sight, as indicated in Fig. 2. If desired, the lap board can be detached from the table and used independently, in which case the elongated side arms become legs. The conformity of the table to the shape of the lap board gives a beautiful design for the former, and at the same time admits of a very convenient arrangement.

The recess in front is used for a double row of spools, retained in place by brass standards. The center piece forms a pincushion. This recess may be tastefully ornamented. The divisions over the right hand drawer may be used for writing utensils, those over the left drawer for "notions," while the division between will hold a large quantity of cut and basted work. These tables are manufactured by the inventor, corner 2d avenue, South, and 14th street, Minneapolis, Minn. He may be addressed for further particulars by parties wishing to manufacture in other States.

The English Engine Driver.

It is one of the most singular facts connected with modern literature that the deep and striking poetry of the rail and the locomotive has never yet inspired any man of genius to sing it forth to the world. Probably it is a consequence of the classical training of modern youth. Our poets get mad over the achievements of Greeks and Romans, over the Isthmian and other games, and seem absolutely blind to the fact that the things which put them into ecstasies are quite childish compared with the everyday marvels of the age we live in. No doubt "distance lends enchantment to the view;" still the Greek charioteer who, standing on a very rickety two-wheeler, whips his horses along in the Olympian races is at best a prosaic figure when placed in contrast to an engine driver on any of our great lines of railway. The fire horse of our modern steam charioteer is infinitely more majestic than the noblest stallion seen in old Greece, and the speed at which he flies through the air is, compared with the Isthmian games, as the eagle's flight is to the crawling of the snail. In simple truth there is scarcely anything done by human beings that approaches, in daring, in true and absolute heroism, to the hurling of an express train through space at the rate of a mile a minute and more, a speed far superior to the velocity of the hurricane.

The master of the locomotive, though perhaps not willing himself to be a hero of romance, is, for all that, a very real, if quiet and unassuming, hero. There is something most manly, firm, and of the true heroic about all engine drivers, more especially those who have seen many years of service, and are trusted with fast and express passenger trains traveling long distances. Engine drivers of the latter class are seldom under forty years of age; and being picked men, fully conscious of the immense responsibility of their position, and accustomed to look with clear eye and unflinching nerve upon danger and death, daily braving the elements in the simple execution of their duty, they are, as a rule, singularly calm and self-possessed.



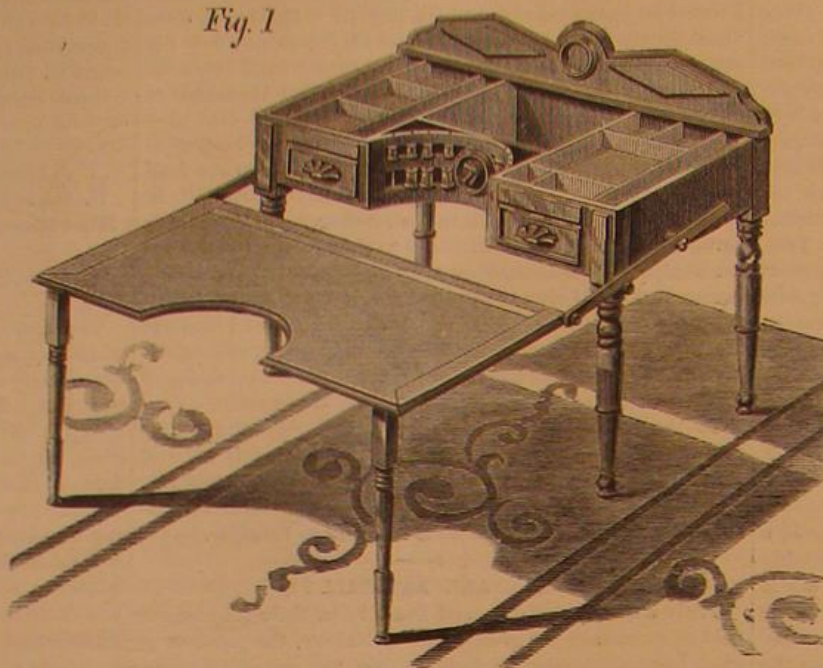
The pay of the highest class driver, a senior in all respects, is from \$1.75 to \$1.87 per day; \$1.87 is the maximum on most of our smaller railways, notably those south of the Thames; but the maximum is considerably surpassed in the pay given to the most trusted engine drivers on the great lines running northward and westward from London, and the trains of which are unsurpassed for speed and excellence. The Great Western Company give the high pay of \$2.75 per day, besides a bonus of \$50 per annum to a few veterans in the service, drivers of expresses. The \$2.75, among others, is the "compensation" of the dauntless, iron-sinewed charioteers who drive the "Flying Dutchman," fastest train in the world, from London to Bristol.

On most of our great lines of railway, the hours of duty of the engine driver, like the hours of work of the guard, vary from day to day. The driver generally follows a time bill under the regulations of which every week day gives him

a different train, with additional changes on Sundays, the whole so arranged that he has alternately day and night duties, and has besides about one half of the Sundays in the year for days of rest. Experience, the guiding principle in all railway management, has shown that this system is the best that can be made, and it is certain that, as it works well, so it gives thorough satisfaction to the drivers, more especially to those best able to form a judgment, the veterans of the service.

Considering the extremely fatiguing nature of his duties,

Fig. 1



SNYDER'S LADY'S WORK TABLE.

his exposure to the rain and wind and all the extremes of heat and cold, and the wear and tear of mental anxiety he has constantly to undergo, and which reaches a climax when snow and fog, his great enemies, obstruct his outlook, the work of the engine driver is truly astounding as to its extent and amount. The average distance traveled over by the drivers of passenger trains on our smaller lines, as representative of which the South Eastern may be taken, is 800 miles a week, or about 40,000 miles a year; but this average is far surpassed by the drivers of the great express trains on the lines north of the Thames. A careful calculation of the distances traveled by the Great Western driver, whose time bill has been analyzed, shows that, in the course of one year, commencing November 4, 1873, and ending November 3, 1874, he hauled his trains, often at express speed, over 65,323 miles of ground, being an average of 1,256 miles per week. It seems terrible work; still the veteran here referred to, upwards of twenty-two years in the service of the Great Western, testifies, with many others, to the fact that the exertions gone through, great as they are, do not only not affect the health of a strong man with good nerves, but fortify his constitution, so as to harden it against age and disease. It is certain that engine drivers, as a class, look extremely florid and healthy, and mostly younger than they really are. No doubt they get abundance of ozone into their lungs; and if they will only stave off the enemy rheumatism by good flannel armor and temperance—the latter universal among the best drivers, not a few of whom are teetotalers—they have as much chance of living to the age of Methuselah as any of the most favored classes of the community, including country parsons. Besides, great as are the physical hardships which the engine driver has to undergo, there is some compensation for it, as for most things, in a corresponding feeling of elation, which no habit can altogether destroy, from flying through space with enormous swiftness. If Dr. Samuel Johnson held it the greatest joy of human life to travel in a post coach with four horses at the rate of twelve miles an hour, the man who rides the Flying Dutchman must surely feel at times, if not always, a joy of superhuman intensity by getting through space five times as fast—at a greater rate of velocity, indeed, than anything that ever moved on the face of the earth, except a cannon ball. There are men of birth and education, who, properly trained, act occasionally as engine drivers—a well known instance of the kind exists on one of our southern lines—and they confess that there is an excitement and a charm, that nothing can excel, in the riding of a fire horse. It may be said of the engine driver, as of no other mortal man: "He hath his way in the whirlwind and in the storm."—*London Railway News.*

A Large Magnet.

The Sheffield Scientific School, says a contemporary, has just received a very important addition to its physical apparatus, in an immense electromagnet, together with the accessories necessary for the study and illustration of magnetic phenomena. This splendid apparatus has been presented to the school by its ingenious and enterprising manufacturer, William Wallace, of Ansonia, who for many years has made a special study of electricity and magnetism, and for his own use has constructed some of the largest and most efficient pieces of apparatus ever employed in this department of physics. This great magnet, for which the Sheffield school is indebted to Mr. Wallace's deep interest in its work of scientific training, is only second in size, it is believed, to one other in the country, which was also made by Mr. Wallace a few years ago, and was purchased by the Stevens Institute of

Technology. The Yale magnet weighs altogether nearly half a ton, and is capable of lifting, it is said, twenty times that weight, or over ten tons, when in full action. The public, it is presumed, will have an opportunity of seeing it in operation before long, as one of the lectures in the mechanics' course, now going on at the school, is on the subject of magnetism.

Washing Out the Stomach.

Dr. Ewald, of Berlin, Prussia, is said to have been very successful with the process some time since devised by him for washing out the human stomach. "For this purpose, a piece of ordinary india rubber tubing, such as is used for gas lamps, and about six feet long, is employed; one end is rounded, and two holes are punched at a short distance from the end. This tube is found to possess quite sufficient rigidity to be passed without difficulty into the stomach. To the outer end a funnel is fitted, into which is poured either water or a solution of soda, etc., according to circumstances. If the contents of the stomach are to be removed, the outer end of the tube must be sunk to the level of the pubes, or even lower; then the patient must make a short but forcible contraction of the abdominal walls. By this means the tube is filled to its highest point with the fluid contents of the stomach, and becomes a siphon, the liquid continuing to flow until there is no more, or until the tube is stopped up. This latter seldom occurs, if the tube be of moderate caliber."

This is certainly a novel treatment, but one which we would not advise any of our readers to try. We think that the running of an india rubber tube down into the stomach, and pumping water into it, is a ticklish operation.

IMPROVED SAD IRON.

A simple form of detachable handle is illustrated in the annexed engraving, the object of the device being to economize space on the stove or range, and to obviate the use of fixed handles and iron holders, thus offering advantages both in point of economy and of convenience. The standards of the handle are jointed together, and at their widest branching portion receive a rod. One end of the latter is threaded, and passes through a movable nut in the standard, at A. The other extremity passes through a square aperture in the opposite standard, and carries a pivoted cam, B. The wooden handle is supported by the rod between the standards, as shown. Below the joints the standards terminate in two vertical pieces, which are of proper size to fit into holes bored close together near the center of the top of the flat portion of the iron, and slightly inclined from each other from the top downward. When the cam, B, is pushed down, after said pieces are inserted in the holes, it presses the standards toward the handle so as to cause the parts to bind in the holes, thus securing iron and handle firmly together.



Fig. 2



Raising the cam, of course, releases the portions. A sectional view of the iron, with handle in position, is given in Fig. 2.

In order to adjust the handle it is removed from the iron, and the nut, at A, inserted in the square hole, C. This holds the nut as the handle is turned to regulate the binding pressure of the standards, and to adjust them for holes of varying distances apart.

We are informed that this device obtained the highest premium at the recent Mechanics' Fair in Boston. Patented through the Scientific American Patent Agency, July 14, 1874. For further particulars regarding sale of shop rights to manufacture on royalty, address the inventors, Messrs Rathbun & Shaw, 209 Union street, Worcester, Mass.

A MACHINE HORSE.

The annexed illustrations are reduced facsimiles of the drawings attached to the specification of a machine horse, recently patented in England, and with reference to which sundry paragraphs have appeared in many of our contemporaries on both sides of the Atlantic, and to which allusion was recently made in these columns. The invention will elicit a greater degree of interest for its oddity than for its practicability; in fact, we fail to perceive how the oscillation of a heavily weighted lever would be sufficient to develop power enough to give the machine the tractive force of a horse. If the inventor means that this oscillation is to be imparted by hand (and we see nothing to the contrary in the specification, nor anything mentioning the use of a superior force), then we fear that he has fallen into the too common error of supposing that machinery can generate power. However, the device is quite a curiosity, and hence we submit the drawings, with the following brief description, to the investigation of our readers.

Fig. 1 is a sectional elevation. Fig. 2 is a plan view from beneath. The shape of the frame, A, is that of an elongated triangle, and the materials are cast iron and wood. K is one of the two balance levers, each loaded at the ends with two iron balls which are filled with either mercury or lead. These levers are pivoted and are attached to the sector, J, which gears with the pinion, I, and this last engages with the rack, H. The rack rests and slides to and fro on fixed pulleys, L, and communicates with the connecting rod, H, giving the same, as the balls oscillate to and fro, a reciprocating motion, and thus, by the medium of a crank, rotating the gear wheel, B. The last meshes with the pinion, G', of the wheel, G, and thus rotates the cog wheels, D and E. These cog wheels are upon axles which are journaled in the frame, and which, on either side of the wheels—these being arranged in the center—carry a pair of legs. Consequently the forward axle, marked No. 3, actuates the fore legs, while the rear axle, No. 4, actuates the hind ones. There are, however, two pair of legs on each axle, each pair being in one, and the axle passing through the center, and the pairs on the same axle being set at right angles to each other. This will be understood by reference to the engraving, in which F F, full lines, show one pair, and F F, dotted lines, the other. Similarly at G G, in the rear axle. The disposition of the legs is such that two feet strike the ground at a time, and these are diagonally opposite each other: for instance, the left fore and right hind foot, and vice versa. Pivoted hoofs are provided at the pedal extremities, which, it is claimed, afford a clinging purchase. Guiding is accomplished by manipulating the lever, Q, which, by suitable interposing gear wheels and chain bands, turns the steering wheel, U. The rear wheel, T, sustains the main portion of the weight of the machine.

M. Charles Bret, captain in the French army, is the inventor, and he thinks that the machine, with the trotting feet uncoupled, might advantageously be used as a driving engine, an idea to which we must decline to agree, at least until some one convinces us of the utter fallacy of all generally accepted mechanical truths.

Railway Reflections.

Has not the railway affected, influenced, altered yea, directed, the drift—the direction, of human thought? We are all influenced by the circumstances that surround us. Who is there that is independent of the material or the social phenomena of his time? The mode, manner, and style of locomotion used by man influence his being, molding his character and affecting his habits of thought and action. The fashion of our motor power controls our feelings, and affects our emotions. To mount the horse is to partake of his nature—to sympathize with his spirit, bound, curvet, or caper, as his sportive mood may suggest. When we are seated in the railway carriage do we not mentally snort in accord with

the iron steed—take pride in his speed, and glory in the force with which he devours distance? How different is the feeling of a man who is carried in a palanquin, or towed in a canal boat, from that of one who is whirled along in an express train, with a telegraph caution ticking in front, and a way train whistle screaming in the rear!

The railway has enforced habits of promptitude, illustrated the value of time, and shown the power of discipline. On the disk of our railway dial, no shadow is allowed to linger. Our time tables are as absolute as the laws of the Medes and Persians; the locomotive has employed our legislatures to

lent should be subject to special state supervision; and they submit that an officer should be empowered to require that the best practicable means be taken not only to prevent the poisoning of the air by the volatilization of the arsenic, but also to hinder the access of the poison to running water.

The Art of Thinking and the Habit of Observation.

We have frequently directed the attention of parents and instructors to the importance of teaching children to think, and we now quote, from the Philadelphia Ledger, some apposite remarks on the subject.

"In very early life, the perceptive faculties are the principal channels through which we can reach the mind. Closely connected with this subject is the cultivation of the thinking powers. The two are indeed so intimately blended that neither can be effectually improved without some increased development of the other. In learning to see and hear with delicate accuracy, we insensibly strengthen our powers of thought, and accustom them to work more effectively. Still the operation of thinking deserves a far more systematic training than it usually obtains.

"When we are striving for success or excellence in any special pursuit, we think to some purpose. Our will concentrates our thoughts to the point in question, dismisses

BRET'S MECHANICAL HORSE.

devise new codes of laws for its government, and engaged our judges in interpreting its rights and privileges. Into every grade of modern society, the interest of the railway has extended.

The multitude of engineers, mechanics, workmen, clerks, and conductors who are kept employed in this service would be difficult to estimate; they constitute a large section of the population, a standing army of industry; and what an enormous supply of iron, timber, coal, oil, and other natural products the railway demands every year! In the manufacture of its necessary supplies, how many new trades have sprung up and are supported!

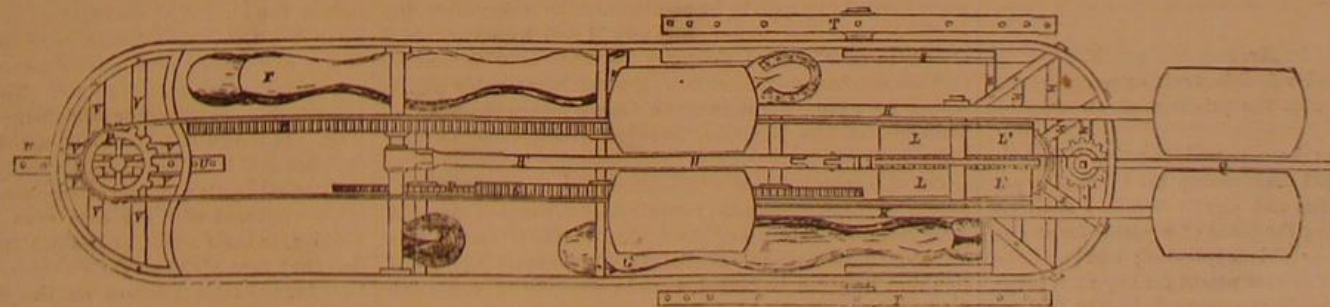
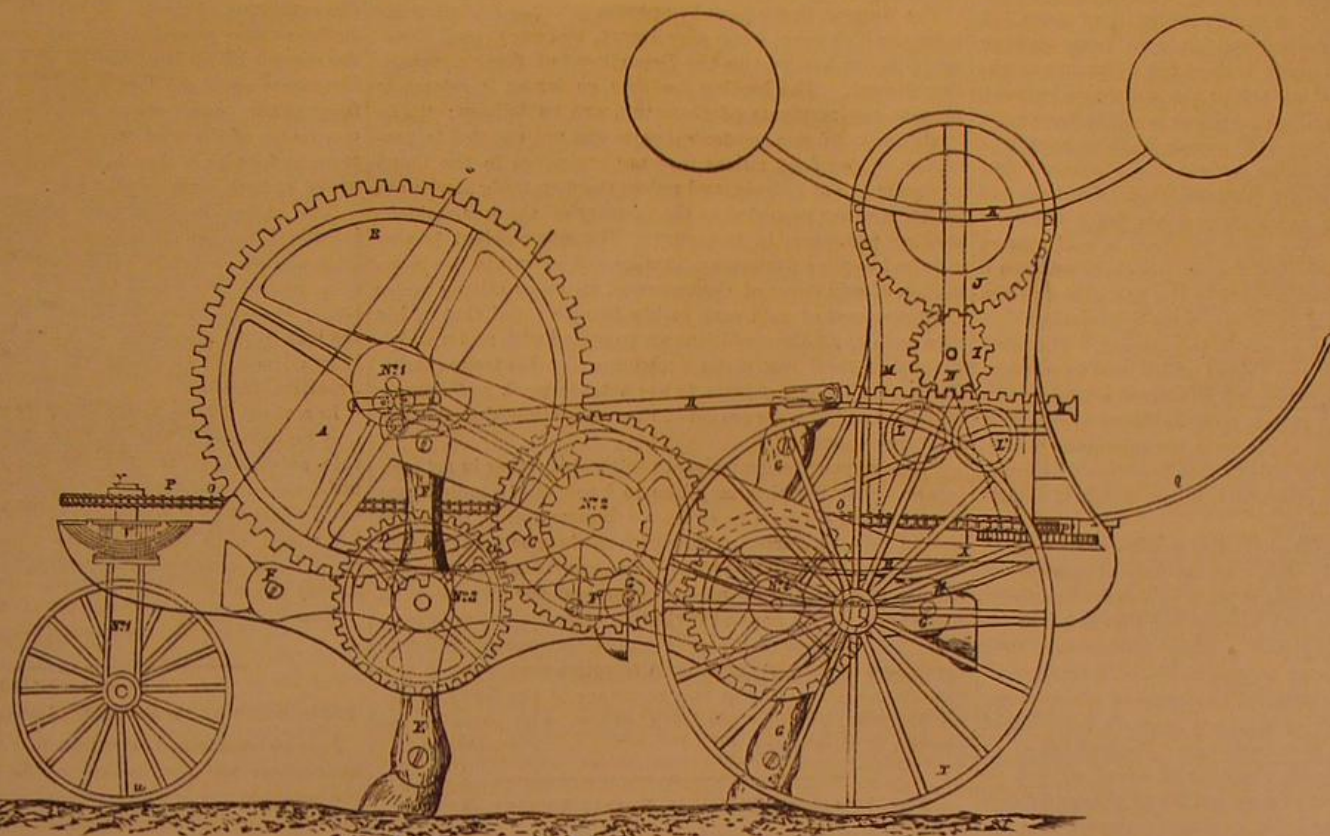
The property of our railways dominates the money market of the country. The capital of our time has run so largely into railways that every one who owns any surplus may be said to have an interest in railway property. It would be interesting to calculate the proportion of capital invested in railroads, as compared with banking, manufactures, insurance, or even agriculture.

summarily all irrelevant subjects, presents the matter in its various bearings, with some degree of logical sequence, and rarely allows the mind to drift away from it until some definite result has been obtained. There is a considerable portion of every one's time in which nothing but thinking can be done. There is time spent in cars, where even reading is injurious; and there are times of waiting, resting, and enforced inaction, when the mind has undisturbed opportunity for effective operation. Then, too, there are many employments so mechanical as to claim no portion of the mind's aid. When we have learned to do anything 'without thinking about it,' the thoughts necessarily run in other channels. Much manual labor is of this description. A distinguished prisoner of war, of large mental resources, being allowed to choose his employment while in confinement, selected one so simple as to require neither skill nor thought, assigning as a reason that, though his hands would be occupied by compulsion, his mind at least would continue his own and remain in freedom. We all have some of such work, and many

have much. Now, if we had learned to employ this time in clear and consecutive thought—if our will could control our reflections, directing them in definite channels, and aiming to reach some well defined conclusions—we can hardly compute how great an effect would be produced in strengthening our

mental powers, in maturing our judgment, in bringing us to the knowledge and appreciation of truth, and thus of increasing our solid happiness and our permanent value to the community.

"The best exercise of every faculty is the chief road to true enjoyment, and no one who has once tasted the pleasures of thinking to a purpose will ever willingly allow his mind to dissipate in wandering thoughts and day dreams. Neither is such discipline so difficult as some imagine. If begun in early life, by awakening the childish interest in what is seen and heard, alluring the mind to reflection by question and answer, and accompanying the thoughts to dwell for short periods, but intently, upon familiar subjects, it will become pleasant exercise, and gradually grow into the habitual tenor of the mind. What we truly will to do is already half accomplished; and the watch thus placed over the thoughts will, of itself, reduce to order and regularity much that is now chaos and confusion. It is by no means necessary that the subjects thus mentally discussed should be remote or abstract. On the contrary, let them be matters familiar to our minds and agreeable to our tastes. Let the memory please us with pictures of the past, and the imagination revel in beauty of scene or heroism of deed. Let the business man revolve the scheme which he longs to execute, and the philosopher meditate on the prin-



BRET'S MECHANICAL HORSE—PLAN VIEW

"As the overflow of the Nile enriched the plains of Egypt, so has the flood of railways over the land enhanced the value of the soil. The locomotive has virtually irrigated barren wastes, actually tempered the climate of inhospitable regions.

Probably no interest has been so largely promoted by the railway as that of real estate. Every farm has felt its influence. It has brought a market place to the farm of every husbandman; a customer to the workshop of every mechanic. Families are reunited; friendships maintained; intercourse established by the facility of railway travel. We eat, drink, sleep, live on the railway.—The Railway World.

The Production of Arsenic in Copper Mines.

In 1873, 5,449 tons of arsenic were produced in England. More than a third of it came from the Devon Great Consols mine. Sometimes 200 tons a month are sold from this mine, a quantity of white arsenic sufficient to destroy the lives of more than 500,000,000 of human beings. The Commissioners of Mines saw, stored in the warehouses of the mine, ready packed for sale, a quantity of white arsenic probably sufficient to destroy every living animal upon the face of the earth. The Commissioners consider that, in the case of mines in which arsenic is actually manufactured, it is only reasonable that the manufacture of a poison so viru-

ciples of life. But whatever be the subject, let the thoughts pursue it with a consistent progress that shall eventually in some real benefit to the mind."

Similar in nature and importance is the habit of rapid and accurate observation, the great value of which was the subject of an address to the Dairymen's Association, delivered by Hon. Horatio Seymour. In the course of his remarks, he said:

"It seems singular that some men pass through life without observing things which come before their eyes almost daily. An intelligent farmer once told me that he would not recognize any of the horses belonging to his neighbors, excepting those noticeable from some peculiarity of color. A Chicago merchant, who daily drove his own horse eight or ten miles, told us he had never noticed any difference in the movement of horses; did not notice the difference between trotting and pacing. A college president is said to have made the question 'in which way do the seeds lie in an apple?' a test of the habit of observation among his students. Our tests with this question would indicate that more than one half of the average men and women either don't know, or will answer incorrectly. We once received a well written essay on the value of observing closely, yet there was not a capital letter or a punctuation mark in the half dozen pages. Many such instances could be given, were it necessary."

"This matter is not one of slight importance. The carefully observant man will see things which will be of pecuniary importance to him, while his ill trained neighbor may lose by not seeing. The farmer with habits of observation will notice slight symptoms of illness in his animals or plants; will readily see the effect of this or that practice; will much more quickly discover countless little things which, if neglected, may result in serious loss."

"As in the case of habits generally, much can be done in childhood, and it certainly should be the duty of parents and other teachers to help children to learn to observe carefully, quickly, accurately. It is told by some one that in his childhood he practiced running past a shop window and then stopping to describe as many articles as he could recall, and in this way he acquired wonderful quickness of observation. There are hosts of points to which a farmer's boy should have his attention called at an early age. Suggestions as to the mode of growth of plants, the form of a leaf, growth of a fruit, or the pointing out of peculiarities of different classes of animals, may do him great good in developing this habit, and also have a marked effect in interesting him in his calling."

"This habit of observation should not be confined to the things we see alone, but should extend to the things we hear, and those we read as well. In this latter matter, there is great lack. Many read to little profit because they have not trained themselves to observe carefully."

Correspondence.

Notes from Washington, D. C.

To the Editor of the Scientific American:

In addition to the bill given in your issue for February 13, another has been introduced by Mr. Archer in the House, amending the acts relating to trade marks and labels, which provides for the registry of trade marks, labels, or stamps, for terms of thirty, ten, or five years, on payment of fees of \$25, \$10, or \$5, according to the length of the time applied for; but only half of the two first sums has to be paid in advance. It also provides for reissues and appeals to the District Courts for such cases, in the same manner as in patent matters.

Another bill, introduced by Mr. Hoskins, provides for the patenting of any new and valuable fruit or plant, for the term of seventeen years, with the privilege of an extension for seven years more.

In the Senate, a bill has been passed enacting "that the act approved March 9, 1868, authorizing the issue of a patent for induction apparatus and circuit breakers shall not be construed as authorizing the issue of a patent for any invention applicable to telegraphic apparatus; and any issue, under color of said act, of letters patent for any such invention applicable to telegraphic apparatus, is hereby declared to be null and void, as contrary to the meaning and intention of said act of March 9, 1868." This has reference to the patent granted to C. G. Page for his induction apparatus and circuit breakers, so extensively used in telegraphing.

Mr. Storm has introduced a bill into the House, which enacts "that it shall not be lawful hereafter for any person who has been appointed, or who may hereafter be appointed, as an officer, clerk, or employee in the Patent Office, to act as counsel, attorney, or agent for prosecuting any application for a patent, or an extension thereof, which was pending in said Office while he was said officer, clerk, or employee, nor by any means to aid in the prosecution of any such application, within four years next after he shall have ceased to be such officer, clerk, or employee."

A resolution has been adopted by the House, on motion of Mr. Young, of Georgia, "directing the Commissioner of Patents to inform the House whether patents are now issued for chemical compounds; and if not, why not?"

From all appearances, it would seem that the sewing machine lobby would fare badly, the Senate committee having reported adversely on the Wilson extension; and the House committee have agreed to report the same way, though, I believe, they have not yet done so. The temper of the Senate in this matter of sewing machine extension was shown in the case of John W. Marsh's application for an extension for a patent on a trimming attachment to sewing machines,

which came up on Monday last; and although no opposition was made, the bill was refused a third reading by the significant vote of ayes 13, noes 23—the fact that it had something to do with sewing machines being sufficient to kill it.

Notwithstanding this, it is possible that the Wilson extension may go through, as it is said that \$250,000 have been raised to influence the right parties to work for its passage; and they will do all that can be done to put the case through. As "there's millions in it," those engineering the matter will do their best, and, by watching their chances, as they did with the Batchelder extension, may succeed in their nefarious endeavors.

The German Parliament has passed an act to protect trade marks, which takes effect May 1 next, and our Consul General at Berlin has sent to the Department of State a translation thereof. The leading features, so far as it relates to persons not residents of Germany, are as follows: "The trade marks of non-resident traders are not entitled to protection in Germany unless they are registered in the Court of Commerce at Leipzig, and unless German trade marks are in like manner protected in the country of the non-resident seeking protection in Germany. The non-resident is also required to file a declaration that he will submit to the jurisdiction of said Court of Commerce in all cases arising under the provisions of said acts, and to furnish proof that in his own country all the conditions are complied with under which the non-resident can claim protection for his trade marks. The right of non-residents to use a trade mark in Germany is limited to the same period of time as is allowed to them in their own country."

Those of your readers who are interested either in art matters or women's rights may like to know that Vinnie Ream has secured a contract to execute a bronze statue, of heroic size, of Admiral Farragut, for which she is to be paid \$20,000. The bill authorizing this statue was passed some three years since, and a number of models were sent for inspection, in compliance with a general invitation given to artists to compete; but the committee in charge of the matter failed to agree, and at the last session the selection was referred to a commission, consisting of the Secretary of the Navy, General Sherman, and the admiral's widow, who awarded the contract to Miss Ream.

OCCASIONAL.

The American Institute Rotary Engine Tests.

To the Editor of the Scientific American:

It is an unfortunate trait in the genus *homo* that, as a rule he suffers defeat with a bad grace; and it appears to be an established fact that it is the American specimen which invariably takes the longest time to arrive at a knowledge of the fact that he is beaten in a contest. This peculiar feature of American human nature was quite felicitously illustrated in a conversation of the writer with one of the judges at the late Fair of the American Institute, who had served in that capacity for several successive years; he said, in effect, that when he essayed to judge of the merits of several competing exhibits, he always made up his mind, *a priori*, that, when his judgment was rendered, he would probably be named by all but one of the contestants in terms which, well, would not be appropriate in a religious, or even a scientific, journal. He, in that remark, illustrated very well the chief difficulty under which the American Institute and all similar bodies labor; and it appears to have been no better exemplified anywhere than in the case of the rotary engine tests at the late Fair.

After the results of these tests became known, two of the defeated contestants, and particularly the second best, made quite earnest attempts to bring discredit, by charges of unfairness, upon the writer; and now I see, by an editorial article in your issue of February 20, that, notwithstanding that the original recalcitrants were most irrefragably put to rest by the proper documentary evidence before the Board of Managers of the Institute, there yet remains another malcontent.

The article referred to ("Metalline, and the American Institute"), if not intended, is nevertheless calculated, to reflect upon me, notwithstanding the saving clause ("certainly in one acquainted with the gentleman will venture the assertion that he could be biased, even in prospect of a possible fat commission"); and I desire in reply to it, and in order to calm the troubled spirit of your protestant, or any one else who may be disposed to make themselves unhappy over the result of these rotary engine tests, to say a few words as to the method in which they were conducted, and the precautions taken against possible cavil. The reference to some supposed negotiations of stock, and subsequent business relations of mine with the proprietor of the successful rotary engine, strikes me as a very absurd kind of innuendo; something out of the line of the SCIENTIFIC AMERICAN, and altogether foreign to the usual good sense displayed in its editorial columns: I will, therefore, credit it to you in that view.

The writer, in the capacity of Superintendent of the Machinery Department of the American Institute, was directed by Professor R. H. Thurston, Chairman of the Committee of Judges, and by the Board of Managers, to test the competing rotary engines as to power and economy, and report the result to the Committee. In accordance therewith, I made all arrangements for and supervised personally every trial. I therefore hold myself responsible for any error or unfairness, if such can be shown. Professor Thurston, with his customary acumen and forethought, in consultation with myself, decided to send four of the graduating students of the Stevens Institute to attend each of these trials, in order, first that the results might not be questioned by the defeated contestants, and, additionally, to give the young men an op-

portunity to acquire a little practical information of a kind not so readily obtainable for them at the Hoboken Institute. As an additional precaution, one of the young men, at the conclusion of the trials, made copies of the log, and placed them in possession of Professor Thurston, where they now are. The original logs were left in my possession, from which to compute the results, and are now, with my official report, as a compendium of the report of the Committee of Judges, in possession of the American Institute.

The apparatus used was identical in every case, with the single exception of the brake, a different one being used with two of the defeated engines, in deference to the wishes of the exhibitors of them. When the engines had been run a sufficient time preceding the test to insure average conditions, the control of all instruments and apparatus, together with the recording of all data in the log, was turned over to the four young men above mentioned; and thence to the conclusion of the trial (five hours in each case) I had nothing more to do with it than to see that my instructions, and those of the Judges, were carried out.

Now unless the party from whom you "hear of a protest" intends to impugn the integrity of the young men (some 8 or 10 in all) who actually conducted the trials, as well as my own, he had better hold his peace; and he has every opportunity to check them for himself by consulting the copy of the logs in the possession of the Chairman of the Committee, if he is inclined to doubt the correctness of those at the American Institute.

In a word, I have to say to all (if there are any more) who may be inclined to feel discontented and uncomfortable on this subject that, if they will point out any irregularity or unfairness in these trials, or errors in the results obtained by me, I shall at all times be ready to answer any and all questions; and much desire that the "protest" you mention may make its appearance in some more tangible form than to be merely heard of.

New York city.]

JOHN T. HAWKINS,
late Supt. Mach. Amer. Inst. Fair.

Air Currents and Air Floats.

To the Editor of the Scientific American:

It is an ascertained scientific fact that the ocean and the atmosphere are correlative in their thermal values. The temperature of the water regulates the temperature of the air. It salts the air as well, and is of vast importance, in this regard, to the products of the soil and the constitution of the animals abounding adjacent to its direct influences.

Along our Atlantic sea board, we have a Gulf Stream pouring its equatorially heated water northeastward to the coast of Newfoundland, whence it is projected over the Atlantic to the coast of Ireland. It is a warm river, of several hundred miles in breadth, running across the Atlantic.

This river is as available for the floating of air ships from our sea board to England as was (and is yet) the Mississippi for floating flat boats from the Falls of St. Anthony to New Orleans.

A balloon, kedged in this stream, will necessarily float along its isothermal line, and it will float much faster than the stream, since the warm air correlated above it will flow in the direction of least resistance, which has an eastward tendency. Can we kedged the balloon in this ocean river? More easily than the water ship can be kedged to the channel of the winding river down which it floats.

With the device termed a droge, a conically shaped bucket float, open at its wide end, suspended at any desired distance from the balloon and fastened with two cords (one at the point, the other at the open end), it is easy to increase or lighten the burden of the balloon; in other words, to let her up or down without a discharge of ballast or gas. Professor Henry hints at the possible contingency of the interference of a cyclone in such an adventure. That is very thoughtful, but the same contingency holds with regard to sea ships as well. To the balloon, it would not be disastrous, as all the cyclones in this latitude are inevitably dragged eastward by the normal motion of the atmosphere, a meteoric fact too often witnessed with my own eyes while sailing in their vicinity, in their midst, or in their front. I know very well that they turn round on their common centers, and that they have innumerable vortices on their peripheries. The destructive vortices are caused by the interruptions on the surface, and would not, even if they extended to the height of the balloon, be dangerous to it.

Where there is a will, there is a way. Is there not in the land sufficient meteorologic intelligence, coupled with bounteous generosity, to send an air-tossed veteran through this channel for exploration, or some other willing adventurer, more competent than your obedient fellow citizen?

Philadelphia, Pa.

JOHN WISE.

Nitroglycerin as a Motor.

To the Editor of the Scientific American:

The idea (originating in a fertile French mind), of superseding steam by an explosive compound far more dangerous than gunpowder, may seem vague; and yet I can see but one obstacle to be overcome in order to make it a success.

The danger of untoward explosions may probably be avoided by keeping the components of the compound in separate tanks, and bringing them together in the cylinder, continuously, as required.

The wants of elasticity and the suddenness of expansion of this powerful substance will probably cause an unsteadiness of motion too violent to be overcome by ordinary machinery, and herein consists the great impediment to its use. And yet it may not be impossible to counteract this defect by employing heavy governors and fly wheels, and by also keeping the amount of the explosive (let into the cylinder at each stroke

of the piston) down to the minimum, so that it will be required to expend itself in keeping up continuous motion.

In adapting machinery for this use, the size of the cylinder could be reduced in proportion to the increase of the potency per square inch of nitroglycerin over steam.

In regard to the necessity of keeping the constituents of this potent substance in separate vessels until required for use, it is a marvel why this has not been required by law long ere now, as the frequency of awful explosions and the destruction of life and property are sufficient to call public attention to the subject. One might naturally suppose that the Lycurgus of "Free America" is just now taking a Rip Van Winkle vacation from his public duties.

St. Albans, Vt.

CHARLES THOMPSON.

[For the Scientific American.]

ANTS.

Every reader is familiar with the ants, at least as referred to in the Book of Proverbs, vi., 6: "Go to the ant, thou sluggard; consider her ways, and be wise." Again, in xxx., 25, we find: "The ants are a people not strong, yet they prepare their meat in the summer." Thus the Scriptures have noticed the habits of the ants, and their wonderful instinct has been described in several articles published in the SCIENTIFIC AMERICAN. The common ants, however, belong to the family *formicidae*, or genus *formica*, while my subject matter relates to the white ants, which must not be confounded with the common ants, as they belong to a different family, the *termitidae*, genus *termes*.

Those who are curious to read the wonderful accounts of the warrior termites (*termes bellicosus*, of Smeathman) will find the memoir of Smeathman copied in numerous works on natural history (Maunder; F. A. Pouchet, M. D., in the work called the "Universe," etc., page 185; Westwood, F. L. S., who, in his "Introduction to the Modern Classification of Insects," vol. II, page 11, illustrates and describes several species, all foreign to the United States). Mr. Fitch, in his reports on the noxious and other insects of the State of New York, section 196, says: "American white ant, *termes frontalis*, Haldiman (*neuroptera termitida*): Myriads of white ants, mining in and wholly consuming the interior of fence posts and stakes, while the outer surface remains entire." He also says it "is the only species of white ant which we have in the United States." These creatures I have been familiar with for some years, finding them in my rambles among decayed logs in the woods; but have not made microscopic examinations of the various individuals composing the colony, as I have of those I shall now introduce.

My neighbor, Mr. George Hensel, has an extensive greenhouse, and knows how to manage it. He set aside (on a broad shelf, covered with sand and loam, perhaps two inches deep) some choice pelargoniums for cuttings, also some geraniums, and among them a luxuriant echeverria, in the ordinary flower pots. The latter plant was set in its pot upon an empty inverted pot of the same size. Mr. Hensel discovered that these plants, from some unknown cause, were drooping, and to his surprise, in a few days after, discovered that nothing but a thin shell, apparently sound on the outside, was left of the roots and lower portion of the stem. He noticed among the debris and soil in the pot, a minute ant-like creature, to which he called my attention; this led me to investigate, and I found that these minute, blind creatures do all their mischief under cover; they build tubular, pendant passage ways (from an upper to a lower field of action) by agglutinating particles of sand, actually forming hollow "ropes of sand" (in which they ascend and descend) eighteen inches long. Under the sand on the shelf referred to, were tunnels as straight and direct as any engineer could make them, opening up directly under the hole in the bottom of the flower pot, by which they made their insidious approach to the root and stem of the plant it contained; and from this point beneath the pots, three to five such channels were noticed, radiating to various intersecting tunnels. But the most remarkable engineering skill was discovered in the inside of the inverted flower pot. In order to gain access to the roots of the echeverria above mentioned, their tunnels ended on the inner side of the pot at four points; then a tubular column of sand was constructed against the side of the pot (to which it was glued) to within a few inches of the top; then the tubes were built inwards, and met around the hole in the center of the bottom of the inverted pot, through which they established communication with the upper pot; and thus these sappers and miners, with consummate skill, made their attack so completely under cover that no one would suspect their presence, and without injury to the external epidermis of the stem of the plant. Their excavations are all confined to the interior of the plant, in this case a highly succulent one, belonging to the natural order of house leeks (*crassulacea*). The fact that they killed one dozen choice plants during December, 1874, proves them to be dangerous insects in the greenhouse. Numbers of winged specimens were discovered in the greenhouse on December 18; these shed their wings in the course of a few hours, and disappeared. Mr. Hensel tells me that he has for years known the common white ants; but the males and females became winged in May, and confined their mining to dry soft wood only. Kollar, in his treatise on insects, mentions the *termes lucifugum* and *ruficollis*, of southern Europe, "where they cause great damage to the olive trees." He writes also of a third species, which he termed *termes flavipes*, "found in the hothouse of the imperial palace at Schönbrunn, where they were, no doubt, introduced with foreign plants. This species does no injury to the living plants, but gnaws through the tubs in which they stand, and the other woodwork of the houses."

I mention these facts simply to warrant me in expressing

my opinion that this is a new species, notwithstanding that an eminent entomologist (to whom I presented the facts), on inspection, believes that they are the same as those mentioned by Mr. Fitch, as the American white ant. In that case one thing is certain, they have acquired a new taste, and now relish living, succulent plants, instead of dead and dry wood; or if they had such a taste before, it was unknown to our entomologists. Harris does not mention them in his work, that I can see; nor does any one else allude to their feeding on living plants, with the exception of those mentioned by Kollar, on the olive.

It is well to give publicity to these facts; perchance the same may have been experienced in other hothouses without the culprit being detected or the fact made known.

The ants figured by Westwood and other authors are similar to these, except the class called warriors, with their enormously large heads, fully equal to one half of the whole insect. These do not have the curved or sickle-shaped jaws, crossing at the regularly curved tips; but the jaws are stout, long, and parallel to each other, straight out, but nearly bent at right angles at the tips, which also cross each other near the points. The workers have also very large heads, with no traces of eyes visible on them. The soldiers, so called, are also similarly remarkable, and are all of a uniform dirty white color. Mr. Hensel tells me that the winged members were of a darkish brown color. There seem to be four distinct classes in each colony (Latreille says five, but he includes the larvae, pupae, neuters, males, and females). They are sufficiently remarkable, and, in scientific engineering, they put to blush some of our learned tunnelers, who, with all their eyes wide open and instruments, can not excel them in finding a point, and hence the ants are entitled to enter an appearance in so classical a paper as the SCIENTIFIC AMERICAN.

Lancaster, Pa.

J. STAUFFER.

A Harvest for Plumbers.

The long continuation of intensely cold weather has caused great trouble and discomfort in this city, by the freezing of water in pipes. Probably in more than half the houses the water in pipes has been frozen, or the pipes otherwise disabled. The trouble is generally in the street, where the pipes are most difficult of access, and it arises from the reprehensible practice of builders, who, after attaching the supply pipe to the main, carry the former up to within two or three feet of the surface of the street and then run it to the house, instead of running it in a direct line from the main pipes into the basement of the house, which is always so far below the street as to obviate all liability of freezing.

Persons erecting their own dwellings generally see to having the supply pipe laid as low as the main, or sufficiently deep to prevent the liability to frost; but builders who erect houses to sell save a little by avoiding excavating deep enough to lay the supply pipe below a freezing point, and hence the cause of so much trouble in our households. At the present time there are not good plumbers enough in the city to attend to all the demands, and those skilled in the business are put to their wits' end to execute all their orders.

Effects of Poisons on Molluscs.

Professor William North Rice, of Middletown, Conn., states that among the most interesting results of his experiments was the observation that certain poisons, which act with extreme violence upon the mammalia, are very feeble in their action on mollusca. This is especially true of hydrocyanic acid and woorara. Specimens of *ilryanassa obsoleta*, immersed in dilute hydrocyanic acid on Friday, showed somewhat feeble signs of life on the following Tuesday. A specimen of *lunatia heros*, into which a quantity of woorara had been injected, was found the next day to show no sign of any injury. Indeed, both of these poisons seemed to produce death very little sooner than the animals would have died in stale water. The sudden introduction of a large amount of carbonic acid in the manner which has been described, seemed to produce no decided effect. On the other hand, chloral hydrate seems to be very suddenly fatal, the animals treated with it becoming instantly contracted, and not resuming their activity when kept for a number of hours in sea water. Cyanide of potassium is similar in its effects, though not quite so instantaneously fatal. The effects of quinine are similar, though less energetic. Chloroform produces instantaneous contraction, and probably death.

Mammoth Cave Fishes.

Interesting additions to our knowledge of the fauna of the Mammoth Cave have recently been made by Mr. F. W. Putnam, of Salem, Mass., who, as a special assistant on the Kentucky State Geological Survey, of which Professor N. S. Shaler is the director, had great facilities extended by the proprietors of the cave, and he made a most thorough examination of its fauna, especially in relation to the aquatic animals. Mr. Putnam passed ten days in the cave, and by various contrivances succeeded in obtaining large collections. He was particularly fortunate in catching five specimens of a fish of which only one small individual had heretofore been known, and that was obtained several years ago from a well in Lebanon, Tenn. This fish, which Mr. Putnam had previously described from the Lebanon specimen under the name of *chologaster agassizii*, is very different in its habits from the blind fishes of the cave and other subterranean streams, and is of a dark color. It lives principally on the bottom, and is exceedingly quick in its motions. It belongs to the same family as the two species of blind fishes found in the cave. He also obtained five specimens of four species of fishes that were in every respect identical with those of Green river,

showing that the river fish do at times enter the dark water of the cave, and when once there apparently thrive as well as the regular inhabitants. A large number of the white blind fishes were also procured from the Mammoth Cave and from other subterranean streams. In one stream the blind fishes were found in such a position as to show that they could go into daylight if they chose, while the fact of finding the *chologaster* in the waters of the Mammoth Cave, where all is utter darkness, shows that animals with eyes flourish there, and is another proof that color is not dependent on light. Mr. Putnam found the same array of facts in regard to the crayfish of the cave, one species being white and blind, while another species had large black eyes, and was of various shades of a brown color. A number of living specimens of all the above-mentioned inhabitants of the waters of the cave were successfully brought to Massachusetts after having been kept in daylight for several weeks, proving that all the blind cave animals do not die on being exposed to the light, as had been stated.—*Nature*.

SCIENTIFIC AND PRACTICAL INFORMATION.

A TUNNEL UNDER THE STRAITS OF GIBRALTAR.

A company has recently been formed in Spain, under the title of the Inter-Continental Railway Company, the main object of which is to unite Europe and Africa by a tunnel under the Straits of Gibraltar. This one, as projected, is to be a right line, extending between Tarifa and Algeiras on the Spanish coast to Ceuta and Tangier on the Morocco shore. The submarine portion will be 44,160 feet in length, or nearly nine miles.

This enterprise offers more difficulties than the similar work under the English Channel, although the latter will have more than twice the length. The maximum depth of the Channel at the point to be traversed is but 163-2 feet, while that of the Straits is 2,621 feet. Supposing that the tunnel under Gibraltar be bored at a distance of 1,000 feet under the bed, its total depth under the sea level would be over 3,600 feet, while the entry and exit galleries would be each three miles in length.

SULPHUR AS A FIRE EXTINGUISHER.

M. Tellier suggests the use of sulphur as a means of extinguishing fire on board ship. The material when burning in the air, as is well known, generates sulphurous acid, in which flame is not sustained. M. Tellier proposes to cover wicks with the sulphur, and to let them down into the burning portion of the vessel, through holes in the decks. Sixty-six pounds of sulphur ignited will entirely absorb the oxygen in 3,360 cubic feet of air; but as only half the oxygen need be removed in order to render the atmosphere unfit to support the combustion, thirty-three pounds are sufficient for the volume mentioned.

Stove Manufacturers in Council.

The stove makers of the United States recently held a convention in Chicago, and adopted the following resolutions:

"Your committee will call to your notice the question of guaranties exacted, by the retail dealers throughout the country from manufacturers, relative to the breakage of castings. Your committee are fully satisfied that the persistent claims made upon our trade for castings to be furnished free of cost upon the simple demand of the retail dealer, and under whatever pretext, has become burdensome and oppressive, and your committee respectfully recommend that in future all guaranties of this character be wholly discontinued."

"Your committee desire to urge upon the convention the great importance of procuring the passage of a law by the Congress of the United States for the protection of the trade against those persons who take our castings and file and fit the same for the purpose of making duplicates therefrom, and supplying the retail trade in the various towns and cities of this country at prices far below the cost of such castings in our own foundries. Every member of the convention must see and feel the great importance of an effort upon the part of not only the convention, but of every member of the organization throughout the country, to put an end to this unwarrantable confiscation of our rights as manufacturers and dealers."

The latter resolution was referred to the Executive Committee. We do not see what more effective laws the stove manufacturers can wish for their protection than they now have. Under our existing patent laws, the most ample protection is afforded the inventor for either any new construction or any ornamental design.

SCHEDULE OF PRICES.

The Committee on Prices submitted the following report, which was unanimously adopted:

"Your committee, having carefully considered the subject referred to them, recommend the adoption of the following basis of prices: The price on common stoves to be 64 cents; for the medium class, 7 cents; for the first class, 8 cents; for odd plates, 8 cents; with a suitable amount added for plated knobs, reservoirs, and other extras."

The convention adjourned to meet next June at St. Louis.

Our staid cotemporary, the Boston *Daily Advertiser*, in alluding to the impracticable measures under discussion by the advocates for rapid transit in this city, and the twaddle on the subject in the daily newspapers, thus sums it up:

"If they want quick transit in New York, why don't they stop talking and go to work and get it? If they are only fooling, they had better go to a business medium. She will doubtless trance it as quickly as anybody."

On February 10, a fire broke out in the city of Port au Prince, Hayti, caused by the explosion of a kerosene lamp; and the result was that a large portion of the city was destroyed. One thousand buildings, mostly frame, were burned. The city authorities will now, probably, be willing to purchase fire engines, of which they were almost entirely destitute.

IMPROVED SELF-HEATING FLUTING AND SAD IRON.

The invention herewith illustrated consists of two flat and one polishing irons combined in one, to which, when desired, and by simple means, various fluting irons may also be attached. The essential feature is that the device is self-heating, as its interior contains arrangements whereby gasoline or other light petroleum product is consumed. This, the inventor claims, is easily and safely accomplished at a cost of not over one cent per hour.

The engravings represent a perspective view, Fig. 1, and a sectional view, Fig. 2, the former showing the iron with the fluting attachment in position. The body of the device is three-sided, two sides serving as flat irons and the other having rounded edges for polishing purposes. The rear portion, A, is detachable, and is seated, by means of its flanged hub, upon the fluid supply pipe, B, so as to turn freely upon the latter. It is locked to the body by hooks and shoulders below, and by a spring latch, C, which engages with an inclined shoulder of the body. Suitable perforations are provided in the latter at the apex, corners, and rear, in order to admit sufficient air to the interior to support complete combustion of the hydrocarbon. The supply pipe, B, is firmly secured in the handle stock, D, and passes at a slight inclination into the lower portion of the oil reservoir, E, which last is fastened to the stock. The spring latch, F, shown at the middle of the stock, catches in a recess on the rear portion. A recess is provided in each corner of the latter, so as to fasten the handle similarly when any one of the three faces is turned down into use. G is a pivoted top latch placed beneath the protecting shield, H, which drops into other recesses at the corners of the body and so gives additional support to the handlestock. In order to detach the latch, E, a curved rod, provided for the purpose and shown on the right of Fig. 2, is pushed into the opening at the corner of the body, so that its end shoves the latch clear of the shoulder.

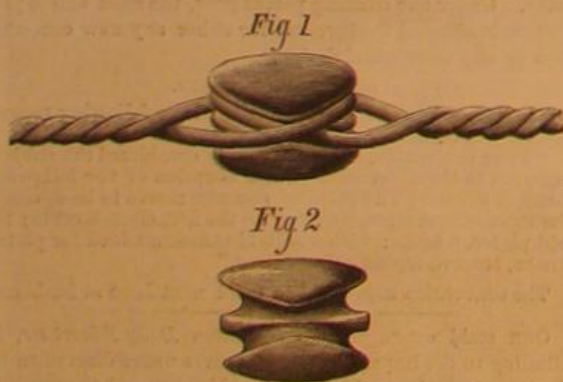
The gasoline is introduced into the reservoir through the faucet shown above, the latter extending down through the receptacle and being seated in the solid portion of the same at the entering point of the supply pipe. Into the latter the oil passes through a groove cut along the faucet, connection being opened or closed by suitably turning the latter. The upper end of the faucet has an orifice for pouring in oil, which is closed by a suitable plug, and also a small vent hole for letting air into the receptacle. By turning this stopper on its seat, the air communication may be closed, thus preventing any escape of the liquid into the supply pipe. The latter, on its outer end, carries a cap piece, back of the flanges, in which small issuing orifices are made. The oil is fed uniformly through cotton or similar material placed in the supply pipe. A burner, I, of triangular shape, divides the flame which heats the sides of the iron.

Fluting irons, J, Fig. 1, of various shapes, double or single, are attached by rear and side lugs, the latter being secured to a V-shaped spring wire, K, which is held by the locking spring, L. This last is seated in one of the corner air holes of the body, and serves to complete the firm connection.

Patented February 2, 1875, through the Scientific American Patent Agency. For further particulars relative to sale of territory and rights, address the inventor, Mr. C. R. Rand, 568 Mission street, San Francisco, Cal.

IMPROVED BALE TIE FOR WIRE BANDS.

Wire bands, for confining pressed bales, have, within a few years, to a great extent superseded ropes and wooden hoops, which change is due to the economy, strength, and neatness of wire for this purpose. To obtain the full advantages of its use, the bends should be made large, as short and abrupt bends weaken the wire.



The tie which is here illustrated is a block of cast iron made in a single piece. By multiplying the patterns a large number can be molded at a time in a single flask. Upon this block, and extending entirely around it, are two similar grooves crossing upon opposite sides of the block. These grooves each receive an end of the wire, so that the wires, when placed in them, cross each other, which brings the two wires into such a position that they draw from the same side of the block, consequently it cannot turn over or be upset by any strain, however severe; and as the wires draw against each other, the strain upon the tie is compressive instead of tensile. This renders the use of cast iron practicable for the purpose. As the wires conform to the bottom

of the grooves, they have an easy bend, and retain their full strength. When the angle of the grooves to each other is sufficient to admit of its being done, a spur is placed between them, as shown in the engraving, the object of which is to confine each wire to its own groove. But when the angle is too acute to admit of this, the spur is then placed in one of the grooves over against one side of the tie. Each form has its advantages, depending upon the size of the wire. Before putting the band on the bale, an end of the wire is twisted into one of the grooves, and the other end twisted into a loop, which will just slip over the tie and pass into the other groove. For inserting the tie and forming the loop, the inventor has devised a simple hand tool, with which the purchaser can prepare his own bands. After the bale has been released from the press, the expansion will draw the wire tightly into the groove and change its shape, so that it cannot unhook in handling. The illustration shows a full sized

Fig 1

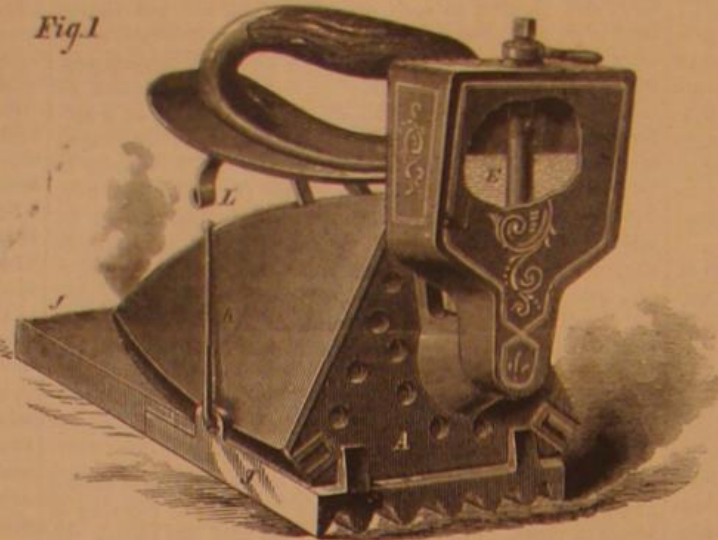
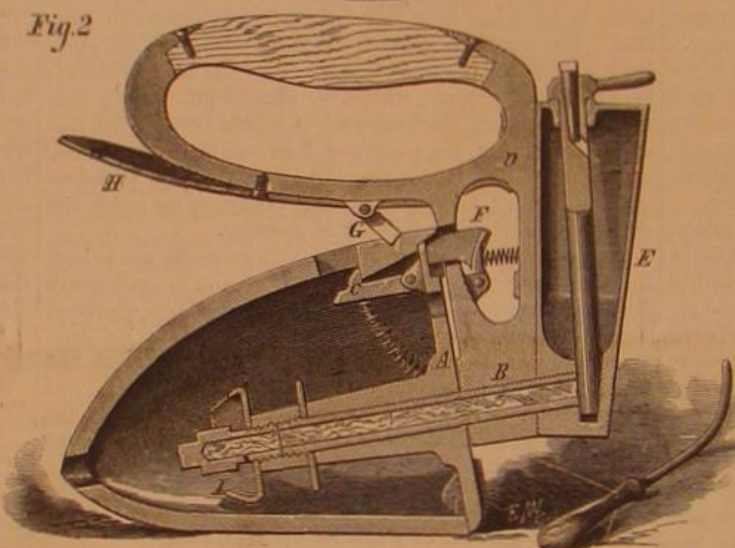


Fig 2

**RAND'S SELF-HEATING FLUTING AND SAD IRON.**

tie for an ordinary hay band, but a more correct idea of its size may be formed by comparison with a one cent nickel coin, which has the same diameter.

A patent has been allowed for this invention, to James M. Albertson, New London, Conn. Information regarding the right to manufacture can be obtained by addressing him as above.

CYLINDRICAL STANDARD GAGES.

Those who have been familiar with the improvements made in machine work, for a few years past, will be able to trace the important influence resulting from the use of accurate and finely divided rules in producing more uniformity in measurement in the different workshops and in the improvement in the quality of individual workmanship. Rules graduated to sixty-fourths and hundredths, and vernier calipers reading to thousandths of an inch were, a few years since, looked upon as hardly of practical utility in machine shops. But in addition to such rules, which are now indispensable, fixed standards are frequently needed for those diameters most used, in order to avoid the errors resulting from measurements taken from rules and vernier calipers, and also to save time. Such standards are of constant use in all regular machine work and are especially valuable because they tend to produce uniformity and interchangeability in the parts of machinery manufactured.

The accompanying engraving illustrates a form of gage claimed to meet this requirement. The first cost is small; and in case of accident or wear from constant use, the device can be readily replaced. Standards of this kind have heretofore been so costly as not to admit of their use



by workmen generally, and therefore machine makers have not realized the advantages which will result from their daily use. The diameters are stamped upon each gage in thousandths of an inch, and also in the ordinary fractional parts. The gages are made of best cast steel, hardened and ground accurately to sizes indicated. Parties interested can obtain further information by addressing the Brown & Sharpe Manufacturing Company, at Providence, R. I.

Useful Recipes for the Shop, the Household, and the Farm.

To renovate old feather beds, when no steam apparatus is convenient, put them outdoors during a heavy rain. Let them dry in the sun, beating them occasionally with sticks to loosen the feathers. They should be turned over several times, and thoroughly dried. A paste of soft soap and starch will take stains out of bed ticking. Spread it over the spots.

When dry, scrape off and wash with a damp sponge.

A good cheap paint for floors is made of five pounds of French ochre, one quarter of a pound of glue, and a gallon of hot water. When well dried, apply one or two coats of linseed oil.

Stains on wall paper can be cut out with a sharp penknife and a piece of paper so nicely inserted that no one can see the patch.

Do not use martingales on working teams. See that the hames are buckled tight enough at the top to bring the draft iron near the center of the collar. If too low, it not only interferes with the action of the shoulder, but gives the collar an uneven bearing.

In removing ink spots from delicate colors, a concentrated solution of sodium pyrophosphate may be employed when oxalic acid or chloride of lime cannot be used without injuring the color.

A membrane of extraordinary firmness may be obtained by dissolving collodion cotton in equal volumes of ether and absolute alcohol, to which a small quantity of balsam of copaiba is added.

Brass, when laid in a leaden vessel containing hydrochloric and a little arsenic acid, assumes iridescent colors, and may be removed when any desired shade of blue is obtained.

A new case-hardening compound, said to be very efficacious for iron, consists of 16 parts lamp-black, 18 of sal soda, 4 of muriate of soda, and 1 of black oxide of manganese.

To clean flasks which have contained resinous solutions, wash with caustic alkaline lyes and rinse with alcohol; if they have held essential oils, wash with sulphuric acid and rinse with water.

Blocks of wood intended for veneers may be steamed in a solution of borax and ammonia. They will then become soft and easy to cut, and, beside, will retain their flexibility for a long time.

Tracing paper, from which a drawing may be removed by washing, is prepared by first saturating writing paper with benzine, and then immediately coating it lightly with a varnish composed of boiled bleached linseed oil, 20 parts; lead shavings, 1 part; oxide of zinc, 5 parts; Venice turpentine, $\frac{1}{2}$ part. Mix, boil for 8 hours, and, after cooling, add white gum copal, 5 parts, and gum sandarac, $\frac{1}{2}$ part.

LIFE-PRESERVING MATTRESS.

Mr. J. F. Peck, of Springfield, Mass., is the inventor of the novel form of life-preserving mattress represented herewith. The body of the article is stuffed with cork, and it has a pillow or cushion at each end, by means of straps on which it is secured to the person, as depicted in the illustration. The device is designed as an ordinary berth mattress,



and thus requires no extra space for separate storage. When adjusted, it sustains the wearer's head and shoulders above water, and at the same time protects the body from injury by floating wreck, or in coming in contact with rocks. Several of these mattresses, secured together and attached to spars, will make a life raft. Patented March 21, 1874.

Another American Invention Abroad.

Mr. J. W. Cole, to whom we are indebted for the drawing and description of the miner's shaft published a few weeks ago, is traveling on the European continent in the interest of the Tanite Company, of Stroudsburg, Pa. He sends home a description of his visit to the works of the *Société de la Meuse*, at Liège, Belgium. He found them using one of their E machines with Tanite wheels. They had two men working on one wheel, and these men were grinding annealed files, which were to be again annealed and then recut. They claimed that these two men did the same work that it formerly required four to do.

This is another instance of the adoption of American machines on the continent. We believe that file manufacturers and recutters in this country have not yet generally adopted Tanite wheels. Is the subject not worthy their attention? It would seem to be, from this account from Belgium.

THE BRETON CATTLE.

We publish herewith a well executed engraving of the bull of the breed of cattle common in Brittany, the extreme north-western province of France; and it is questionable if there is a domesticated member of the genus *bos* more fully fitted for its situation or surroundings—the right beast in the right place. Living on a poor granitic soil for the most part, among the broom, which, with the scrubby herbage intermixed, forms their chief and in many cases only nourishment, they live and they thrive. Hardy as West Highlanders, Welshmen, or Kerrys, doubtless they are not; the climate of Brittany, though bleak and foggy and ungenial compared with other provinces of France, is less so than that of the mountainous districts of the British islands. Then local circumstances modify considerably the calls made on the hardihood of the breed; they are housed at night, and kept indoors in stormy weather—for the wolf still stalks a dreaded devastator over the length and breadth of Brittany. Shelter and safety, however, are about the extent of what the owner's roof affords (and which in many cases is shared with him as fully and closely as that of Paddy with his pig). A scanty dole of bog hay, and haply a ration of pounded gorse or furze, is all the cottager and the small farmer (who form the majority of the agricultural class) have to bestow.

The effect of such treatment shows itself, as might be expected, in the diminutive size of the breed; and a proof of this being an unmistakable case of cause and effect is the fact that, in every locality to which the breed has been introduced, where the soil is of higher fertility or the system of culture such as to afford good ordinary forage, in a generation or two the progeny becomes changed; the poor, slight, attenuated frame, with the hinder extremities frequently what is called cat-hammed and the concomitant indices of early starvation, develops and expands, and assumes the form of a deep-carcased, shapely

animal. It preserves the deer-like head and limbs of its upland progenitor, and surpasses, in the opinion of most people fitted to judge, in its general conformation as a specimen of what is wanted in dairy stock, the far-famed and justly admired Ayrshires—the breed of milk cows, certainly the hardiest as to short and coarse keep that Scotland produces, and which on this latter point at least must yield the palm to the Brittany.

The Ayrshire breed was to some extent introduced into Brittany some years ago, with the intention of effecting improvement in that district; but the effort has proved for the most part an evident failure. The cross formed does not maintain itself on the keep at the disposal of the poor farmers, who form nine tenths of the bulk of the tillers of the soil.

Our engraving, selected from *The Field*, also shows the rustic costume of the peasants of Brittany, who, like their cattle, are endowed with a vitality persistent in spite of poor food and rough living.

Ecclectic Dentistry.

Thousands of teeth are ruined annually by the indiscriminate use of heavy, hard, adhesive gold, and heavy mallet force; where they might be saved for years with soft gold, less force used in filling, and less surface exposed to the action of mechanical leverages. If we have proper self-cleansing surfaces between the teeth we fill for such patients, we do more to preserve them by our separations than we do by our filling, by changing the conditions, so that the destructive agents which wrought the ruin cannot again find a lodgment. The proof of this assertion can be observed where a tooth has been extracted and the adjoining one has a superficial carious cavity on the face which was in contact with the extracted tooth. It will often remain for years without farther change. This example proves the efficacy of self-cleansing surfaces as a preventive of decay.

Gold continues to be the material *par excellence* for filling teeth, where the tooth structure is of sufficient strength for the gold to be impacted into the cavity without fracturing its walls. There are certain exceptional cases, in the posterior teeth, where a good amalgam plug will serve a better purpose and save the teeth longer.

In the preparation of gold foil for filling teeth, we cannot be too careful not to handle it; for however clean we may wash our hands, there are more or less of the excretions of the system oozing from the pores of the skin. The fact can be easily demonstrated by rolling or folding one strip of gold thus, and another on a clean napkin or piece of spunk with a nickel-plated spatula, and then passing each piece through the flame of an alcohol lamp. From the former there may be seen steam and smoke arising, while in the latter we cannot discern either.

Tin, amalgam, Hill's stopping, and oxychloride of zinc are all good materials for filling teeth, where they are properly used. I think it is not improbable that at no distant day a

plastic material will be discovered for filling teeth, that shall possess all the good qualities of gold with none of its objectionable ones. The man who shall make this much-needed improvement will most certainly be a benefactor of his race. Dr. G. B. McDonnell, in *Dental Cosmos*.

Kentucky China Ware.

The *Southern Agriculturist*, published at Louisville, Ky., takes its neighbors to task for not establishing the manufacture of china ware in their State, which, it claims, abounds in the requisite material for the purpose. The editor, in enforcing his views, says that its production has established an industry that employs a capital of \$100,000,000 in England, and as much more in Germany and France.

"Crittenden and Livingston counties in Kentucky contain an unlimited deposit of pure china clay, known among china manufacturers as kaolin, called by ancient pottery men 'petuntse,' which is simply decomposed felspar. It is refractory, resists the most intense heat: in fact it is not fusible by any degree of heat, but assumes a strong consistence in the furnace. A deposit of this clay also exists near Galesburg, in Southern Illinois, which supplies a large establishment located at Trenton, N. J., where it is ground, elutriated, made into china ware, baked, glazed, and passed through the various manipulations necessary to produce a marketable article, and then shipped back and sold to our good people, who, of course, glory in their independence, or exult in the progress they are making in manufacturing, and perhaps do not really know that they pay an exorbitant price or profit for the privilege of sipping coffee out of a cup made from their own soil.

If this crude clay can be shipped a thousand miles, made up into china ware, shipped back, and then be sold at large profits, why cannot it be manufactured in Kentucky at much greater profit, and still be sold at present prices? Kentucky's wealth in this material is not known, or, if known, our good people are too indifferent or careless to appreciate it. In the district where these immense deposits of china clay exist, there is also to be obtained, near the surface of the ground, an unlimited supply of fluor spar, French chalk, steatite, fire clay, yellow ocher, lead, iron, and coal. Not only china ware can be made out of these clays, but porcelain, glass, drain and sewer pipe, terra cotta, fire brick, etc., and yield a profit of fifty per cent on the investment, and still undersell present prices."

[If the statement of our contemporary is not overdrawn, Kentucky would seem to be the State producing all the material necessary for the successful manufacture of china tea sets.—Eds.]

THE *Revue Industrielle* states that sour milk, after protracted exposure to the sun, develops a poisonous quality, sufficient to cause disease and death to pigs fed thereon.



BRETON CATTLE

Bee Keeping in 1875.

A writer in the *Journal of Horticulture*, England, gives the following hints on bee keeping, adding his own experience on removing dead bees from the hive. If the writer's observations are correct, that the best honey seasons follow the coldest winters, certainly the coming summer must be a productive one in this country.

"I have often observed that our best honey seasons, and they are of rare occurrence here, have followed our coldest winters. Therefore I augur hopefully for the summer before us. It is now (January 16) so warm, and has been for some days, that a fire might have been dispensed with. At this moment I am sitting with my window wide open, facing north, and my bees have been busy pollen gathering. I noticed this pleasant sight for the first time on the 12th, but I have no doubt they were at it some days before, during my absence from home. All my hives, eleven in number, seem to be in good health, and well supplied with provisions.

It is a good thing when the weather is open, as at present, to clear away as many dead bees as can be got at within the the hive without breaking away the hive from its board. This can frequently be done by inserting a piece of wire with a curve at one end, and hooking out the dead on the floor board. The effluvia arising from a mass of corrupting bodies is often very great; and after a long period of cold weather, there is sure to be a considerable quantity of such dead bodies lying about the floorboard inside. The bees ordinarily remove their dead themselves from day to day, when they can get out; but it helps them much to assist them in this labor, besides adding to their health and comfort. Where wooden hives are used, no harm can accrue from breaking up the hive from its board in any case where these fit accurately. It is in the case of straw hives, which rarely sit evenly on the board, that it is perilous to remove these boards in winter. Sometimes I have known the dead accumulate so thickly about the entrances inside as to choke them up entirely, in which case, there being no exit for the bees, the hives perish inevitably. Let all bee keepers watch against eventualities like these, as well as against long-continued accumulations of snow outside on the entrance boards.

These hints are not untimely, as we shall doubtless, ere long, be visited by a sharp increase of cold, all the more severe for the present extraordinary warmth of temperature.

Since writing the above, I have been examining my hives, and found ten out of the eleven pollen gathering, some of them quite vigorously. One hive, active and strong, on inspection by a window at the back, seemed to have a large number of dead scattered below the combs. So being a "good divine that follows his own instruction," I quickly heaved up the hive by means of a screwdriver, and, with a thin stick, swept off right and left about thirty dead bees, whose fragrance was not of the sweetest."

American Plumbago or Graphite.

Plumbago is found in almost inexhaustible quantities in Ceylon, and there are mines capable of producing vast quantities in several States on this continent. The *American Manufacturer* says, however, that repeated trials have been made, and a large amount of capital expended, to work these mines profitably, resulting (with one exception) in failure.

The only plumbago mines in the United States successfully worked are located at Ticonderoga, and are the property of the American Graphite Company, 24 Cliff street, New York. This company has been running its works constantly since their erection in 1863. The mines, however, have been worked for half a century. Those at Ticonderoga yield the foliated, while one at Warrensburg, thirty miles south, contains the granulated.

The American Graphite Company, under the management of Mr. Cyrus Butler, were the first in the world to attempt the purification of plumbago ore in a large way.

The company now produce every quality, adapted for all purposes for which black lead is used. For lubricating purposes, for which there is probably nothing superior, the plumbago must be perfectly pure; and the article produced by the Graphite Company possesses, in a remarkable degree, this qualification, superseding in lubricating qualities even the Ceylon plumbago, the latter being too soft and spongy. The works at Ticonderoga purify the ores, producing an article pure and safe to use in any situation.

Plumbago is infusible, insoluble, and practically indestructible. It is affected neither by extremes of heat or cold, nor by acids or gases. On bearing surfaces, particularly those of iron, steel, and wood, it fills up the interstices and forms a slippery glaze, thus removing the cause of friction.

A Cure for Lockjaw.

In the course of lectures, recently delivered before the British Society of Arts by Dr. Benjamin Richardson, the following important remarks were made upon nitrite of amyl: "One of these specimens, I mean the nitrite of amyl, has within the last few years obtained a remarkable importance, owing to its extraordinary action upon the body. A distinguished chemist, Professor Guthrie, while distilling over nitrite of amyl from amyl alcohol, observed that the vapor, when inhaled, quickened his circulation, and made him feel as if he had been running. There was flushing of his face, rapid action of his heart, and breathlessness. In 1861-62 I made a careful and prolonged study of the action of this singular body, and discovered that it produced its effects by causing an extreme relaxation, first of the blood vessels, and afterward of the muscular fibers of the body. To such an extent did this agent thus relax, I found it would overcome the tetanic spasm produced by strychnia; and having thus discovered its action, I ventured to propose its use for removing the spasm in some of the extremest spasmodic diseases.

The results have more than realized my expectations. Under the influence of this agent, one of the most agonizing of known human maladies, called *angina pectoris*, has been brought under such control that the paroxysms have been regularly prevented, and, in one instance at least, altogether removed. Even tetanus, or lockjaw, has been subdued by it, and in two instances, of an extreme kind, so effectively as to warrant the credit of what may be truly called a cure."

NEW BOOKS AND PUBLICATIONS.

CATECHISM OF THE LOCOMOTIVE. By M. N. Forney, Mechanical Engineer. Price \$2.50. New York city: Railroad Gazette Office, 73 Broadway.

This admirable handbook fills a place in our technical literature which has long been vacant. Although, with commendable candor, the author acknowledges that the plan and title of his work are adapted from Kosak's book on the locomotive, the substance of the articles is so exclusively founded on American practice that it is virtually an original treatise. It is authoritative and accurate in its description of the constructive of the modern steam horse; and it gives many valuable precepts for the manipulation and running of the engine, which have never before, we believe, been printed in any form. The numerous enquiries on these subjects which we receive from all parts of the country are the best proof of the necessity and value of this book.

SCIENTIFIC LONDON. By Bernard H. Becker. New York city: D. Appleton & Co., Broadway.

The author has made a very interesting volume of historical and descriptive sketches of the Royal Society, the Royal Institution, the Society of Arts, the Institution of Civil Engineers, the British Association, the Royal Geographical Society, and several other learned bodies, more or less known to fame. The papers originally appeared in the columns of *Iron*.

GRAPHICAL METHOD FOR THE ANALYSIS OF BRIDGE TRUSSES, extended to Continuous Girders and Draw Spans. By Charles E. Greene, A.M., Professor of Civil Engineering, University of Michigan. Illustrated by Three Folding Plates. Price \$2.00. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

This treatise elaborates a method of investigating the stress on roofs and trusses, originated by Professor Clerk-Maxwell; and it shows once more the value of the graphical method of describing the physical characteristics of complex bodies, a method which seems destined to be adapted to every branch of mechanical and dynamical science. The author points out, with much force, that not only is the system available for the solution of the problem of the strains on a girder, the dimensions of which are given, but it also contains a means of checking the accuracy of the working drawings of the structure.

CHEMICAL EXAMINATION OF ALCOHOLIC LIQUORS. By Albert B. Prescott, M.D., Professor of Organic and Applied Chemistry in the University of Michigan. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

This volume is a useful and trustworthy aid to the analysis of all such alcoholic fluids as are used as food or stimulants. It discourses on the question of adulteration in a sensible and practical manner, and contains statements that go far to justify immediate government interference with the trade of the falsifier.

THE OVERLAND MONTHLY. Devoted to the Development of the Country. Terms \$4.00 per annum. San Francisco, Cal.: John H. Carmany & Co., 40 Washington street.

This excellent magazine maintains a well earned reputation. The number now before us (February, 1875) commences with an interesting account of the naval duel between the *Kearsarge* and the *Alabama*.

A PRACTICAL TREATISE ON THE GASES MET WITH IN COAL MINES. By the late J. J. Atkinson, Government Inspector of Mines, England. Price 50 cents. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

A useful and readable essay, published in Mr. Van Nostrand's Science Series.

THE AMERICAN EDUCATIONAL CYCLOPEDIA, a Reference Book for All Matters Pertaining to Education. Published Annually Volume I, 1875. Price \$2.00 in cloth, \$1.50 in paper. New York city: J. W. Schermerhorn & Co., 14 Bond street.

This volume is a complete manual of the statistics of the educational condition of all the States and Territories, with a synopsis of the occurrences affecting the question during the years 1873-1874. Some biographical sketches of prominent educators recently deceased, and articles on the educational systems of other countries, add much interest to this useful work, an advertisement of which appears on page 157.

DECISIONS OF THE PATENT OFFICE.

BEFORE THE BOARD OF EXAMINERS-IN-CHIEF. PRESENT: MARCUS S. HOPKINS, R. L. B. CLARKE, CONCURRING.—APPLICATION OF MILLER T. GREENLEAF AND GEORGE Q. ADAMS FOR A PATENT FOR A CAR COUPLING.

Continued from page 135.

Our position is a peculiar one with respect to the Commissioner. We are a tribunal vested by statute with certain jurisdiction and powers, but it has never been judicially determined under the present patent act that our favorable decisions, made in the proper exercise of statutory jurisdiction, upon *ex parte* applications, are binding upon the Commissioner. We are no more a *quasi* judicial tribunal. The Commissioner's office is both executive and *quasi* judicial. The whole Patent Office and all its officers are a portion of the executive branch of the government, and none of the judiciary. None of us have full judicial powers and the ordinary means of sustaining the exercise of them. Just what is the legal scope of the power of the Board and the effect of our decisions—upon cases appealed to us as a *quasi* judicial tribunal within the Patent Office, which is under the general direction of the Commissioner as its head—has long been, and still is, a disputed question between the Commissioner and appellants before us, who have sought to invoke our favorable decisions, as sufficient to warrant him in the grant of patents. This question is now actually pending before the Supreme Court of this District in a suit brought for the purpose of determining it. The opinion of the court in *Snowdon vs. Pierce* (manuscript decisions, Supreme Court, D. C.), referring to the act of 1861, although going clearly to the root of the matter, and strongly and unequivocally declaring our judicial independence of the Commissioner, and the reason for it, had not the force, in the opinion of the Commissioner, of a judicial decision of the point. (Commissioner's Decision, 1869, page 6.) He regarded it as merely *obiter dictum*, and declared that the question was an executive one, that ought to go to the Attorney General. His decision, like that of Judge Dunlop in *Snowdon vs. Pierce*, referred to the act of 1861, and sharply disputed the ground taken by the court. The present act, however, is not identical with that of 1861. In fact it appears to be materially different. Beyond the difference indicated from a consideration of it in the light of the ordinary rules for the interpretation of statutes (namely, regarding the words, the context, the subject matter, the effects and consequences, and the spirit and reason of the law), the following extract from the records of the House of Representatives, relating to the passage of section 10, by that body, are not without significance:

"Mr. Butler, of Massachusetts: Now he (the Commissioner of Patents) has under him a Board of Examiners, who are nominated by the President and confirmed by the Senate, and who are equals in every respect. I understand that the opinion of the Committee of Patents is that this provision, as to establishing rules and regulations for the proceedings, does not apply to the conduct of the employees of whatever class. But the difficulty is that the Commissioner of Patents has made a series of time tables, and other regulations covering the acts of the employees, which he has applied to the Examiners, who are his equals and coordinators, and who ought not to be in any way under him. Therefore I want to put in this language to exclude the idea of his having any such power. I am willing that he should govern his clerks and laborers and all who hold under him, but I am not willing that he should have the power of annoying and disturbing, if he chooses, the men who are appointed by the same power as he is, and with the same rank."

"Mr. Jencks: I think I can show the gentleman from Massachusetts that his amendment is not needed. This power to make the rules and regulations is to apply to the proceedings in the Patent Office, and not at all to the persons employed there; and the rules and regulations to which the gentleman refers, and of which he complains, are made by the Commissioner under the power in the existing law, which is reprinted in this bill at the end of section 10 in the following words:

"They shall be governed in their action by rules prescribed by him." (Act of 1861.)

"That power is proposed to take away. It is part of the recommendation of the Committee that these words be stricken out from the existing law, and that the power which the Commissioner shall have and ought to have shall be that of regulating the manner in which proceedings shall be conducted in his Office; the rules of court, so to speak, not the rules of decision but of government. I hope that gentleman will withdraw his amendment."

"Mr. Butler, of Massachusetts: The explanation which the chairman of

the committee on patents has put on record will obviate the necessity of the amendment I had proposed. I therefore withdraw my amendment. But I desire to make another, in the ninth line of the tenth section. The section, as reported from the committee, reads thus:

"The Examiners-in-Chief shall be persons of competent legal knowledge and scientific ability, whose duty it shall be, on the written petition of the applicant, to revise and determine the validity of the claims of the applicant, and to examine upon application for patents, and for the renewal of patents, and in interference cases; and when required by the Commissioner, they shall hear and report upon claims for extensions, and perform such other duties as he may assign them."

I want to strike out the words 'he may assign them' and insert in their place the words 'may be assigned them by law.' The chairman of the committee will see that under the words 'and perform such other duties as he may assign them' the Commissioner has now a discretion to interfere, which the committee by this bill seek very properly to regulate.

"Mr. Jencks: We thought we met that objection sufficiently by taking away the power to assign duties in the Office. But there are many things in which the Commissioner might wish the services of the Examiners-in-Chief, but which it would be very difficult to prescribe definitely by law."

"Mr. Butler, of Massachusetts: Then I will concur in moving to substitute the word 'like' for the word 'other,' so that it may read 'such like duties as he may assign them.'"

"Mr. Jencks: I have no objection to that. * * * * The amendment was agreed to." (Cong. Globe, Part 4, 2d. session, 41st. Congress—1869 and 1870, p. 2,835.)

This authentic record history of the passage of section 10, defining the duties of the Board, like the language of the section itself, plainly shows the intent of the law-making power. The section must be read in connection with section 7 defining the duties of the Commissioner, and both sections must be construed together so that each shall stand—the rule being "*ut res magis valeat quam pereat*."

Section 10, following after section 7, and conferring special powers on the Board, must be held to restrict the meaning of section 7, giving general powers to the Commissioner, if it can be supposed that the two sections are in apparent conflict. But it is plain to us that they are not—that section 7 relates wholly to executive and ministerial duties, over which it provides the Secretary shall have "direction," and not at all to judicial duties. Sections 46 and 47, providing for appeals, confer upon the Commissioner his judicial powers, in the exercise of which he is independent. These sections, in connection with section 10 (with none of which do any other sections of the act in the least conflict), make the law as plain as language can well make it.

It is clear we must in our judicial capacity be, in a certain measure, independent of the Commissioner and of his decisions, favorable to appellants, be binding upon him and all others so far as the duty of granting patents is concerned (except fraud should appear), or else we must be wholly subordinate to his judgment, and our favorable, as well as adverse decisions, be liable to be overruled by him at his pleasure. We are either an independent tribunal in this Office with appellate jurisdiction, to relieve the Commissioner of all judicial responsibility, except in cases regularly appealed to him in our adverse decisions, or else we are mere clerical reviewers of a portion of the work of the Examiners, to aid the Commissioner, subject to his dictation in forming our opinions, and wholly depending in all cases upon his approval of the judgments we pronounce. There is no middle ground. But if the former be the correct view of our powers and responsibilities under the law, it is undoubtedly competent for the Commissioner, in order to prevent the erroneous issue of a patent, in any case where in his judgment there is reason why it ought not to issue, to refuse to issue it, or to refer it to the Board for their consideration and review of the alleged matter of error. And if the Board, for any cause, should fail to agree with him as to the judgment, then he might still refuse to execute and grant the patent, and the existence of the alleged error, to warrant them in the alteration of their sufficiency of his reason for refusing could be tried before the Supreme Court of the District on application for writ of *mandamus*, and then on appeal before the Supreme Court of the United States. This would seem to be ample provision against the erroneous issue of a patent or a dangerous exercise of power on the part of the Commissioner and of his decisions, favorable to appellants, and the intelligence and dignity of Commissioners and members of this Board would endeavor to do their duty, and to avoid conflicts; and we apprehend cases of irreconcilable difference of opinion, of such importance as to involve litigation, would seldom occur. Were each tribunal (the Commissioner and the Board) purely judicial, instead of administrative and *quasi* judicial, each would have a distinct jurisdiction and be as independent of the other as the Office within that jurisdiction as supreme and exclusive courts; and the first duty of each would be to define its own jurisdiction and act accordingly. In that state of things no Commissioner would ever have questioned our judicial independence, and it would be admitted to be our duty to pass upon this case independently of the Commissioner; coming to us as it does, without any very recent action of his upon the question at issue, and with the recent decisions of the courts, as we think, clearly controlling that issue. The case does not appear to be very different than if a statute had in the meantime been enacted, declaring judicially rejected and abandoned application insufficient. It is only the mixed nature of the official duties in this Office that has raised a doubt of the distinct distribution of them by law. But from the language of the statute, and the necessities of the case, we can have no doubt that we are required to *adjudicate*, and not merely to report upon cases duly appealed to us, and, in doing so, to exercise ordinary judicial freedom of judgment. We are to "revise and determine upon the adverse decisions of Examiners." Appellants who pay their fees and employ counsel to argue cases before us are entitled to such adjudications, and to have them enforced so far as they are legally effective. Otherwise they do not obtain their *quid pro quo*, and appeals to us and adjudications by us would be farcical. Nothing can be plainer than that in all executive matters relating to the proper transaction of our business—matters of mere practice, or mode of procedure, etc.—we are, with great propriety, subject, under the law, to the control of the Commissioner. Nor can anything be clearer than that, upon points that have come judicially before us, upon regular appeal from our adverse decisions upon them, and been decided by him, we are bound to follow his decisions to the extent of their legitimate intent and effect, until they are unmistakably overruled by higher authority. Beyond that, it is our opinion, upon the most careful consideration, we are not subordinate to him by law, in our judicial capacity. Nor do we perceive any anomaly, or any change to the public, from such a fact. The Secretary of the Interior has full supervision of the Commissioner and all other officers in the Patent Office, in all executive and ministerial matters. But the Commissioner is vested, by section 47 of the statute, with certain judicial functions, in the exercise of which he is entirely independent of the Secretary; and we know of no instance of the Secretary's attempted interference with respect to them. Following the necessity of the case, in order to enable the public business to be done, the law has made the Commissioner thus independent. Following the same necessity, growing out of the magnitude of the judicial work of this Office, the whole of which it is impossible for the Commissioner to perform and be held judicially responsible for, the law, we think, has made the Board, within the limits above named, independent of the Commissioner. This being so, our legal duty, from which there can be no conscientious escape, requires us to pronounce our judgment upon the issue in this case. We could not be justified in letting it go to the Commissioner with a *pro forma* affirmation of the rejection by the Examiner, thus compelling the party to pay his appeal fee of \$20, and the other expenses incident to such an appeal. There are many considerations, which we duly appreciate, in favor of the greatest care and deference, and of a harmonious exercise of the functions of the different tribunals within this Office. But official ethics cannot require or warrant the deprivation of a legal right of a suitor, by the withholding of its own proper judgment, under circumstances like the present, by a lawful and responsible tribunal. We should greatly have preferred that so important a matter be first enlightened by a decision of the Commissioner; and in order to get this case before him for decision, we have proposed to certify it to him, in analogy to the practice sometimes adopted by the Supreme Court of this District, so as to save the appellants their appeal fee. The Commissioner, however, not approving of that course, we must reverse the decision of the Examiner, and his decision is hereby overruled. We recommend, however, that he call the Commissioner's personal attention to this case, on account of its peculiarity and importance.

MARCUS S. HOPKINS, Examiner-in-Chief.

I concur with the views in regard to the insufficiency of the references, and unhesitatingly unite in a decision reversing the examiner's rejection.

A plain question of law based on admitted facts as presented for our adjudication is in fact the only point relied upon by the appellant.

We find that the examiner erred in holding the invention anticipated by a rejected and abandoned application.

We have the highest authority known to our judiciary to sustain the point made by appellant.

We have the repeated decisions of the circuit courts—as cited—to the same effect.

We have the principles and reasons underlying the law to sanction it to our good sense and judgment.

All we have to do, in the discharge of our duties under the statute giving us power and jurisdiction, is to find and record our judgment.

If done honestly and intelligently, the Commissioner can have no occasion to except to our action.

His power is ample to guard against any evil effect from our finding.

If he thinks a patent should not issue for any cause, he has only to refuse, and it will not issue.

If called to give his reasons upon *mandamus*, his action would be undoubtedly sustained if his reasons should prove good and legal.

I do not believe in forcing parties to pay fees and go to the Commissioner on questions which the law contemplates as within our peculiar province and jurisdiction, and which we should decide on our own consciences and according to our best judgment.

R. L. B. CLARKE, Examiner-in-Chief.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From January 15 to February 1, 1875, inclusive.

BURNING LIQUID FUEL, ETC.—C. E. Robinson, New York city.

COATING METALS, ETC.—D. R. Brownlow et al., Middletown, Conn.

CUTTING FABRICS.—A. H. Cramp (of New York city), London, England.

DYEING AND FINISHING.—P. Magder et al., New Orleans, La.

FUR-COATED FABRIC.—H. Kellogg, Milford, Mass.

HEAD COVERING, ETC.—H. Kellogg, Milford, Mass.

MAKING ICE, ETC.—C. P. N. Weatherby (of New York city), London, Eng.

PRESERVING ANIMAL SUBSTANCES, ETC.—J. R. McClintock, New Orleans, La.

PREVENTING FRAUDS BY CONDUCTORS.—C. G. Imlay, Philadelphia, Pa.

ROLLERS FOR TEXTILE FABRICS.—E. Edwards, Boston, Mass.

ROLLING NUT BLANK BARS.—G. Johnson, Haverstraw, N. Y.

SACK SEWING MACHINE.—H. P. Garland, San Francisco, Cal.

SEWING MACHINE.—E. Moreau, San Francisco, Cal.

SPIKE MACHINE.—A. Whittemore, Cambridgeport, Mass.

Recent American and Foreign Patents.

Improved Die for Making Hollow Rings.

Shubael Cottle, New York city, assignor to Mulford, Hale and Cottle, of same place.—This invention has for its object to produce circular and oval hollow rings from a disk of sheet metal, and without any cross seam, for use in manufacturing chains, buttons, studs, and other articles of jewelry. The operation is accomplished by an ingenious series of dies and cutting tools, which force the metal by degrees into the proper shape.

Improved Barbed Stock Fence.

Francis T. Wilson, Ames, Iowa, assignor to himself and E. J. Bartlett, of same place.—This invention consists of bars combined with the longitudinal rods of a fence, to prevent cattle from rubbing and pressing the rods apart or down to pass the fence. The said bars consist of short pointed pieces of wire inserted in an eye in the rod, crossing each other, and secured by a staple, so as to point in four directions, and be securely held when the rod is strained up tight.

Improved Saw Sharpener.

Joan Crook and James A. Crook, Augusta, Ohio.—This invention consists of emery wheels adapted for dressing both sides of the teeth and gumming the saw, together with driving gear and adjusting devices, and a spring clamp mounted on a radius bar contrived to be contemporarily attached to the collar of a circular saw, all so arranged that the wheels can be readily applied to the teeth, so as to dress them all alike and do the work expeditiously.

Improved Seed Planter.

William C. Reynolds, Colliertown, Va.—This invention consists in a false bottom, for seeder hoppers, provided with subadjacent support and side apertures, designed to relieve the slide from the weight of the seed, and so remove the liability of the aperture to become clogged.

Improved Bandage Winder.

Alfred M. Cone, Corry, Pa., assignor to himself and L. D. Parsons, of same place.—A spindle, made square in cross section, passes through the upper end of a frame and has upon its end a crank, by means of which it is revolved. The bandage is wound around this spindle by revolving the spindle rod. A rod is attached to the frame, and is soldered to the end of the arm, so as to leave a narrow space between the rod and the arm. The cloth or bandage is passed through this space and carried to and around the spindle with any degree of tightness by bearing lightly with the hand upon it below the space or rod. When the bandage has been wound on the spindle, it is readily slipped off.

Improved Steam Condenser.

Edwin O. Brinckerhoff, New York city.—Two steam and water-tight cases are placed the one within the other. A space is left between the tops, bottoms, and sides of the said cases. A double-acting pump discharges into two U pipes. The upper end of one of the U pipes and the lower end of the other pass through the side wall of the outer case, and discharge the cold water into the space between the case, whence it escapes continuously through the waste pipe. The upper end of the other U pipe passes through the walls of both the cases, and is connected with the upper end of a coiled pipe, placed within the inner case, and the lower end of which is connected with the steam and watertight box upon which the coil stands. The lower end of the other U pipe passes through the walls of both the cases and enters the box, so as to discharge a stream of cold water directly into the said box. The exhaust steam pipe passes in through the tops of the cases, and discharges the exhaust steam into the upper part of the inner case, where it is immediately condensed by the streams of cold water passing continuously through the space between the cases.

Improved Top Joint for Vehicles.

Thomas F. Darcy, New York city.—This top can be readily raised and lowered by the occupant while sitting in his place on the seat. The knuckle joints of the braces are made so as to fold forward or toward the pivots of the bows, instead of backward, as heretofore, and are attached to a shaft at the lower end, having a spring applied to it, so as to raise and hold the top up. The lever, to press it down, is provided with a lock catch to hold the top down, or in any intermediate position. It is also arranged to lie down on the cushion out of the way when the top is down, and to stand up alongside of the back when the top is up.

Improved Feed Roller for Planing Machines.

Samuel N. Brown and Henry W. Meyer, Dayton, Ohio.—This invention consists of a feed or pressure roller for planing machines, made of an interior cushioning sleeve of elastic material placed firmly upon the shaft, and covered by a series of outer metallic rings.

Improved Resawing Machine.

John Gerhardt, Montreal, Canada, assignor to himself and James Hutchinson, of same place.—This is a simple self-contained gang resawing machine, which can be readily moved about and set up anywhere. It is self-sustaining, requiring no fixtures or fastenings other than its own supports, which consist of a strong horizontal frame of suitable height, length, and breadth for a resawing machine, on which is the usual upright frame for the saw gate, also the driving machinery, and the feeding and regulating apparatus.

Improved Bench Vise.

Carlous Burton, New Baltimore, Ohio.—The stationary jaw of the vise is made angular to overlap a portion of the end and top of the bench. Upon the plate are cast arms, which are let into the top of the bench, and the ends of which are widened to give them a firm hold upon the said top. The movable jaw of the vise is placed in a horizontal position. To the rear part of the movable jaw are attached two rods, which pass through the stationary jaw, and which keep the movable jaw always parallel to the stationary jaw, or nearly so. The work, when long, is clamped between and held by dogs, one of which is inserted in a hole in the movable jaw, and the other is inserted in one or the other of the holes formed to receive it in the top of the bench.

Improved Railway Tie.

Samuel L. Porter and Duane Peck, Rochelle, Ill.—The bed pieces are of cast iron, with flat top part and flaring supporting sides, that rest upon the gravel, tamped firmly below them. The bed pieces are of equal size, forming a broad and solid base for the rails. Diagonally crossing braces connect the bed pieces across the track, and interlock with short side extensions of the bed pieces below the rails. Other devices secure the rigid and strong lateral connection of the bed pieces. The rails are secured on the flat top of the bed pieces by longitudinal guide flanges. This mode of fastening the rails, together with the rigid support of the bed pieces, prevents effectually the well known moving of the track in endwise direction for certain distance.

Improved Propelling Wheel for Canal Boats.

Gustav Heydrich, New Ulm, Minn.—This wheel is rotated in a central wheel box of the boat, and is provided with hollow sleeves that extend radially from the hub and guide sliding propelling arms. Said arms are released from the pressure of spring levers acting thereon, by an arc-shaped side flange of the wheel casing, so that they engage the bottom of the canal and propel the boat.

Improved Hair Cutters' Gage.

Alexander G. Wilkins, Meadville, Pa.—This invention consists of a slotted gage, composed of parallel ribs, which are bent of one piece to form a point, heel, and top part, the heel and point fitting the convexity of the head, while the curved or bent ribs guide the head and hold it in position for the cutting action of the shears supported on the upper or top part of the gage. The handle is attached to the rear ends of the ribs, and provided with adjusting devices, by which the ribs may be set nearer together or farther apart, for cutting the hair to any required length.

Improved Seed Planter.

John G. Garner, Pittsburgh, Texas.—In this seed planter, the dropping disks are mounted loosely on a driving axle, so as to be shifted thereon, and interchangeable hoppers are provided, adapted for one or both disks, respectively.

Improved Brick Kiln.

William Bull, Ewell, England.—The kiln may be of any continuous form. At the bottom of each wall, openings are left at intervals of three feet. The floor is built between the parallel walls of the kiln, and the openings are carried across the whole width through the flooring, and covered in with bricks. A few inches above each ash flue, a firing flue is left for the insertion of the fuel. The bricks to be burnt are set close together in walls, one brick's length in thickness, parallel to the kiln walls. Between the walls of green bricks and the kiln walls, spaces are left for draft passages. Opposite each firing flue an opening is left in the walls of green bricks, the whole taken together forming a combustion chamber for the fuel, which is inserted through the firing flues. These walls of green bricks are carried up to within about a foot of the top of the kiln. The whole is then covered over with a layer of bricks, flat, on which is spread a layer of ashes. At intervals of forty feet, a width of about eighteen inches of the brick flat is open, over which, when required, a movable chimney on wheels, extending the entire width of the kiln and with outlets, may be placed as an escape flue for the steam and waste products of combustion.

Improved Truss Bridge.

John B. Winters, Attica, Mich.—This invention consists, essentially, of plates and rods for coupling the stress and sway braces to the chords; also, plates for coupling the chords to the caps. The construction is very simple, and the arrangement of the plates allows of fitting in the braces with but little labor.

Improved Screw-Threading Device.

Charles W. Roberts, Cohoes, N. Y., assignor to Norman W. Frost, same place.—The vise plate is made adjustable on the bed. The lower jaw is stationary, and made in two parts, connected together. The upper jaw is fastened to the sliding block, which is attached to the vise screw. This jaw works down between the two parts of the lower jaw. Each of the jaws has a V-shaped opening, the sides of the V being serrated so as to effectually hold the tube within the angular openings, and keep it from turning. The hub of the die wheel works on a stationary screw block as the wheel is turned, and draws the dies on the tube. The tube is held stationary in the jaws of the vise, and the feed block is held stationary on the tube by a set screw. Suitable adjustment adapts the machine to different sized tubes.

Improved Lamp Burner.

John Gleason, Brooklyn, N. Y.—This invention has for its object to prevent the upper part of a lamp from being heated by the burner, and thus guard against explosion, and at the same time produce a better light. The invention consists in a safety extension collar, formed of the double walled body, having its outer wall finely perforated and a single hole in its inner wall. It is provided at its ends with collars to adapt it to be interposed between the burner and collar of a lamp. The hole in the inner wall of the extension collar also allows any explosive gas that may be formed in the lamp to escape, thus further guarding against explosions. It is made so as to go on all lamps, from the largest to the smallest, and is particularly adapted for gas fixtures, and intended to take the place of gas in stores, as any kind of illuminating oil or liquid gas can be burned with perfect safety, with or without chimneys. A sample burner will be forwarded on receipt of fifty cents, on application to the inventor, at 260 Hicks street, Brooklyn, N. Y.

Improved Garter.

Lucius F. McDonald, Belfast, Me.—A short piece of elastic webbing is looped around a metallic loop, and its ends are secured to each other and to a buckle by a metal plate, which is looped around the tongue bar of the buckle, and has a short slot for the passage of the tongue of said buckle. Around the metal ring is also passed a light sheet metal plate, the ends of which are bent together, and receive between them the end of the leather strap. Upon the side edges of the plate are formed lips, which are bent down upon the upper end of the said plate. The ends of the plate and the lips are pressed down upon the end of the strap, and are further secured in place by punching.

Improved Dumping Car.

John E. Bemis, Chicago, Ill.—The object of this invention is to so improve the platform dumping car which was patented to same inventor under date of May 5, 1874, that the mode of throwing the tilting platform in and out of gear with the trucks is simplified, and the dumping and discharging of the load facilitated. The motion of the cars, by means of a slight backing of the locomotive, tilts the platform and dumps the load on the same, in the manner set forth in the aforesaid patent. After the load is discharged the platform tilts back on the trucks, and is carried into regular position by the forward motion of the locomotive.

Improved Device for Filling Bags.

Junior D. Platt, Plattville, Ill.—The stand is made adjustable by means of a screw clamp, to which it is attached, so as to be placed in any convenient position on the counter or shelf. A pivot pin in the lower end of the stand passes through the clamp, and allows the stand to be turned in either direction, as may be required. This stand is curved in its upper part, and its upper end has a flaring horizontal band, which receives and supports a funnel.

Improved Harrow and Planter.

Beauman Butler, St. Johnsbury Center, Vt.—The cross bars are armed with harrow teeth and cultivator or drill teeth, according to the kind of work to be done. There are also scraper bars, and a tongue roller extending across from one to the other of the runners. The front scraper is arranged vertically on pivots, and is armed with a metal plate at the front. There is also a foot lever, extending backward and resting on the first cross bar, to be pressed down by the driver to hold the scraper to its work, its office being to crush the clods and otherwise smooth the surface in advance of the teeth. The scraper may be used in rear of the harrow teeth, and provided with a suitably arranged lever for operating it. The hind scraper is a broad plank, armed with a metal plate, and arranged obliquely to the surface, the front edge being the highest, to run over and press down the lumps smoothly. It is also arranged on pivots at the upper edge to adjust the bearing portion higher or lower, as required, and it is provided with adjusting holders.

Improved Bird Cage Attachment.

George Fiedner, Portland, Oregon.—This is a crib for cages, for holding pieces of cake, apple, sugar, and the various articles which are usually placed between the wires of cages, and consequently not securely confined.

Improved Butter Worker.

Joseph Thompson, Albany, Wis.—In using the machine the butter to be worked is placed in the box between a grate and one of the followers. The cover is then closed, and a lever is operated, moving the followers back and forth through the box, and forcing the butter back and forth through the grate, working it thoroughly and bringing it to a uniform color in a very short time.

Improved Friction Drum.

Joseph S. Mundy, Newark, N. J.—This invention relates to improvements in friction drums for pile drivers and hoisting machines, and consists in the construction of the friction pulleys, and in the mechanism at the other end of the drum, by means of which the drum is made to take more or less friction, as may be required.

Improved King Bolt Bearing.

Gilbert J. Orr, New York city.—This is a bush in the axle hole for the king bolt, to take the wear to which the axle itself is subject without it, and be removed for the substitution of a new one when too much worn, to save the loss of the axle. It also consists of a nut for fastening the bush in the axle, and an inverted cup screwing on this nut to form a cup around the bolt above the axle, to contain absorbent material to be saturated with lubricating material.

Improved Toy Gun.

Wilhelm Wiedemann and Lewis Lindsey, Lawrence, Kan.—The barrel is formed of two parts, with a narrow open slit between them. The projectile is impelled by means of an elastic cord passed through the barrel, and its ends attached to a wire crosshead, which latter passes through the long slit. The wire crosshead also passes through a catch block, which, when drawn back, catches over the point of a tumbler, which latter is held in position by a trigger and spring. When the trigger is pulled the tumbler is released, the catch block slips from its end, and away goes the crosshead with the projectile before it.

Improved Fruit Picker.

Benjamin F. Price, Mount Sterling, Ill., assignor to himself and A. A. Hill, of same place.—The invention consists of jaws pivoted to each other, made the one with a double concave edge and the other with a single concave edge, and provided with rubber springs, in combination with a flexible tube, staff, and operating cord. The jaws can be drawn together to cut the stems of the fruit by pulling upon the said cord.

Improved Tag.

Cevendra B. Sheldon, New York city.—This invention consists in attaching the card to the twine by folding the corners of the card over the ends of the twine, at an obtuse angle to the parallel sides of the same, and fastening the said corners, with the inclosed ends of twine, with suitable adhesive matter.

Improved Shoe.

George D. Hill, Baltimore, Md.—The invention consists in first sewing together the ordinary in and out soles by a seam at the heel, and then sewing them, together with an extra insole, by an independent sole seam.

Improved Sash Fastener.

John Berndt, Denver, Col.—The invention relates to an upper and lower sash connected by a cord so as to be clamped and held at different elevations, and consists in bringing down the cord through a vertical hole in the top of the lower sash and partly through a munnion thereof, the pulley being arranged within a slot, and the clamp attached to the surface of the munnion.

Improved Curtain Fixture.

George C. Mathers, Louisville, Ky.—This invention relates to certain improvements in curtain fixtures, and it consists in the combination with a notched disk journaled in a slotted bearing, of a stationary detent, an endless cord, and two small friction wheels, the said wheels being arranged to one side of the disk, and the said cord passing around the same in such a manner as to form a laterally drawing loop, which, when a draft is exerted upon the cord, brings the disk away from the detent, and the journal of the disk in a portion of the slotted bearing where it is free to revolve.

Improved Wedge.

Charles McDermott, Oakland Station, Ark.—This invention is a wedge constructed with a chamber or cavity. The head and inclined sides of the wedge are formed, preferably, of a single plate of wrought metal, and the straight or parallel sides of triangular plates, the same being welded firmly together. The wedge is hence cheaper, lighter, and more convenient to handle or transport than the ordinary solid wedge. It may be also driven with greater ease, by reason of its inertia being more readily overcome by the blow of the maul.

Improved Wagon.

Jacob Becker, Jr., Seymour, Ind.—The invention consists in a very novel simple construction of wagon brake, whereby the holding back of the horses automatically applies the brake, while the tongue may be locked by a slide so as not to apply the brake. It also consists in a new mode of coupling the reach, in pivoting the doubletree, and in preventing the bolster from rocking.

Improved Wheel Plow.

Peterson Prawl and Francis H. Wemple, Waverly, Ill.—Both the transporting wheels run in the bottoms of furrows, so as to have smooth and level paths, and thus cause the plow to run true and steady. There is a pivoting connection between the axle and the beam, to enable the plow to be turned in smaller space than would otherwise be possible. The axle may be turned by turning an arm through the medium of a lever, to which is attached a lever pawl, the engaging end of which takes hold of the teeth in a curved bar. To move a small wheel down to support the machine in a level position while being turned, the pawl is released from the notched bar, and the lever is moved forward until the lower side of the small wheel is in the same horizontal plane with the lower side of the large wheel.

Improved Cotton Auger.

Albert O. Schultz, Memphis, Tenn.—This invention consists of a cotton auger with upper and tapering blade, and intermediate upward-inclined teeth, being provided with symmetrically fluted sides for reducing the cross section, and giving thinner and more pointed teeth and blades.

Improved Hand Fire Engine.

Henry Neumeyer, Millerstown, Pa.—This consists of a tank and three, more or less, single-acting force pumps combined so as to throw a single and continuous stream of water from a hose pipe. The cranks are so constructed that, while connected with the shaft, they may be slipped from the ends thereof and turned round into the tank, so as to be out of the way when they are not in use.

Improved Cotton Seed Planter.

Benjamin F. Miller and William J. Reeves, Gateville, Tex., assignors of one half their right to James M. Morris and Edward A. Jones.—The teeth are attached to a shaft which revolves in bearings in the sides of the hopper, in such positions that the teeth may project through a slot in the bottom of the hopper, so as to force the cotton seeds out through said slot. To a sliding rod within the hopper are attached one, two, or more crosspins, which keep the seed in the lower part of the hopper stirred up so that the teeth may carry it out, uniformly and without fail.

Business and Personal.

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

Agricultural Implements, Farm Machinery, Seeds, Fertilizers. H. H. Allen & Co., 139 & 141 Water St., N. Y.
Magic Lanterns, Stereopticons of all sizes and prices, for Parlor Entertainment and Public Exhibitions. Pays well on small investment. Catalogues free. McAlister, Man'g. Optician, 49 Nassau St., N. Y.

Fleetwood Scroll Saw, with Boring Attachment, for all descriptions of light scroll sawing. See adv't., page 95. Trump Bros., Manufacturers, Wilmington, Del.

Manufacturers of Hydrants, send price list and cuts to Fisher & Fiske, Martinsburg, West Virginia.

Miller's Brick Presses for fire and red brick. Factory, 339 South Fifth Street, Philadelphia, Pa.

Agents Wanted to Sell Staple Goods. Good commission paid. For sample, enclose 20c. to Star Manuf'g Co., New Bedford, Mass., P. O. Box 25.

Wanted—A thoroughly practical Glue Maker. Address I. P. Cartwright, Weston, Mo.

To Machinists.—For Sale, Cheap—A partially finished Engine Lathe, 11 feet bed, 25 inch swing. For further particulars, call on or address Clark, Smith & Co., Fort Plain, N. Y.

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For Solid Wrought-Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, &c.

Notes & Queries

C. D. should consult a florist.—J. W. W. can find directions for making nitro-glycerin on p. 283, vol. 30.—**C. G.** will find full information as to grate bars in Trowbridge's "Heat and Steam Engines."—**E. J. H.** is informed that there is no rule for determining the horse power of a boiler.

—Q. R. N. will find full information as to the rubber horse shoe on p. 166, vol. 31.—**M. M. W.** will find a recipe for baking powder on p. 123, vol. 31.—**D. L. L.** should consult a treatise on water wheels.

—T. W. will find directions for hardening needles, etc., on p. 347, vol. 31.—**I. C. F., W. R. M.,** and many others are informed that water glass is silicate of soda, advertised regularly in our columns.—**J. L. S.** can preserve his canvas tent by using the preparation described on p. 347, vol. 31.—**B. C. S.** can scour his castings by the process given on p. 139, vol. 31.

(1) W. H. B. asks: Will steam destroy the temper of spring steel kept constantly in it? **A.** The springs, if properly tempered, will continue serviceable for a long time unless the steam pressure is unusually high.

(2) F. L. asks: How much coal and water are needed to propel a freight train of 30 cars for 100 miles at the usual speed? **A.** These elements vary greatly. We find, from an inspection of locomotive returns, that a ton of coal will move an ordinary freight train a distance varying from 35 to 62 miles.

(3) S. F. S. asks: Can you tell me how to file a circular saw for sawing cord wood into stove length? **A.** No. 1 is a good shaped tooth for very soft wood, the wide bevel being the front of the tooth.



The point would be liable to break or bend in very hard wood or in knots. No. 2 will stand to saw the hardest timber or knots, but will not cut as easily as No. 1. No. 3 is a form of point generally used for promiscuous sawing of both hard and soft wood. The shapes of saw teeth should be varied to suit the kind of wood to be sawn. The set must be wide enough to clear the plate. In sawing very hard wood, less set is required than in sawing wood that is soft and fibrous.—**J. E. E., of Pa.**

(4) B. M. M. and others ask: What study would be best for a machinist to take up? **A.** It would be well to begin with geometry, drawing, and natural philosophy. We can recommend Minifie's "Mechanical Drawing," Robinson's or Loomis' "Geometry," and Silliman's, Ganot's, or Deschanel's "Physics."

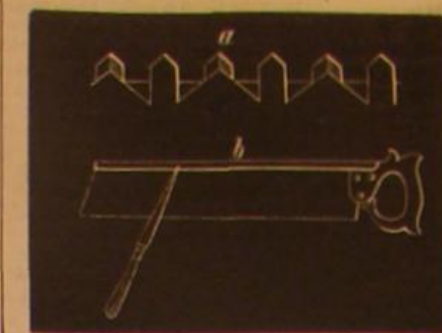
(5) F. E. H. says: I wish to make two large wooden troughs to hold a silver and copper solution, for electroplating. Please give me a recipe for varnish that will stand the cyanides. **A.** Coat it with marine glue.

(6) F. R. G. asks: I am engaged in constructing a reflecting telescope, which I wish to be a Gregorian. The mirror is 7 inches in diameter and of 6 feet focus. What should be the focus of the small mirror, and where along the tube should it be placed so as to give the best effect? **A.** Focus of small convex mirror, Cassegrain, 8 inches, 64 inches from speculum. A Cassegrainian would be much better. The small convex mirror corrects part of the spherical aberration of the speculum. It is placed at its own negative focal length inside the focus of the large mirror.

(7) W. L. W. asks: Is musk such as is used for perfumery, extracted from the common musk rat? **A.** It is prepared from the musk root, *muskat*, or *Jatamansi* (a substance imported from the East). The root itself has long been used in India and Persia as a medicine, a perfume, and for incense. It has a pleasant, musk-like odor, and acts as a powerful stimulant on the nervous system.

(8) A. W. R. asks: Can you give me any information as to the saw here shown? The engraving shows the shape of the steam or lancet-

toothed saw. a shows the form of tooth of full size, and b, the position for holding the saw. The saw is held flat on the bench, and one side is fin-



ished before the saw is turned over. No setting is needed, and the plate should be thin and of the best quality and temper. **A.** We have never used this particular shape of tooth. For very fine smooth sawing, this form of tooth would undoubtedly work well; but must be filed by an expert workman.—**J. E. E., of Pa.**

(9) S. M. asks: 1. How are galvanometers made? **A.** A magnetized needle is placed in the center of a coil of insulated copper wire, the needle being suspended by a thread, or resting on a pivot. 2. I have a magneto-electric machine for medical purposes. It has always worked well until lately, and now I cannot get a hard shock though I put on all the force I can. The induction coil is all right, but I can only get a very feeble current through the secondary coil, and that at very irregular intervals. It is driven by a revolving armature between the plates of a small electromagnet; the circuit is broken and connected by two small silver springs, which press upon an arrangement on the shaft of the armature. The armature revolves about 200 times per minute. **A.** Probably the coating or insulation of the wire of the secondary coil is destroyed, and thus prevents the secondary current from traversing the entire length of the wire.

(10) R. A. asks: How can I separate silver from copper in blocks of mixed metal? **A.** Dissolve the mixed metal in aquafortis of 1:2 gravity. Precipitate the silver as chloride with solution of salt, and reduce the chloride with zinc and dilute sulphuric acid. Evaporate the remainder (containing copper) to dryness, ignite to drive off the acid, and reduce the metal in crucible, or precipitate the copper in solution by iron.

(11) D. C. M. asks: Where can a mineral rod be obtained? **A.** If you mean by a mineral rod a diving rod, we cannot say, because they are only sold by quacks and used by ignorant persons.

(12) B. P. M. asks: When did the first land plants make their appearance? **A.** In certain shales and other deposits, belonging to the Devonian formation.

1. Is the school started by Agassiz still open, and is it the best school of its class? **A.** It is still open, and is the best. For further information, address the officers. 2. Do medical colleges admit students who only take anatomy? **A.** Not as a general rule.

(13) W. D. S. asks: 1. What substance will dissolve in water at its natural temperature? **A.** Most of the salts of the alkalis and metals. 2. What substance will dissolve in water only when heated to 200° or 212° Fah.? What substance will dissolve in water heated (under pressure) to 500° or 700° Fah.? **A.** Substances which dissolve under these circumstances will also dissolve, although not to so great an extent, at lower temperatures.

I drop a piece of copper into nitric acid; powerful analytic and synthetic action ensues, and there rises a murky, yellowish, brown vapor. What is this vapor? **A.** Hyponitric acid.

(14) A. S. asks: What degree of heat is required to melt nickel? **A.** Nickel has remarkable magnetic properties, which it loses on being heated to 650° Fah. The standard authorities do not state the melting point of nickel further than it is very high and near that of iron.

(15) F. E. asks: How can I line a tin can with lead? **A.** Tin lined lead pipes are now common, and a compound sheet of the two metals might be used for your purpose.

(16) T. H. W. asks: 1. How can I coat castings with copper? **A.** The article should first be rendered free from rust by rubbing with an emery cloth, or by dipping into a pickle composed of sulphuric acid 2 ozs., hydrochloric acid 1 oz., water 1 gallon. After the article has remained some time in this pickle, it should be taken out and the rust removed by a brush and some wet sand; if the oxide cannot be easily cleaned off, it must be returned to the pickle. As soon as the article is rendered bright, it is washed in a warm solution of soda or potash, for the purpose of removing all grease. Lastly it is well rinsed in hot water, and immediately placed in a concentrated solution of sulphate of copper, to which a little sulphuric acid has been added. In a short time it will be found to be coated with an even covering of metallic copper. 3. How can I blue wire cloth, such as is used for dish covers? **A.** See p. 296, vol. 30.

(17) W. R. asks: 1. Can you give me a recipe for a dye that will change a set of wooden white chessmen to a pretty red color? **A.** To 2 lbs. genuine Brazil dust add 4 gallons water. Place the articles, immersed in this liquid, in a suitable vessel, boil them for three hours and let them cool, then add 2 ozs. each of alum and aquafortis, and keep lukewarm until the required shade is obtained. 2. What would be the greatest distance at which a brilliant light would appear to stand over and so designate a particular house? **A.** We do not fully understand your question. The magnetum light has been distinctly seen at sea, when

25 miles distant, and the lime, "Drummond," or "calcium," light at a distance of fully 100 miles.

(18) H. M. asks: Can you tell me of a varnish which is perfectly transparent, for polished silver ware? **A.** We think the following recipe will answer your purpose. Take gum mastic 6 ozs., turpentine 14 ozs., place them together in a large bottle, and shake for some time without the application of heat. When dissolved, strain it through a piece of calico, and place it, in a bottle tightly corked, so that the sun may strike it for several weeks, which will cause a mucilaginous precipitate, leaving the remainder as transparent as water. It may then be decanted into another bottle, and put by for use.

(19) H. W. J. says: I have a camera obscura, but the lenses are gone. It will take a picture about 3 inches square. What kind of lens would be best to get? **A.** Try a meniscus, 1 inch in diameter, of 5 inches focus, or buy a quarter size view tube.

(20) E. B. I. asks: 1. How can I make paraboloid chucks to grind glass specula by means of a common lathe? **A.** Keep the mirror spherical until polished, then polish out the center until the focus of marginal and center rays is the same when you read the SCIENTIFIC AMERICAN at 50 yards distance. 2. If cast, how are the molds constructed? **A.** Cast a pair, tap for lathe spindle, turn to template of correct radius, then grind together with emery. 3. After the speculum is ground and polished, how can it be tested for minute errors, and how can such errors be corrected? **A.** The parabolic mirror has twice the longitudinal aberration of the spherical one. That of the spherical one is equal to the square of half the aperture divided by eight times the principal focal length. The mirror is mounted on wooden cleats and viewed at the center of curvature: 1, with an eyepiece mounted on a graduated table close to an artificial star, a lamp with two pinholes in its opaque screen. If spherical, the image is sharply defined, and surrounded by interference rings. 2. By moving an opaque screen across the cone of rays in front of the pupil of the eye. If the mirror be spherical, it will resemble a plane surface.

(21) H. Z. E. asks: 1. Does the earth in its path round the sun always move in the same plane? **A.** No. 2. What is the shape of the earth's orbit? **A.** An ellipse. The eccentricity is $\frac{1}{60}$. In 24,000 years it will diminish to 0.003 and commence to increase.

(22) D. B. & D. H. B. say: We have an engine running our engine; he sometimes runs with 30 lbs. of pressure, at other times as high as 75 or 80 lbs. He contends that low pressure is as good as high pressure in regard to economy. We say that low pressure takes more fuel, more water, and more steam. Which is right? **A.** The difference is in general considerably in favor of high pressure, but not always, however. We could not give an estimate of the difference in your case without knowing more particulars.

(23) E. O. G. says: 1. I state that, at the depth of 1 mile in the sea, a human body will, by the pressure, be rendered unrecognizable, at 3 miles torn and pressed out of shape, and at 7 miles torn to pieces. Am I correct? **A.** We do not know. 2. At what depth is there a pressure of a thousand atmospheres? **A.** At about 34,000 feet.

(24) N. R. says: I have a well 80 feet deep, which is 15 feet from boiler. Can I force the water up through pipe, 90 feet high from bottom of well, with 70 lbs. steam? **A.** Yes.

(25) P. P. says: I read that, in warming buildings by steam pipes, each square foot of surface will heat 200 cubic feet of the surrounding air to 75°, and will require 170 cubic inches of boiler capacity for its supply. 1. Is this a good standard to go by in estimating the quantity of pipe needed to heat a building? **A.** There is no general rule for all kinds of buildings. 2. What increases and diminishes the weight of air, and what increases and diminishes the density of air? **A.** Cold or compression increases the weight of a given volume. Heat or expansion diminishes it.

(26) J. H. says: 1. We have a boat 16 feet long by 3 feet wide, flat-bottomed, pointed at bow and nearly so at stern. Can this boat be driven as fast by a propeller as by one pair of oars? **A.** The oars will answer best. 2. On p. 43, vol. 32, in your answer to J. H., you speak of pitch and gutta percha not being attacked by water. Would this be good for painting the outside of a boat with, to prevent the water soaking into the wood? **A.** Yes.

(27) A. B. asks: What is meant by the area of a piston? **A.** The number of units of square measure, such as square inches or square feet, in the cross section.

I have a rose bush that seems to be full of small reptiles resembling snakes. How can I kill them without killing the rosebush? **A.** Apply to a nurseryman.

What is meant by the frogging box of a locomotive? **A.** The term is new to us. Perhaps some of our readers can explain it.

(28) A. L. M. asks: What is the best plan of seasoning green dogwood or other small woods to avoid cracking? We are putting it in a tight box and turning on live steam, and intend piling it in a dry room (heated by steam) afterwards. Will this answer, and how soon will it dry? **A.** No doubt this plan will answer if it is thoroughly steamed, and it will dry in a few days.

1. What should be the size of a crank pin for a 45 horse power engine? **A.** The question is too indefinite to admit of a general answer. 2. How can I tighten a loose crank on shaft? **A.** It should be bushed and refitted.

(29) L. A. T. says: 1. On p. 19, vol. 32, under head of "British Naval Guns," we find the following: "The latter was proved capable of penetrating wrought iron plates 14 inches thick, as well as a backing of 18 inches of timber and a skt"

of 1 1/4 inches plates," etc. We wish to know if the projectile will pierce the above mentioned in one body? In other words, will it (the gun) shoot through a total of 33 1/4 inches of the above at one shot? A. Yes. 2. Can a ball be made to go through 14 inches of solid iron? A. Yes. 3. Can a vessel be made to float on water with that amount of iron on it? A. Yes. 4. "It penetrated 12 inches armor." What is meant by armor? A. The plating on the vessel's side.

(30) L. H. H. asks: What can I use on belts that have become glazed and hard? A. We believe castor oil and neatfoot oil to be among the best preparations. We know, however, that engineers have a variety of materials which they think very well of; and as the matter is one of interest, we ask for information from our readers.

(31) C. E. P. asks: Please give me a good practical recipe for coloring raw wool with a log-wood blue. A. Use 10 1/4 lbs. logwood, 1 1/4 lbs. prussiate of potash, 3 1/4 lbs. supersulphate of tartar, 2 1/4 quarts muriatic acid, 1 1/4 lbs. nitric acid, 1 1/4 lbs. muriate of tin.

With an engine 9x18, how can I get the most power with 50 lbs. steam, with a 4 feet band wheel on engine shaft and a large belt to drive line shaft with, or by coupling the line shaft to the engine shaft and drive each machine with a small belt from a pulley on line shaft? A. In the second way.

(32) F. H. H. asks: 1. Can oil or grease be extracted from bones, leather, etc., by the use of bisulphide of carbon? A. Yes. It is used in large quantities for this purpose. 2. How can the grease be recovered or separated from the carbon? A. By distillation, using a retort connected with a worm, and condensing tanks, similar in arrangement to the apparatus used in the distillation of light oils.

(33) C. C. asks: How can I construct a furnace to smelt copper and silver ore on a small scale? A. It would require a whole treatise to give you the desired information, and we advise you to consult standard works on the subject, if the services of a practical man cannot be obtained.

(34) C. F. says: I wish to condense about 7 cubic feet oxygen into a cylinder 7 inches in diameter and 18 inches long, and about 10 feet hydrogen into one of the same size. What will the pressure per square inch be on each cylinder? A. The pressure will vary inversely as the volume. Thus, if 10 cubic feet of hydrogen, at a pressure of 15 lbs. per square inch, are compressed so as only to occupy a space of 1 cubic foot, the pressure will be 150 lbs. per square inch. Iron 3/8 of an inch in thickness will answer for the cylinders. You will find rules relating to gases in Ganot's or Deschanel's "Physics."

(35) E. H. M. asks: What would be the best packing to use in a cooking vessel to prevent the escape of steam? A. It would probably be well to give the cooker such a form that you can get in a packing ring, and clamp the two parts together.

(36) J. M. T. asks: At what speed will an engine 5x6 and a boiler 5 feet high x 36 inches in diameter, with 70 lbs. of steam, drive a propeller screw 36 inches in diameter in a tank of water, the wheel to be stationary? A. At about 300 revolutions a minute, if the wheel were completely immersed.

How high will a pound of steam raise a column of mercury? A. About 2 1/10 inches.

1. Is there any back pressure on a high pressure cylinder of a compound engine? A. Yes. 2. Are the cranks of such an engine set at right angles or opposite each other? A. In both ways, and at intermediate angles. 3. Would a three-cylinder engine on the compound principle, having cylinders for three pressures from high to low, be practicable? A. Yes. It has been done.

(37) G. S. asks: The diameter and length of a hydraulic cylinder being given, how can I find the thickness of metal to withstand any pressure per square inch? A. It is customary to strengthen such cylinders with bands or other devices, when the pressure is very great. But for an ordinary thick cylinder, made of cast iron, the following rule will answer: Safe strain in lbs. per square inch $4,000 \times \text{thickness of cylinder in inches}$.

internal radius in inches $\div$ thickness in inches.

(38) A. B. asks: What is the milk of lime that distillers use for cleaning vats, etc.? A. Cream or milk of lime is a thick mixture of the hydrate of lime with water. It is readily obtained by first slacking the lime properly, and then mixing it with water until of the consistence of thin whitewash.

(39) J. L. asks: What is the difference in strength of a 14 inch and 16 inch boiler flue against external pressure? What is the variation of inches in diameter to base calculation on, for external and internal pressure, or how much additional thickness of iron would be required to make strength equal for both kinds of pressure? A. The following empirical rule will enable you to make the desired calculation: The resistance to collapse, in lbs. per square inch of surface, is found by multiplying the square of the thickness in inches by 866,000, and dividing the product by the product of the diameter of the flue in inches and the length in feet. Let F =thickness of flue in inches, D =diameter of flue in inches, L =length of flue in feet, P =resistance of flue to collapse, in lbs. per square inch. Then $P = \frac{866,000 \times F^2}{D \times L}$.

(40) W. K., of Lippe, Germany, says: Since discovering that the following method of hardening picks for burr stones was the best, I brought it into use at several places, and all the millers who use it will have no other method: Have the pick made of the best tool steel, with a stout edge to it, both sides being similarly shaped; let the tool be about one inch and a half wide. Heat the

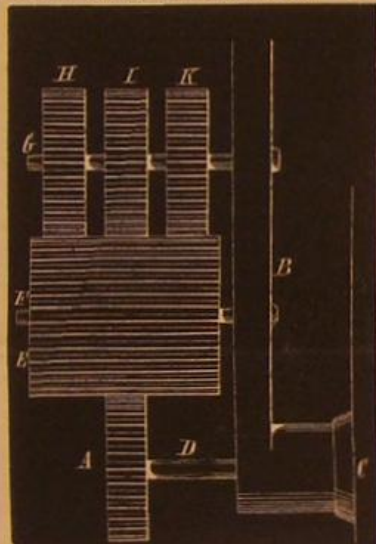
edge to a cherry red and dip it into clear, cool water, not further than one tenth of an inch. In doing this, let your arm rest on something firm, to enable you to hold it quite steadily. As soon as the tool is sufficiently cooled off, it is ready for use. The advantage of this method is that you obtain a hard edge, not liable to fracture, as it is sustained by the soft steel behind it.

(41) H. P. asks: How can monograms, etc., be erased from china ware? Will hydrofluoric acid do it, without making a spot? A. Stop out the part of the vessel which you do not wish to have attacked with a dam of wax or melted paraffin, and allow the liquid hydrofluoric acid to remain in contact until the surface is sufficiently attacked. But it would be a very troublesome and difficult operation. There is no other solvent so powerful as this.

(42) L. G. S. asks: Can you tell me what solution or preparation is used for dipping plain wooden crosses in, so that they are covered with crystals that are generally red and not more than 1/8 inch in diameter and 1/4 inch long? A. Try coloring a saturated solution of saltpeter or alum with aniline red, and continue dipping until a sufficient thickness has crystallized. Or use a solution of bichromate of potash or red prussiate of potash.

(43) J. S. F. asks: Is there any such an art as throwing the voice? Several persons have told me that ventriloquists can throw their voices in any direction, and at any desired distance. I contend that it is mostly deception, for it does not look reasonable to me that sound can be pitched about, separate from the body. A. Your view of the matter is correct. The deception consists in so working upon the imagination that an audience readily believes the sound to come from a distance.

(44) J. L. D. says: There is a curious combination of gear wheels called Ferguson's mechanical paradox. It consisted of 3 pinions connected to one spur wheel, one of which runs in opposite direction to the spur, one in the same direction, and one not at all. How can this be? A. The



wheel, A, is secured to the pin, D, about which the arm, B, revolves. There are two pins, F, G, secured to the arm. The wheel, E, is loose upon F, and gears with A. The three pinions, H, I, K, are loose upon the pin, G. I has as many teeth as A; H, one more, and K, one less.

(45) C. W. J. asks: What is Burnettized lumber for building purposes? A. Lumber treated with Burnett's disinfecting fluid, which is largely used as an antiseptic; and this fluid is a solution of chloride of zinc.

1. What is the fertilizing principle of cotton seed? A. It is probably due to the potash contained in the seed. 2. Would not the seed of the castor oil plant answer as well? A. That must be, of necessity, a matter of experiment with you; we know of no recorded comparisons between the two.

How can I make red and green ink for ruling? A. Red ink: Digest powdered cochineal 16 parts, oxalic acid 2 parts, dilute acetic acid 80 parts, distilled water 40 parts, for 36 hours; then add powdered alum 1 part, gum arabic 1 to 10; shake up, let stand for 12 hours, and strain. Green ink: To powdered bichromate of potash 8 parts, contained in a porcelain dish, add oil of vitriol 8 parts, previously diluted with 64 parts water; then heat, and, while evaporating, add gradually 24 parts of alcohol, and reduce to 56 parts, which filter, and in the clear liquor dissolve 8 parts of gum arabic.

(46) J. L. W. says: You say: "Never allow drinking water to be drawn from a cistern supplying a water closet." Why not? A. Because the cistern is often so connected with the water closet that there is danger of the gases passing from one into the other, or the water, which readily absorbs noxious gases and vapors, becomes impregnated with them.

(47) E. L. asks: Of what is carbolate of iodine inhalant made? A. The mono- and di-iodated compounds of phenol are produced, with copious evolution of hydrochloric acid, by the action of chloride of iodine on phenol. The solution of the residue in soda ley yields, on addition of hydrochloric acid, a grayish white, viscid body, which, when heated under the ordinary atmospheric pressure, is resolved into a large quantity of iodine and rosolic acid; but when distilled in a vacuum, it yields liquid mono- and di-iodophenol, containing a small quantity of rosolic acid. Mono-iodophenol, C_6H_5IO , is a colorless, syrupy liquid, insoluble in water, soluble in alcohol and ether; and it forms, with alkalis, crystallizable salts which are soluble in pure water, but insoluble in strong potash ley. Di-iodophenol, $C_6H_3I_2O$, is a colorless

solid, which melts at about 110°, dissolves sparingly in water, and crystallizes from hot dilute alcohol in slender flattened needles. It dissolves in alcohol and ether, and in alkalies, forming with the latter compounds which are soluble in water but insoluble in strong potash ley. When heated it gives off iodine, and leaves rosolic acid.

Why is it that the dead are always buried with the head to the west? A. Are they?

I have a microscope and telescope, both of which are achromatic; the object glass of the latter is 2 1/2 inches in diameter, its focal length about 54 inches. Is there any way by which I can combine the lenses of the microscope and use them for an eyepiece in the telescope to increase the power of the latter? A. No.

What would be the effect of black pepper sprinkled upon beef or pork when packing it for winter and summer use? A. It would probably be of no advantage.

What effect would saleratus or bicarbonate of potash have, if added to the brine in packing either beef or pork? A. It would alter the taste, and would not prevent spoiling.

What is paraffin? A. It is a white solid, contained in the heavy portion of mineral oils.

(48) M. W. H. asks: Is cherry tree gum of any value for mucilage? A. We do not find it mentioned as of any value. A good mucilage is the following: Dissolve clear gum arabic in hot water, and add a very small quantity of sulphate of quinine. The latter effectually prevents the mucilage from becoming moldy, and replaces the poisonous croscote, corrosive sublimate, etc., frequently used to remedy this evil.

Are there any lead mines that have no silver in the ore? A. The galena, or sulphuret of lead, which is the ore usually mined, always contains a small percentage of silver.

What is the value of pure gold per ounce? A. Pure gold is worth about \$90 an ounce.

(49) J. S. says: 1. I have a well, the water in which is hard, and there is a chain pump in it, the chain being covered with zinc. Is it unhealthy to use the water? A. Generally speaking, no. 2. How does zinc poison affect the system? Does it ever injure the eyesight in any way? A. The salts of zinc, when taken in poisonous doses, cause violent vomiting, burning pain in the stomach, dull eyes, fluttering pulse, and cold extremities. Death seldom ensues, in consequence of the emetic effects.

(50) D. D. N. says: We found that our lamp burnt with a low flame for about 10 minutes, when suddenly the flame would dart up to about 15 inches in height. The oil would trickle down, and the blaze descend below the chimney holder. What was the matter with it? A. Your trouble was probably due to the use of too light an oil, the vapor of which soon partially filled the inner chamber, and, owing to the warmth of the room, expanded and caused the overflow. In this case the remedy is to use an oil of a greater specific gravity.

(51) L. K. L. asks: 1. Which flame is best for a blowpipe to solder white metal to white metal, gas or alcohol? A. Either will do. 2. How can I make a white metal solder? A. You will find a recipe on p. 123, vol. 32.

(52) J. A. D. asks: What acid or combination of acids will separate the cotton and the wool in a mixed fabric? A. A solution of ammoniacal oxide of copper in excess of ammonia dissolves cotton, but not wool. To remove the wool from the cotton, steep in a concentrated solution of potash, when the wool is absorbed, leaving the cotton.

(53) A. F. asks: 1. Will boiling or steaming timber injure its solidity? A. The pores of the wood will become filled with liquid, and some of the substances soluble in water will be extracted. 2. Are there any chemicals that will improve it? A. It is sometimes treated with chloride of zinc, or chloride of mercury, or tungstate of soda.

(54) J. H. says: I wish to make a light garden hose out of cotton drill or cotton duck, by using two thicknesses of the materials. What kind of cement, that is insoluble in water, can I use to stick the two layers of cloth together? A. Dissolve india rubber in bisulphide of carbon, or in hot benzene.

(55) L. S. asks: What cement is used for cementing tea lead to paper by the Japanese? A. Generally what is known as rice glue. It is made by intimately mixing rice flour with cold water, and then gently boiling it; it is beautifully white, and dries almost transparent. Papers pasted together with this cement will sooner separate in their own substance than at the joining.

(56) H. S. M. asks: What is the shortest, surest, and best way to analyze water? A. Water analyses are difficult, and can be made only by chemists. 2. What is the best way to find if the water we wish to analyze is fit for drinking? A. As a general rule, when a bottle is half filled with the water to be examined, set aside in a warm place, and after a few days (on opening the bottle) is found to have a bad smell, taste, and color, it is not wholesome.

Has oxygen been found to be a compound, as was reported lately? A. No.

What is the latest system of symbols in chemistry, and what is taken for the unit? A. The weight of the hydrogen atom is the unit. The system is described in Cooke's "Chemical Physics."

(57) T. F. R. asks: What is it that causes the phenomena which we see after a person has imbibed drink of any kind that will intoxicate? A. "The effects of ardent spirits may be divided into three stages. First, excitement of the vascular and nervous systems. The pulse is increased, the face flushed, the eyes animated and perhaps red. The intellectual functions are powerfully excited. The individual is more disposed to joy and pleasure, cares disappear, the ideas flow more easily

and are more brilliant. Second, intoxication or drunkenness, which is a disordered condition of the intellectual functions and volition, manifested by delirium, varying in its character in different individuals, and by an incapability of governing the action of the voluntary muscles. This state is accompanied with excitement of the vascular system, and frequently with nausea and vomiting; it is followed by an irresistible desire for sleep, which usually continues for several hours, and is attended with copious perspiration. When the patient awakes he complains of headache, loathing of food, great thirst, and lassitude; the tongue is furred, and the mouth clammy. Third, coma or true apoplexy, which is usually observed when excessive quantities of spirit have been swallowed in a short time. The pulse is generally slow, the pupils are usually dilated, and the breathing is for the most part slow; but exceptions exist to all of these statements. In some cases actual apoplexy (with or without sanguineous extravasation) is brought on. The immediate cause of death appears to be either paralysis of the muscles of respiration, or closure of the glottis. The effects of spirit agree, in a considerable number of circumstances, with those of wine, but present some peculiarities. Spirit more readily induces excitement, which, however, is of shorter duration, being more rapidly followed by collapse, relaxation, or debility. Death is by no means an unfrequent consequence of deep intoxication from spirit."—Pereira.

(58) W. H. S. asks: 1. How can I cast plaster of Paris molds without getting airholes in them? A. Make your plaster of the consistence of thick cream. For hardness, use a strong solution of alum, instead of pure water. 2. What kind of varnish should I use for a child's carriage? A. Copal. 3. What is a good varnish for plaster of Paris patterns, to fill up the pores? A. Try paraffin varnish.

(59) W. M. says: You recently published a recipe for coloring hair dark brown. I tried it according to directions, and all it did was to leave a reddish brown deposit on the hair, which brushed off as soon as dry. What is the matter? A. You probably did not remove all the oil or grease from the hair. It is to be observed that hair dyes of all kinds will only act effectively and satisfactorily on perfectly clean hair. The presence of the slightest contamination of oily or greasy matter will arrest or greatly lessen their action, and render it unequal in different parts. Hence the hair, in all cases, should be first thoroughly washed with warm soap and water, then rinsed with tepid water, and lastly wiped dry, previous to their application. A few grains of soda or salts of tartar, added to the first water, will facilitate its detergent action.

(60) R. D. asks: 1. What acids or fluids, mixed with hydrofluoric acid, will etch a clear ground on glass? A. Did you use a solution of hydrofluoric acid or hydrofluoric acid gas? 2. How can I prepare what is termed by etchers white acid? A. We do not know of any acid by this name. 3. What acid or mixture of acids, applied to glass and covered with felspar, will produce a frosted appearance? A. Sulphuric acid. The better method is to place fluor spar or felspar in a shallow leaden dish, and cover it with sulphuric acid. The glass plate may be placed to cover the pan, and as the hydrofluoric acid gas is generated it will attack the under side of the glass plate. 4. What clear varnish is used by sign painters as a finishing protection to gliding on glass? A. This is prepared by dissolving in boiled linseed oil an equal weight of either copal or amber. This is to be diluted to the proper consistence with turpentine.

(61) J. E. S. says: In your last issue you gave the following formula for imitation gold: 100 parts copper, 7 parts tin, 3 parts magnesia, 3 1/2 parts sal ammoniac, 1 1/2 parts quicklime, and 9 parts bitartrate of potassa. Of what use is the magnesia in this? A. The recipe was originally published by two French authors, MM. Mourier and Vallet, who claimed for it the advantages mentioned, but did not state their reasons for adding the magnesia, which would not seem essential.

(62) M. M. M. asks: Are trichinae found in the fat or lean meat of the hog? A. In both, and principally in the muscles.

(63) W. Y. asks: Can the nerves of the teeth be killed? A. Yes. The employment of arsenious acid for the purpose originated with Dr. Spooner, of Montreal. "The use of the actual cautery may be often successful; but inasmuch as it almost always produces inflammation in the investing and alveolar membranes, it should never be recommended. Nitrate of silver seldom succeeds, and usually increases the pain. The employment of arsenic, if applied directly to the nerve, will always succeed. The pain, it is true, will be removed by the destruction of the nerve; but so great a portion of the vitality of the tooth is at the same time destroyed that the organ is apt, sooner or later, to become a source of irritation to the surrounding parts. The propriety, therefore, of the employment of remedies of any kind for this purpose, except to a front tooth, may be looked upon as exceedingly questionable. It is true, the vascular and nervous connection kept up between the investing membrane and the outer surface of the root may, for a time, and more especially if it be an incisor or cuspidatus, prevent it from exerting any marked injurious effect; but in the majority of cases, the vitality even here is so much weakened as, eventually, to render it productive of more or less irritation. The effect of arsenic cannot always be confined to the lining membrane; it often extends to the investing, and for this reason I regard the immediate extirpation of the pulp with an instrument, if the tooth have but one root, as by far the preferable method of treatment. But this operation cannot always be performed with certainty of success on a molaris or bicuspis."—Harris.

(64) J. M. says, on the question of size of pump pipes: I put the air vessel or water chamber on to the suction pipe to the pump, as suggested by N. E. L.; and while the speed of the pump could be increased somewhat, the results were not near as good as prophesied by N. E. L. I am now convinced that, where elbows or bends are used in the supply pipe to a pump, the diameter of the pipe should be much increased; this applies also to long pipes, and if the manufacturers of pumps would make their machines to receive pipes equal to the diameter of the pump cylinder, much better results would be obtained than are now accomplished. I am now putting up a pump exactly like the pump that I originally asked you about. The opening in pump is for a pipe six inches in diameter; but I intend to use a pipe eight inches in diameter to a point as near the pump as possible, and expect thereby to be able to run the pump faster and show better results than I have been able to with the pump on which I used the six inch pipe for the whole distance. My experience shows that it is not safe to be governed closely by the rules set down in the books on hydraulics. As no allowance is made for rough and uneven places found in almost all pipes, which retard the flow of water much more than is generally imagined, the only sure way that I know of is to use pipes large enough to furnish sufficient supply. In testing a fire pump recently, I found that the lining in a rubber-lined hose was torn in a few places, and hindered the flow of water so much that the power of the pump was diminished fully one quarter. The chamber of which N. E. L. speaks, on the suction pipe to a pump, is of much less use on a pump which takes in water at both strokes of the plunger or piston than on a single acting pump, as in the latter case this chamber has a chance to fill while the pump is making one stroke. [If this writer errs at all, it is certainly on the safe side.—Eds.]

(65) S. N. M. says, in reply to F. D. N., who asks: What is the rule by which paper can be cut so as to cover a globe? A globe can be covered with spindle-shaped slips, each in length equal to half the circumference, laid from pole to pole; the narrower the slips the more neatly they will fit, say 10° wide at the center. Calculate the linear width. Draw a straight line equal to $\frac{1}{2}$ the linear circumference, and bisect it. Through the center point draw a perpendicular indefinitely on each side. Take points on this perpendicular, each side at a distance from the central point, equal to $\frac{1}{2}$ the linear width of the slips. Through these two points and the ends of the first line, draw arcs of a circle. The figure thus drawn is the exact pattern of the required slips. To find the diameter of the circle on which these arcs are to be drawn, divide the square of $\frac{1}{2}$ the circumference of the globe by $\frac{1}{2}$ the linear width of the slips; add the quotient to the divisor, and the sum will be the required diameter. Example.—Let the diameter of the globe be 12 inches; its $\frac{1}{2}$ circumference will be 18.84 inches. Let the slips be 10°, and their linear width will be 1.047 inches. The diameter of the required circle will be 14 feet, 2.17 inches; radius 7 feet, 1.08 inches. In practice, take a rod for a radius, with an awl for a center pivot, and a small sharp-pointed knife at the other end to cut out the slips.

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

J. E.—It is litharge or the oxide of lead, and is formed whenever melted lead comes in contact with the oxygen of the air. It can be reduced to metal again. Argentiferous galena is sulphuret of lead containing a small percentage of silver.—E. P. C.—It is quartz, and has no special value.—W. McC.—No. 1 is a calcareous earth, containing the remains of fossil shells and a small amount of organic matter. On certain kinds of land, it might be used with benefit. No. 2 is clay and earth impregnated with bitumen, which could be obtained by proper treatment, and used for heating and illuminating purposes.—R. T. P.—They are earthy magnesian limestones, one of them containing a considerable percentage of bituminous matter; another is colored by a green earth.—O. S.—The brilliant metallic particles are pyrites, not gold, of which there are no external indications; although it is possible that, if the rock were properly crushed and assayed, it might be found to be auriferous.—S. W.—It is fluoride of calcium, or fluor spar. It fuses readily in a blowpipe flame, and is faintly fluorescent. Its specific gravity is 3.05. By further search, you will probably find well formed cubical crystals, of which we should be glad to have specimens.—W. S. V.—Send pieces large enough, and we will determine them. These fragments are too minute.

H. L. N. asks: How can I clean a knife from rust formed by perspiration, so as to make the knife look as though it had just come from the works?—W. H. B. asks: From what point does steam press equally in all directions? Does it not press equally in all directions from a certain center? Is not that center the mathematical center of the vessel in which it is, of whatever shape the vessel may be?

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 Boiler Explosions. By M.
On Honing Razors. By G. W. D.
On Exhaust Steam. By J. P. S.
On Combustion. By C. W.
On Ants. By H. L. A. C.
On a Calculating Machine. By E. K. W.
On a Phenomenon Explained. By A. S. H.
On the Transit of Venus. By D. W. de F.
On Flying Machines. By A. B. B.
On Counting Money. By J. W. C.
On a Man-Eating Tree. By F. H. H.
On Finding Lost Property. By H. W. S.
On Shifting Passengers from Cars. By B. F. L.

On the Occult Sciences. By J. B.

On Amalgam Fillings. By F. H. H.

On the Sewing Machine Monopoly. By L. M. H.

On Mathematical Facts. By M. P.

On Boulders. By D. B.

Also enquiries and answers from the following:

R. L. R.—A. B. H.—W. S.—D. M.—A. W.—J. H. S.—

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

—W. H. H.—S. L. F.—A. O. 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: "Who makes picture frame mitering machines? Who makes engineers' and surveyors' instruments? Who publishes a book containing a list of all the mines in the United States? Who buys black walnut knots, etc.?" 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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- 4,340.—C. Schaaf, Brooklyn, N. Y., U. S., and C. Baner, New York city, N. Y., U. S. Improvements on ice-breaking boats, called "Schaaf's Improved Ice-Breaking Boat." Feb. 1, 1875.
- 4,341.—I. C. Williams, Richmond, Henrico county, Va. Improvements on processes of preparing plug tobacco, called "Williams' Process of Preparing Plug Chewing Tobacco." Feb. 2, 1875.
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- 4,344.—E. E. Fitz, St. John, N. B. Improvements on method of mounting and operating globes, called "Fitz's Method of Mounting and Operating Globes." Feb. 2, 1875.
- 4,345.—W. I. Doremus, New York city, N. Y., U. S. Improvements on oscillating spring chair, called "Doremus' Oscillating Spring Chair." Feb. 2, 1875.
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- 4,347.—W. S. Shippe, Minerva, Stark county, O., U. S. Improvements on plane guides, called "Shippe's Plane Guide." Feb. 2, 1875.
- 4,348.—W. H. Farris, Cairo, Alexander county, Ill., U. S. Improvements in water circulating and steam generating side or basket grate bars, fire fronts, and rear arch bars; and the combination therewith, and with circulating grate bars not having side or basket bars, of pipes and valves for applying the same; applicable to locomotive, river, and other horizontal or box boilers, called "Farris' Improved Water Circulation and Steam Generating Grate." Feb. 2, 1875.
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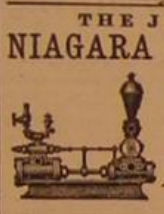
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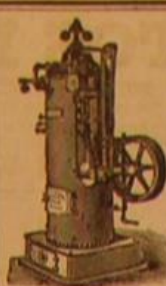
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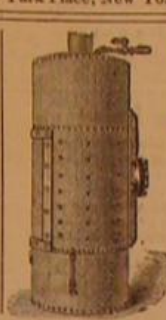
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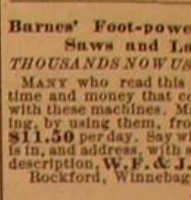
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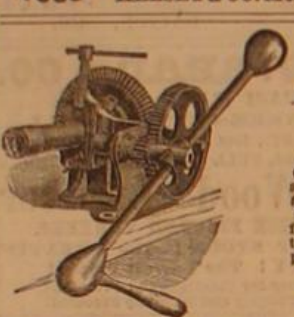
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Vol. XXXII.—No. 11.
(NEW SERIES.)

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A moderate knowledge of practical taxidermy necessitates two essential qualifications: first, a touch both gentle and delicate; second, some knowledge of natural history and anatomy. A badly prepared bird or animal is worthless as a specimen, and a ghastly object to behold. The last mentioned application will, we have no doubt, be peculiarly applicable to the result of our reader's first effort after he rises from the perusal of the lines below. We do not say this in order to discourage such attempt—far from it—but merely to insinuate, in advance, that the practice of the art is not half so easy as it appears from the simple description of the various processes. Therefore we hope that all who, having armed themselves with scalpel and forceps, are now sitting with the victim of Tabby's last raid on the canary cage in front of them, and this paper spread out in convenient position for reference, will blame, not our elucidation, but their own inexperience, if, in lieu of the life-like image existing in their mind's eye, a badly rumpled little knob of yellow feathers reward their toil. Skill is only to be gained by study and practice, and the path is sure to be thickly strewn with monstrosities in astonishing variety; but when once a certain degree of deftness is attained, the student will find that an occasional ramble through the woods, with a light shot gun for company, will be sure to produce enough interesting specimens to keep him amused, as well as instructed, during many of the long evenings between now and summer.

We should begin with a small chicken. Not that a stuffed chicken—unless of course, its interior be filled with bread crumbs, and its exterior be roasted—is an object of extraordinary beauty, or at all suggestive of anything in particular, but because it is easy to get, and it has a moderately tough skin. Besides, if we are economically inclined, the meat will make good soup, and need not be wasted. Don't begin with a canary, nor with a chipper or any other small bird. Stuff several chickens first, or any larger animals.

We will suppose, now, that the student is seated at his work bench. A defunct pullet elevates its rigid claws in the air before him. He has rolled up his sleeves, and is about to make his initial incision. Before he does so, let us look over his kit of tools. Our artist has sketched them all, on the table before the individual which, in the large engraving, he represents

geon's instruments. The blade is short and very sharp, while the handle (not jointed) is long enough to allow of a firm grasp. From the same maker, a couple of pair of surgeon's scissors should also be obtained, one quite small and sharp-pointed, the other of medium size; also two or three spring forceps of various dimensions. A small pair of pliers for clipping wire is required, some spools of cotton (Nos. 10, 30, and 100), a quantity of excelsior and tow, some cotton batting, a little prepared glue, a number of pieces of wire about fifteen inches long, and straight (size No. 20 or thereabouts), a box of dry oatmeal, and some arsenical soap. This last can generally be obtained of druggists, or, if not, can be

back the skin, and the meat removed, when the bone is replaced, and the other thigh treated in similar manner.

The skin is next detached, to the wings, which are cut from the body at the joint next the same, and the bones scraped clear of meat. Then the neck is divided, so that the skin, with the head attached, can be peeled from the entire body clear to the root of the tail. The last is bent toward the back, with the left hand, the finger and thumb keeping down the detached parts of the skin on each side of the vent. A deep cut is then made across the latter until the back bone, near the oil gland at the root of the tail, is exposed. Sever the back bone at the joint. This detaches the body, which may be removed and thrown aside, while the root of the tail, with the oil gland, is left. Great care is needed in this operation, as, if not enough bone be left at its root, the tail will come out; but all fleshy matter should be neatly dissected away.

The neck now requires attention. This need not be split or in any wise cut. The skin is merely pulled over the flesh, as a glove is removed from the finger, until the skull is exposed and appears as in the sketch, Fig. 4. With the point of the knife, remove the ears; and on reaching the eyes, carefully separate the lids from the eyeballs, cutting neither. It requires very delicate and slow work at this point, so as not to injure the eyelids. Then scrape out the eye cavities, and cut away the flesh of the neck, removing, at the same time, a small portion of the base of the skull. Through the cavity thus made, extract the tongue and brains, and after cleaning away all fleshy matter, paint the eye orbits with arsenical soap, and stuff them tightly with cotton. Care should be taken not to detach the skin from the bill, as it is necessary to leave the skull in place. Finally, fill the interior of the skull with tow, after coating internally with the prepared soap.

Cotton, it should be understood, will not answer as a material for stuffing any portion of the body through which, subsequently, it may become necessary to pass needles or wires. It packs too hard, and therefore tow or excelsior must be employed.

The skinning operation being now completed, the stuffing is next proceeded with. To prepare for this, the bird, before being skinned, should have been measured, first as to its girth about the body, and second as to its length from root of tail to top of skull, following the shape of the form. From these data an artificial body of the right dimensions is constructed and inserted as follows: On a piece of straight wire, equal in length to the last measurement above mentioned, a bunch of excelsior is secured by repeated winding with stout thread.

This bundle, which is represented in our Fig. 4, is molded to a shape resembling that of the bird's body, and its girth is regulated by the similar measurement already obtained from the bird itself. As will be seen, it is attached at the end of the wire, the long protruding portion of which



THE TAXIDERMIST AT WORK.

made of carbonate of potash, 3 ounces, white arsenic, white soap, and air-slaked lime, 1 ounce each, and powdered camphor, three sixteenths of an ounce. This is combined into a thick paste with water, and applied as below described, with a small paint brush. It should be marked as poison, and kept scrupulously out of the reach of children or pet animals.

If the bird has been shot, immediately afterwards all the holes made in its body, as well as the mouth, should be plugged with cotton, in order to prevent the escape of blood or liquids. Operations should not be begun for twenty-four hours, so that the body may have ample time to stiffen and the blood to coagulate. It is well during this period to inclose the bird, head downwards, in a cone of paper, so that the feathers will be held smooth. See initial letter.

The first process is skinning, and it is in this operation that delicacy and neatness is required. In commencing, the left hand is used to part the feathers, exposing the skin from the apex of the breast bone to the tail. With the scalpel held like a pen, a free incision is made between these points, as shown in Fig. 3, care being taken to divide the skin only, without cutting into the flesh. The skin is then pressed apart, and oatmeal dusted into the cut, in order to absorb any fluids which may escape. Careful lifting of the skin clear of the flesh follows, until the leg is reached, when the scalpel is again used to disarticulate the thigh joints. The bone of each thigh is then exposed for its whole length, by pushing



Fig 3.—SKINNING—THE FIRST INCISION.
serves as a foundation for the neck. The extremity of the wire is clipped by the pliers to a sharp point, and then forced

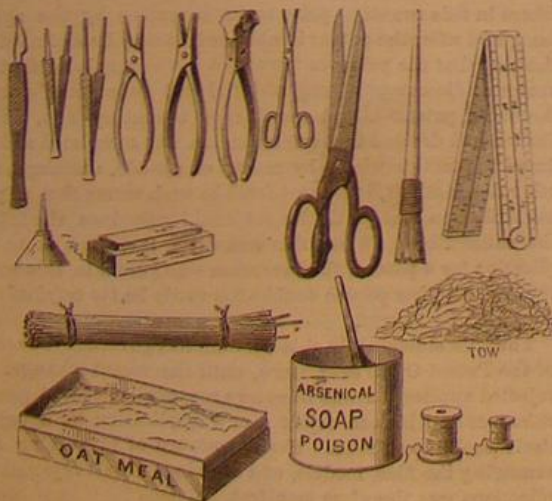


Fig. 2.—TAXIDERMICAL IMPLEMENTS.

at work, and in Fig. 2. First, there is the scalpel. This can be purchased for a small sum from any maker of sur-

diagonally upward through the skull, on top of which it is clinched flat. Cotton batting is then wound about the wire between skull and body, until sufficient thickness is obtained to fill the skin of the neck. The position of the various parts at this point is represented in Fig. 4. Painting the inside of the skin with arsenical soap follows, and then the skin is drawn back so as to envelope the false body, and a needle and thread is thrust through the nostrils to make a loop for convenience in handling.

The finest pair of forceps is employed to pull the eyelid skin into place, to arrange the feathers, and to pull up the cotton in the orbits so as to stuff the cavities out plumply. More cotton is next pushed down the throat until the same is entirely filled (Fig. 5). Two pieces of wire—quite stout for large bird—are then sharpened at one extremity. Taking the wire in one hand and guiding it with the other, the operator shoves it into the leg, from the ball of the foot up alongside the thigh bone, the skin being turned back for the



Fig. 4.—MODE OF ATTACHING THE FALSE BODY.

purpose. Cotton is then wound about both wire and bone, in order to fill the thigh out naturally, and the same process is repeated for the other side. The ends of the wire below are left protruding in order to support the bird on a perch, if such be desired. The upper ends are pushed clean through the artificial body, from below up, and clinched on the upper side. This secures the legs, which are afterwards bent in natural position (Fig. 6).

The bird can now be set up, that is, the wires stretching out below the claws can be wound about a perch or pushed through holes in a board and clinched on the under side. In the latter case, it will be necessary to spread the claws and fasten them with pins. For small birds, the cut in the breast need not be sewn up; a chicken or larger fowl will require

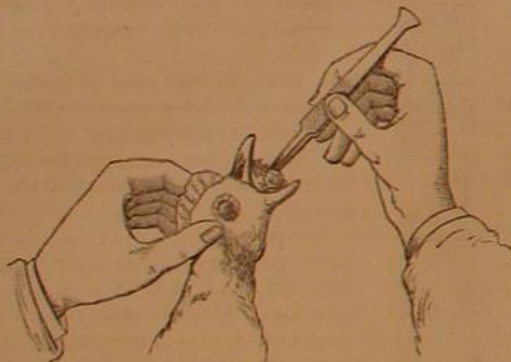


Fig. 5.—FILLING THE THROAT.

a few stitches to hold the edges together. If the tail feathers are to be spread, a wire is thrust across the body and through each feather, holding all in the proper position. The wings are then gathered closely in to the body, and two wires, one from each side, are pushed in diagonally from up, down, and through the skin of the second joint (Fig. 7). The wings are thus held, and the wires, as well as that through the tail, are left protruding for an inch or more. A touch of glue within



Fig. 6.—STUFFING THE LEGS.

the eyelids prepares the latter for the eyes. These must be purchased from taxidermists, but for small birds common black beads will answer. If plain glass beads can be obtained, by the aid of a little paint the student can easily imitate the eye of a chicken. After the eyes are inserted, a sharp needle is used to pull the lids around them and into place.

The operator must now, with a fine pair of forceps, carefully adjust the feathers, smoothing them down with a large camel's hair brush. This done, thread must be wound over the body very loosely, beginning at the head, and continuing until all the feathers are securely bound. The bird is then left to dry for a day or two, when the thread is removed, the ends of wire cut off close to the body, and the work is complete.

Stuffing animals requires less delicacy and care to avoid injuring the skin than with birds, but necessitates a closer knowledge of the form and natural position. The mode of skinning and stuffing is the same, except that the neck is cut down, as the head cannot, of course, be drawn through. This last is also the case with ducks, woodpeckers, and other slender-necked birds. In preparing deer's heads and antlers, the skull is best taken in, as it can be secured on a piece of wood, on which the neck can be built up. In skinning the head, the incision should be made on the back of the neck, and care should be taken completely to fill all cavities of the skull.

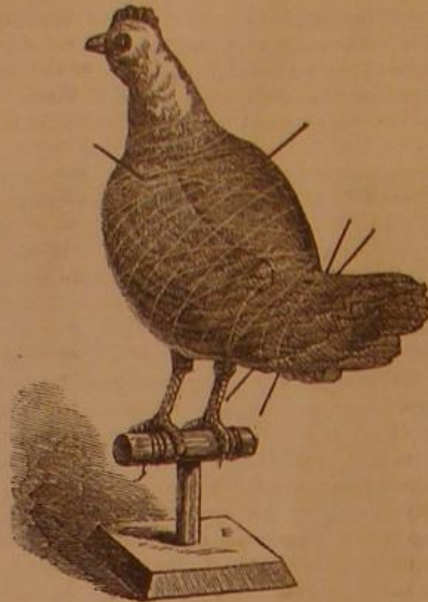


Fig. 7.—THE BIRD PREPARED FOR DRYING.

We should advise amateurs in this interesting art to endeavor to give an aspect of life to their productions, by grouping them or placing them in odd though natural positions. For instance, a chicken can be easily placed as in the act of picking up food or crowing—any position will be better than stiffly standing erect. Similarly animals can be represented attacking prey, fighting, or playing. A very fine group, now in the Central Park Museum, this city, representing an Arab mounted on a camel and attacked by lions, will exemplify our meaning. All the animals in this group are superbly prepared and placed, though, of course, such a work requires a skilled naturalist as well as taxidermist.

We are indebted to Messrs. Ulrich and Riedel, taxidermists, of No. 16 North William street, this city, for the practical suggestions above given.

Sir Charles Lyell.

We regret to announce the death of Sir Charles Lyell, a veteran scientist whose labors in the field of geology have gained for him universal renown. He was a native of Scotland, and was born in 1797; and he graduated at Exeter College, Oxford, where Dr. Buckland (afterward Dean of Westminster, and father of our contemporary, Mr. Frank Buckland) was Professor of Geology. The personal influence of Dr. Buckland, one of the most successful teachers who ever imparted a charm to an abstruse science, probably turned Lyell's attention to geology, he having commenced, on leaving the university, the study of law. In his twenty-ninth year he published his first paper, "On the Recent Formations in Forfarshire, Dorsetshire, and Hampshire." His fame as a writer was rapidly achieved, the scientific world at once recognizing his patient and laborious research, and his masterly and lucid method of exposition. His "Elements of Geology" and "The Principles of Geology" are his two most valuable works, and are known as accurate and exhaustive text books; while his more recent volume, "The Antiquity of Man," is perhaps the most important contribution yet made to that branch which connects his favorite science with the whole problem of the Universe and its origin.

Sir Charles traveled much in this country and Canada in 1841, and a very interesting book on our geology was published by him soon afterwards, called "Travels in North America," a second volume being the result of subsequent investigations made in 1845. During his first visit, he gave a course of lectures on geology in Boston, Mass. He served twice as President of the Geological Society of England, and departed this life full of honors and distinctions bestowed upon him by learned societies in all parts of the world.

New York Science and Art Association.

This institution, at its last regular meeting, elected for President, S. Irenaeus Prime, D. D.; Vice Presidents, E. P. Rogers, D. D., Howard Crosby, LL. D., Professor D. G. Eaton, Henry Day, W. P. Titus.

Its course of lectures this winter has been very brilliant, and every one of them attended by crowded assemblies. The Association gives the lectures freely to the public, its only object being the diffusion of useful knowledge. To this end it invites learned and able men to discourse to the people on topics of commanding interest, and the multitudes desirous of being instructed show that these efforts are appreciated.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 87 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS.

One copy, one year, postage included.....\$3 20
One copy, six months, postage included..... 1 60

Club Rates:

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

By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise they will be entered from January 1st, 1875. In case of changing residence state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXII, No 11. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, MARCH 13, 1875.

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THE NEW RULE OF THE PATENT OFFICE.

Contrary to the uniform and long-established practice of the Office, the Commissioner has recently promulgated a rule that hereafter no rejected and abandoned application shall be a competent reference on which to reject an application for a patent. A person may now hunt among the models of rejected applications, to which free access is allowed; and if he finds anything that has never been patented, or described in a printed publication, or gone into public use, he may—if he can bring his conscience to the sticking point for making the necessary affidavit—obtain a patent therefor which will be good and valid against all the world for seventeen years. It is true that an affirmation, showing that he had derived his knowledge of the invention in the manner just supposed, would defeat his action for infringement; but such proof can rarely be obtained.

The patent law denies a patent unless, among other requirements, the thing patented was "not known or used by others in this country" prior to its invention by the applicant; and after the patent is obtained, it may be defeated by showing that the patentee "was not the original and first inventor or discoverer of any material and substantial part of the thing patented." A quarter of a century ago, Judge Cranch had decided that an invention was completed and reduced to practice when, by means of models, drawings, and other descriptions, it was set forth in such terms that a person skilled in that particular art could reproduce the invention so described. When this was done, therefore, in an application for a patent, the invention was known in this country, and no other person could afterwards be the original and first inventor thereof.

The rule embodied in this decision has governed the action of the Patent Office ever since, until the recent change. A rejected application was therefore regarded as just as good a reference on which to reject a new application as a patent itself would have been. The importance of preserving and arranging the files, models, and drawings of all rejected applications was therefore manifest.

The business of the Office has grown up chiefly under the rule above referred to, and the education of the practitioners therein has been shaped accordingly. The change of the rule, without any corresponding change of the statute, natur-

ally created no little surprise and aroused a feeling of disapproval in our minds.

But upon reviewing the action of the Federal courts on this subject for several years past, we find that they have been gradually drifting away from the rule laid down by Judge Cranch, and the views of the inferior courts in this respect have finally been sanctioned and confirmed by those of the Supreme Court of the United States. We are far from being the advocates of what Mr. Jefferson used to denominate judge-made laws. We believe that the proper duty of the judiciary is to give effect to the statute, according to its fair intent and meaning—leaving to the legislative department the duty of correcting whatever may be thought amiss in the law as it exists. When the courts overstep this rule and undertake, by construction, to change the statute into what they think it should be, they launch forth upon a sea of uncertainty, and find themselves the authors of unnecessary difficulties for which there is no adequate compensation. Different judges will have different views of expediency. No one can tell into what shape prevailing doubts will finally crystallize. The most intelligent members of the profession find themselves incapable of giving reliable opinions, and property in patents becomes to a needless extent a gambling contrivance. To us it has always seemed as though the ruling of Judge Cranch, above referred to, was in substantial accordance with the statute, and that, if thought erroneous, an act of Congress was the proper remedy, especially after it had been so long recognized and acquiesced in by the Office.

But the ultimate decision of the courts is the rule to be observed in administering these and all other laws. Whatever may be our individual opinions, the great court of last resort must be regarded as being endowed with judicial infallibility so far as our own subsequent actions are concerned. The rule of the Patent Office should be made to harmonize therewith, and the Commissioner was bound by his duty to act accordingly. This he seems to have done by the establishment of the rule we have been considering, and to which the conduct of all interested parties must be made to conform.

This rule will to a great extent dispense with the necessity of preserving the files, models, or drawings of abandoned applications, or at all events of leaving them open to public inspection. Until the applications are abandoned, the previous rules of the Office preserved them in secret. After their abandonment, they can hardly be needed for any commendable purpose, and perhaps their preservation might be discontinued altogether, to the great relief and convenience of the Office. With this matter, however, we do not intend to meddle at present.

PISCICULTURAL PROGRESS.

That fish culture is evidently destined to become as much a settled pursuit as stock raising, we believe its past progress, as well as its prospects for the future, leaves no reasonable doubt. The success which has attended the efforts of the public-spirited gentlemen, who, for several years, have devoted their time and studies to the industry, is certainly very flattering, and an abundance of the finest and most delicate of game fish, in almost every stream and brook suitable for their development, appears now to be dependent mainly on the degree to which individuals will interest themselves in procuring the necessary spawn. This, through the new transporting apparatus, which we illustrated last week, is reduced to so simple and easy a proceeding, that the means for populating otherwise waste waters is to be obtained merely for the asking, or at most attended with an expense intrinsically trivial, and entirely inconsiderable in comparison with the benefits to be gained.

We took occasion recently to speak of the landlocked salmon as an excellent fish for stocking streams. There is another species which is worthy of equal commendation, and which is, besides, especially suitable for streams preserved for sporting purposes. We allude to the grayling, the natural habitat of which is in streams in Michigan, flowing into the Lake. This fish has, during the past year, been successfully hatched in New York State. It is not so good eating as trout, but is not at all inferior as a sporting fish. It is easily kept in good condition, and does not require so much food as the trout, and it is in season while the trout is not. The grayling spawns in April and the trout in November.

Mr. Seth Green, however, adheres to the belief that trout is the only fish with which to restock worn-out streams, and he states that in no event can grayling and trout be reared in the same waters.

Mr. R. B. Roosevelt, President of the American Fish Culturists' Association, at the recent annual meeting of that body, briefly recounted progress during the past year, in his opening address. Shad have been put on the Pacific coast, and captured in Sacramento river where they have never before been taken. So, also, bodies of water previously destitute of fish have been well filled with salmon trout, white fish, and various varieties of bass. Experiments are in progress with relation to the sturgeon, and it is believed that this valuable and large fish may be successfully artificially hatched.

NATURE'S EFFORTS.

"If Nature put not forth her power, about the opening of the flower, who is it that could live an hour?"

So argues one of Tennyson's "Two Voices," anent the "stirring of the blood" which makes youth ambitious of great deeds. As poetry it is admirable, it lying in the province of poetry to personify all things, Nature not excepted. As prose, it would be less commendable; as Science, utterly intolerable. Yet men who think themselves scientific not unfrequently indulge in expressions in the same strain, which,

if they mean anything, mean that the aggregate of phenomena to which we apply the term Nature is capable of willing and choosing, and of adapting special means to special ends—a palpable absurdity. Curiously, too, such language is often indulged in by those who deny the implied divinity of Nature, and recognize no controlling intelligence behind the veil.

An instance occurred the other evening: A more than usually thoughtful physician was speaking about the large family of small children, left orphans by a consumptive patient just dead; he said: "That is the usual way; those least worthy of perpetuation—those who have least to transmit to their offspring—multiply the most. Men know that they are slowly dying of an incurable disease, and that their children are almost certain to inherit ill balanced bodies and untimely death; yet they multiply to the last, just as plants when struggling under unfavorable conditions invariably run to seed. It seems," he continued, "as though Nature, conscious of impending defeat, threw all her available force in the direction of seed, to increase the chances of perpetuating the stock."

We have little faith in the theory which ascribes infinite perfection to Nature; in most cases, things are as they are simply because they could not be much worse and exist; still we should shrink from an interpretation of the facts of life imputing, like our friend's theory, infinite foolishness to Nature. The under dog in the fight may be an object of pity. From a human or humane point of view, he may be a proper subject for assistance. But to expect Nature to interfere in his behalf would be as unreasonable as to expect her to make a special effort now and then to help water to run up hill. If the fittest survive—and that is the natural order—the least fit must go down and stay down.

But do not the frailer sort seem to multiply excessively, as our medical friend asserted? To a great extent they do; but that does not necessitate his interpretation of the fact. That simply involves the same fallacy which a prominent sanitarian exemplified in his explanation of the fact that, in the poorer districts of great cities and in other places, as in rural Russia, where ignorance and poverty abound, the birth rate is relatively excessive. It shows an effort of Nature, he said, to make up for the unsanitary condition of such places, and the consequent waste of life in them: in other words, the death rate being excessive, the birth rate has to be correspondingly great to enable Nature to keep her seed up in the matter of population. Of the folly which Nature would exhibit in thus choosing the worst possible ground for fighting her assumed battle with death, he said nothing.

It was easy for a more logical and sensible observer to turn the tables entirely by calling attention to the fact that the excessive death rate, observed under such conditions, is the consequence and not the cause of the excessive birthrate. A high birth rate implies rapid child-bearing, exhausted mothers, ill-cared-for children, and many deaths in infancy—the invariable source of a relatively large death rate; and the same unthrift and ignorance, which result in poverty and overcrowding in unwholesome tenements, are very apt to manifest themselves also in improvident child-bearing with its fatal consequences.

As in this, so in all other similar cases, the moment men begin to indulge in the seductive habit of attributing intention, purpose, design, or what not, to the drift of phenomena, that moment they turn their eyes from their real connection and delude themselves with vain imaginings.

RUBBER TIPPED PENCILS.

On July 23d, 1867, James B. Blair obtained a patent for a rubber head for lead pencils, claiming, as a new article of manufacture, "an elastic erasable pencil head." The patent was acquired by "The Rubber Tip Pencil Company," who pretended that the patent gave to them the exclusive right to make rubber heads for lead pencils and under threat of legal proceedings against all who proposed to make such articles, they prevented competition, obtained a large business, and soon grew wealthy. A few stationers, however, ventured to dispute the broad claims of the Tip Company, and a suit finally came to the United States Circuit Court for trial. The defendants alleged that the rubber head claimed by the plaintiffs was simply a bit of rubber with a hole in it, on which a patent could not be sustained. The court took the same view, and decided that the patent was invalid. An appeal was then taken to the United States Supreme Court, as will be seen from our report on another page. The Supreme Court affirms the previous decision, thus completely rubbing out the absurd claims of the erasable pencil head Tip Company.

WASTE LAND AND FOREST CULTURE.

After a century spent in spoiling our woodlands, we are, as a people, slowly awakening to the fact that the chief end of man is not to cut down trees. We are beginning to learn also that, so far from being incompatible with forests, permanent civilization is impossible without them, that the tree slayer's ambition to bring the whole land under tillage would result, if successful, in making tillage a waste of labor through climatic disturbances. Alternations of drouth and deluge, blighting heats and blasting colds, have ever been the penalty for general forest destruction; and many a land once fertile is now a desert for this cause alone. Indeed woodlands are to climate what the balance wheel is to machinery, the great conservator and regulator, without which all other conditions are wasted.

There is probably not a periodical in the country which has not had more or less to say about the waste of our woodlands. The general opinion seems to be that we can recover

the advantages we have squandered only by the creation of great forest reserves, with a general commission of forestry to see to their protection. Had we a strongly centralized government, it might be easy enough to carry out such a scheme successfully. As things are, we very much doubt its feasibility, except perhaps in regions like the Adirondack Wilderness, where the soil is unfit for anything else, and where such precautions are very little needed. Within our personal recollection, large areas in Clinton and Essex counties have been twice stripped of timber by lumbermen and charcoal burners; yet to-day the same hills are covered with a thrifty third growth. Where the difficulties of transportation are so great, there is little danger that the natural wood growth will fail to keep pace with the wood cutters. It is only where land has been cleared and brought under tillage, or laid waste by repeated fires, that special effort is required for the restoration of the forests. The fears that have been expressed in regard to such irreclaimable wildernesses as those of Northern New York are therefore quite gratuitous.

Besides, it is a general distribution of woodlands, not local forests, however extensive, that the country chiefly needs. The farms of Central New York are benefited by groves in their immediate neighborhood far more than by the forests of Essex and Franklin counties. Still more do the farmers of the West require frequent spaces of woodland, to break the storms of the prairies, to regulate the rainfall and temper the climate, and to meet the local demand for wood. Great forest reserves in Michigan or Wisconsin would help them comparatively little. They should look rather to local measures for the cultivation of trees; and the most that they should ask of government is a law authorizing townships to compel the gradual conversion of unused land into woodland. In every part of the country, there are tracts of land held by individuals or by corporations for speculative purposes. Very largely such landholders are non-residents, who count on being enriched through other men's efforts. While A, B, and C are clearing their farms and establishing schools, churches, and other conditions of civilization, a market is made for the lands of D, who contributes nothing to the advancement of the new society, yet gains in the end perhaps more than the actual settlers. It would be no injustice to him to make him do his part towards the building-up of the community through whose labor he is made rich; and there is no way in which this could be more surely accomplished than by compelling him to plant a portion, say one tenth, of his idle land to trees every year. There would be no injustice in this, for the growth of the timber would add year by year to the value of his investment, while the resident community would be benefited by securing a local supply of fuel and lumber with all the climatic advantages of abundant woodland. The settler can ill afford to wait twenty or fifty years for the maturing of a crop; the speculator on the other hand, who is simply holding the land for its "unearned increment," can well afford to have a legitimate increment in timber growth slowly swelling the value of his investment. The necessity of planting might limit his purchases, but it would scarcely limit his profits in the end.

In all the older States, there are vast areas of waste land owned by railway companies and other corporations, much of it of little value for plow land or pasturage, yet well suited for the growth of wood. The railway companies are in the habit of sending to the remotest parts of the country for ties, when, by the exercise of a little forethought, they might grow them more cheaply at home. It would be to their advantage in the end, as well as a benefit to the community at large, if they were compelled by law to do so.

So too in mining regions, as in Pennsylvania, where miles and miles of mountainous country have been stripped of timber and scourged by fire until nothing remains but blackness and desolation. With their abundant riches underground, the great coal companies can afford to neglect the land above; but the State at large cannot long afford to let them do it. Such waste of woodland has brought ruin to every country that has permitted it; and if the owners of the soil will not restore its natural covering through enlightened self-interest, the inhabitants of the State will have to interfere in self-defence.

Fall of a Meteoric Stone.

The Times has already made mention of a brilliant meteor that was seen at Iowa City and other points in Central Iowa, on the evening of February 12, at half past ten o'clock. Its course was from southeast toward the northwest. It was apparently about half the diameter of the moon, and accompanied by a beautiful train. The color and vividness were about like that of molten iron. While in view it was seen to separate into many fragments, and, after about three minutes, the reports of three explosions were distinctly heard. One of the fragments seems to have fallen about three miles south of the village of West Liberty. An observer near that point says: "For fully a minute the heavens were lighted by the fierce glare of the swiftly descending fire ball; and when it struck, the earth shook as from an earthquake for miles around, and the noise of the concussion was heard by the people of Grinnell, 95 miles away. The fiery ball, striking *terra firma* in a large open field, frightened residents in the vicinity half out of their wits. It sank fifteen feet into the ground, and left a hole of that depth and ten feet in diameter. For hours it continued to spit forth flame, crackle, sputter, smoke, and occasionally discharge loud cannon-like reports, to the infinite terror of the people in that vicinity. None dared approach while this miniature volcano continued in action; but with the cessation of life, hundreds gathered around to investigate the wonder."—*Dubuque Times*, February 10.

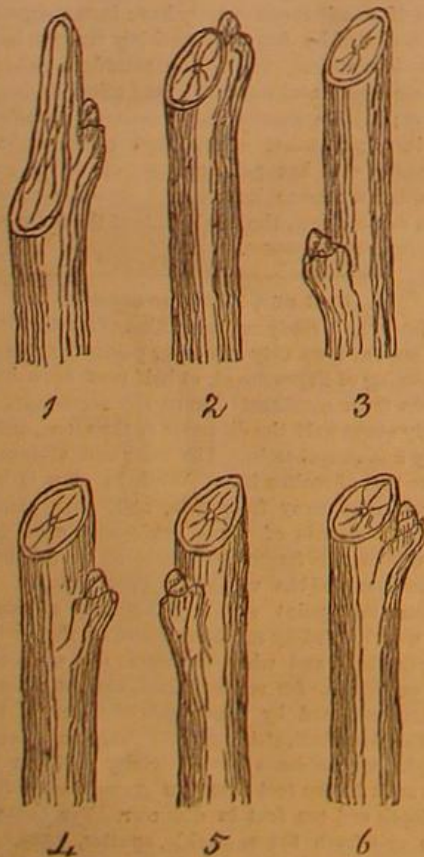
IMPROVED ANIMAL TRAP.

The moment we looked at the model of this invention, we thought about pirates. Not that we mean to insinuate that there is any bond of connection between buccaneers and rat traps—romance forbid such base comparisons! But when we saw an apparatus in which the unsuspecting animal is beguiled to walk along a treacherous pathway, which suddenly turns a somersault and deposits him, before he has any time to remonstrate, in some unknown region beneath, we were reminded of the polite requests, on the part of the big whiskered gentry, which resulted in their captives promending to the end of a plank, from which they failed to return. The inventor says that this trap will fix any animal in exactly that way, any animal, moreover, from a mouse to a buffalo. Although a mouse might stand such treatment and not need subsequent repairs, we doubt if a buffalo would. In fact, we think that the average buffalo, after gloriously coasting down the end of a plank into a yawning chasm, would experience such a general disorganization as to render him of no further utility whatever as a buffalo. Still he would be caught, and that is exactly the object of the trap, to the representation of which, as applied to rats, we devote the annexed illustration.

The deluded rodent, shown on the left, takes the high road leading to destruction via the pivoted platform, A. In cheerful anticipation of a feast, he proceeds to the inner extremity of said platform and tackles the banquet, and probably places his paws on the swinging piece, B. Either touching the bait, E, or meddling with the swinging piece is, on his part, an unfortunate mistake, as the effect is to push back the curved catch, C, and so release the lower extremity of the latter from a lug, D, by which said catch supports the end of the platform. The victim's weight then overbalances the lead on the opposite extremity, and he immediately loses interest in the bait and devotes his mind to jabbing his claws into the platform with the vain hope of making his abrupt departure look as if it were less involuntary. Eventually he finds himself in darkness beneath, from which he may, at his convenience, emerge into the cage like apartment above, and regale himself by watching his relatives served in the same manner, or he may find profitable food for thought in speculating over the neat arrangement of the counterpoise or weighted end of the platform, which, after the victim is deposited, brings the latter back to a level position, when the catch again engages with the supporting lug, and the trap is ready for new prey. We doubt, however, if his conclusions would accord with ours, namely, that the trap is a very ingenious and useful little device; he might receive the further information, that it was patented August 25, 1874, and that State, county, and township rights are for sale, with disgust, and undoubtedly he would anathematize Mr. John Dildine, of Limestoneville, Montour county, Pa., who is the inventor to be addressed for further particulars.

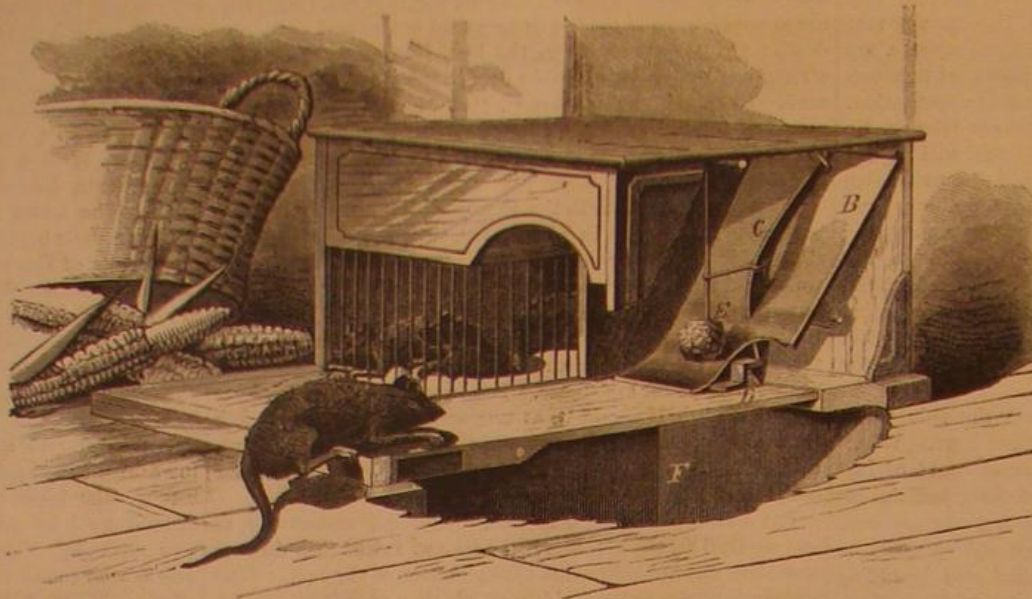
THE MANIPULATION OF PRUNING.

Lindley truly says: "Pruning is the art of scientifically removing certain branches, or parts of them." But except



by well educated and experienced gardeners, it is seldom, if ever, properly performed. Unless the operator thoroughly understands the principles upon which it is based, and the proper mode of operation, it is better to let Nature take

her own course, as less loss will then be incurred and less injury done. By ignorant men the simple operation of cutting off a shoot is almost always done in an injurious way. Some make a long "slivering cut," as in Fig. 1. Here the cut is begun too low down and is carried up too high, exposing the back of the bud to the weather and either killing it outright or causing it to make a feeble or weakly growth. Others, as in Fig. 4, cut "to the quick," producing the same evil effects. To avoid this, some make "snag cuts"—beginning the cut on the same side of the shoot as that on which the bud is placed, and thence sloping upwards from it, as in Figs. 3, 4, and 5. This necessitates going over the work a second time to remove the snags after the bud has



DILDINE'S ANIMAL TRAP.

made a growth, as the young growth cannot cover the dead snag.

The proper cut is shown in Fig. 6. It is called the "clean cut," and is made by cutting at an angle of 45°, beginning at the back of the bud, and finishing slightly above it. When pruned in this way the wound readily and rapidly heals, and commences to be covered with new wood as soon as the young bud pushes into growth. Pruning should always be



Fig. 7.

done with a keen-edged knife, holding the shoot in the left hand, and making one sharp, quick draw. The knife is a far better instrument with which to perform the operation than pruning shears and scissors, as these necessarily bruise the bark, at least on one side. Shears or scissors may do for rose bushes and common shrubs; but for grape vines, fruit trees, and greenhouse plants, the knife is the only proper instrument. Many persons advocate fall and winter pruning, but we think it will be seen, by referring to our engraving, that the exposure of the bud, after pruning, to the drying cold winds, the severe frost, and the effects of sleet and snow, cannot but be injurious, and will either kill or greatly weaken it. Such has been our own observation. Hence, we recommend that the operation be delayed until the middle of February, and performed between that time and the middle of March.

The apple, pear, plum, and cherry, as a general rule, bear only on two-year-old wood, or on spurs from older wood. The young wood should, therefore, be shortened back but little—say one third, or not more than one half—as otherwise it will expend its strength only in forming new wood. We have seen numerous instances in which, because of the ignorance of the pruner, a pear tree, for instance, has had a top as thick as a broom, and borne scarcely any fruit, because the young wood had been cut back, year after year, to three or four buds. The tree should always be encouraged to commence bearing as soon as possible after planting; as

this has a tendency to prevent excessive growth, and as it is then comparatively easy of control, and will not require much pruning. The object of the pruning is to prevent the head becoming too thick, and to induce the formation of fruit spurs. The Morello cherry bears its fruit chiefly on last year's wood, and should therefore never be pruned back severely. As a rule, all cherries should be but sparingly pruned, as the use of the knife has a tendency to cause them to gum. Fig. 7 represents the growth of the wood of an apple tree, showing a bearing spur on the three-year-old wood, the blossom buds on the two-year-old wood, and the leaf buds on the last year's growth. In this, *a a a* represents the fruit buds, *b b b* the leaf buds, and *c* the scar from the fruit borne the last year. When, in the course of time, the spurs of any of these trees become too long, they must be shortened back to the eyes near their base. They will then throw out a new set of spurs.

The peach and the nectarine bear their fruit on the last year's wood. Hence all the pruning they require is to cut back this wood about one third of its length, thinning out all superabundant wood, but retaining enough in the center of the head to prevent the mass of the fruit being borne towards the ends of the branches, in which case the branches may break or split with the weight, to the great injury of the tree. As the trees are thrifty growers, a little consideration will direct us how to obtain a symmetrical and balanced fruitful head.

Of all the fruits cultivated by man, none has been so twisted about, so tortured, by systems of training, pruning, and feeding, as the grape vine. Were it not possessed of a constitutional vigor and a power of recuperation common to few, if any, other plants, it would long since have disappeared from cultivation. The books that have been written about it would make a small library. Each author inveighs against every other system of training or pruning, and declares his mode the only correct one, and it alone the one which should be universally adopted. Each forgets that the vine grows and produces fruit in almost every soil and climate, whether on the rocky sides of mountains where the thermometer goes down to zero, or upon the alluvial savannahs of Demarara, and subject to its equatorial heats.

While the vine produces its fruit on the new growth of the current season, the main requisite for its successful cultivation is the formation of moderate-sized, healthy, well ripened wood of the previous year—such as will furnish one or more strong eyes for the new year's growth. All the systems of training and feeding that have been invented have this object in view, and all the various modes of pruning resolve themselves into the procuring of two eyes or shoots—one for the production of wood for future use and the other for the immediate production of fruit. This is best brought about by the spur method, in which a shoot from a strong cane has been pruned back so as to produce two shoots, only one of which was allowed to produce fruit the last season, as shown in Fig. 8. Here the upper shoot was the fruit bearer, and the lower one not allowed to bear. Now we cut back the upper one on the line *a*, and the lower one on line *d*. From the bud on the lower shoot will come a fruit-bearing shoot for the current season, and the bud, *b*, will make a growth shoot to produce fruit the next year. The present lower shoot will then be cut away, as the upper one has now been—and so on year after year. If the bud, *b*, should be developed at *c*, instead of in its present position, it will make no difference, as in all probability a bud will be developed on the upper side, next year, from which to get a growth shoot, the one beyond it making a fruiting shoot.

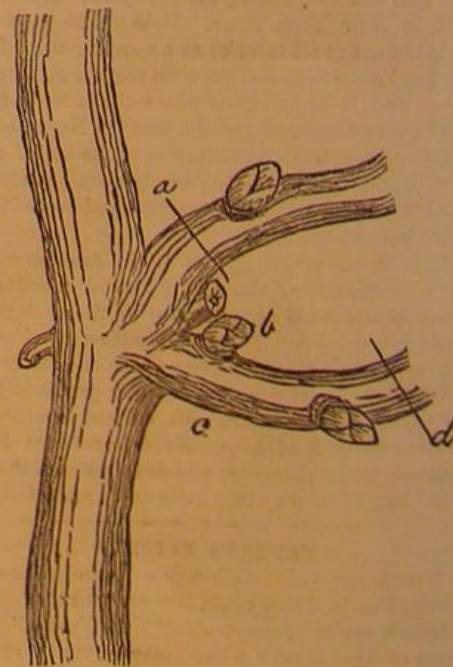


Fig. 8.

In a single article we can only give a few hints, or a general outline of how the operation of pruning should be performed.—*The American Garden.*

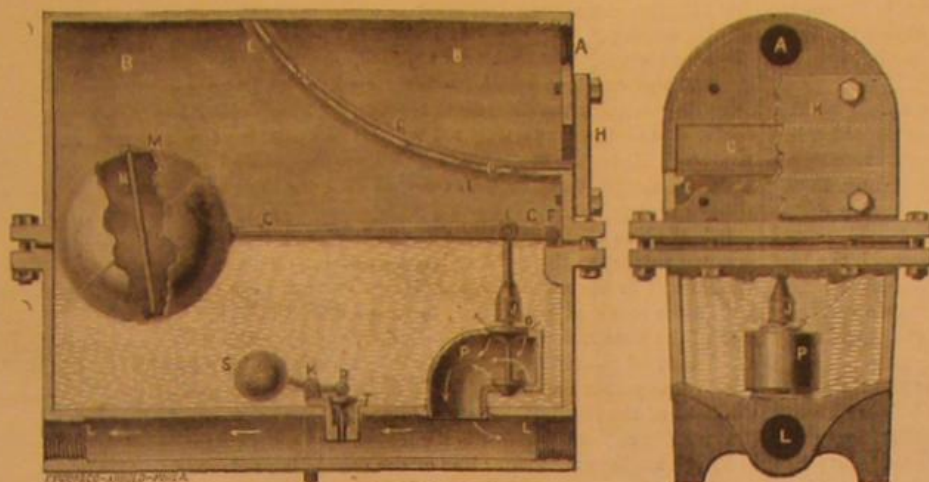
NON-FREEZING FLOAT STEAM TRAP.

Every practical engineer is familiar with the requirements of a perfect steam trap, which are as follows: It must liberate the water of condensation from steam heating surfaces, under all pressures and at all temperatures, draining one foot or a thousand feet of pipe with equal facility, without being regulated or adjusted; it must allow no steam to escape; it must be frost-proof; and it must be so arranged that it may be readily cleaned without disturbing the machinery.

The device now under consideration, patented September 29, 1874, by Mr. W. H. Jenkins, of Philadelphia, Pa., was used at the late Exhibition of the Franklin Institute; and it drained, we are informed, the principal portion of the main steam pipes for supplying power to drive the machinery. It is stated by the inventor that it possesses economy, efficiency, and convenience, which are attained by the construction hereafter described.

It is constructed on the float principle. Steam enters the trap at A, and, with the water of condensation in the pipes, will pass through the filter, C, leaving there the scale and dirt. When sufficient water collects in the case to raise the float, M, the lever, G G, fulcrumed at F, and the valves, O O, connected to the lever, G, at I, are also raised, allowing the water to pass into the outlet, L. As long as the water runs into the trap, the valves, O O, will remain open; but if the supply stops, they will close, until the water again reaches a point enabling it to raise the float, M. In the upper part of the case, B, the lugs or flanges, E E, support the perforated wrought iron sheet, D D, upon which rests a filter of fine wire gauze. This is so arranged that, by removing the bonnet or plate, H, the filter may be taken out and cleaned without disconnecting the pipes, or otherwise disturbing the machine. The float, M, has an opening at the top; and by means of the tube, N, this opening is transferred to within an eighth of an inch of the bottom. The float, being thus subjected to the same pressure within as without, cannot collapse, which permits its being made of very thin material, and thus renders it more buoyant, and the inventor states that it cannot become water-logged; since, if a quantity of water collect in it, the

variation of pressure ordinarily occurring would at once remove it through the tube. The float being spun together, and made entirely without the use of solder, is not affected by heat. The balanced valves, O O, and the counterbalanced valve, R, and their seats, P and T, respectively, are made of the best brass, and so arranged that they can be ground in without the trap being removed, or the lower half of the case disconnected from the pipes. The valves, O O, being nearly balanced in upward and downward pressure, a large outlet can be operated by a small float, this being a decided point of advantage in this trap. The counterbalanced valve, R, is connected to a lever fulcrumed at K, and extending to



JENKINS' AUTOMATIC STEAM TRAP.

the iron ball, S. When there is no pressure within the trap, the weight of the ball, S, will keep the valve open. When steam is turned on, the air in the pipes and case will pass out through the port of the valve, R. When the pressure increases to 3 lbs. per square inch, the valve will close and remain so until the pressure is removed, when it will open by its own action, allowing the water and steam to pass out, leaving the case dry and hot, and thereby rendering it impossible for any water to freeze in the trap. In order to set the trap in operation, connect the pipe to be drained with the inlet, A. Attach to either end of the outlet, L (plugging up the other end), the waste pipe. The inventor assures us that, when properly connected, the trap requires no attention ex-

cept cleaning at long intervals, as there is no chance for affecting its action from without, thus securing it from being tampered with. It is manufactured in three sizes, No. 0 to drain up to 2,000 feet of one inch pipe, No. 1 for 4,000 feet one inch pipe, and No. 2 to drain up to 20,000 feet of one inch pipe.

For further particulars, address Messrs. Jenkins & Kern, 228 Church street, Philadelphia, Pa.

House Drainage.

At the Sanitary Conference recently held at Birmingham, Eng., Mr. Walton read a paper on the objects of the Artisans', Laborers', and General Dwellings Company, one of its essential purposes being the erection of low-rented houses in which every attention is paid to insure the best sanitary arrangements.

In making the drainage of their houses, the company invariably, and as a fixed rule, avoid carrying the drains under any portions of the houses. Instead of this a drain is arranged at the backs of two rows of houses, running lengthwise in the gardens, and into the main drain. The drain pipes are lead from the backs of the houses instead of beneath them and hence into the street, as is generally done in all after modes of house drainage. This plan they have carried out in the houses they have built at Liverpool, Birmingham, Salford, etc., and they are adopting it near London at the Shaftesbury estate, where they have already erected 800 and are constructing 400 more houses. It has been found that wherever this plan has been adopted, the death rate in these houses, compared with that of a similar number of ordinarily drained houses, has been much less.

IMPROVED SAFETY GOVERNOR.

The illustration, Fig. 1, shows the above named governor with a number of improvements, which have recently been added, and are partly explained as follows:

Fig. 1 shows the governor and stop or throttle valve combined; the advantage of which will be apparent, as it obviates the necessity of the usual clumsy throttle separate from the governor. The stop valve and actuating parts are so constructed as by no possibility to interfere with the govern-

Fig. 1.

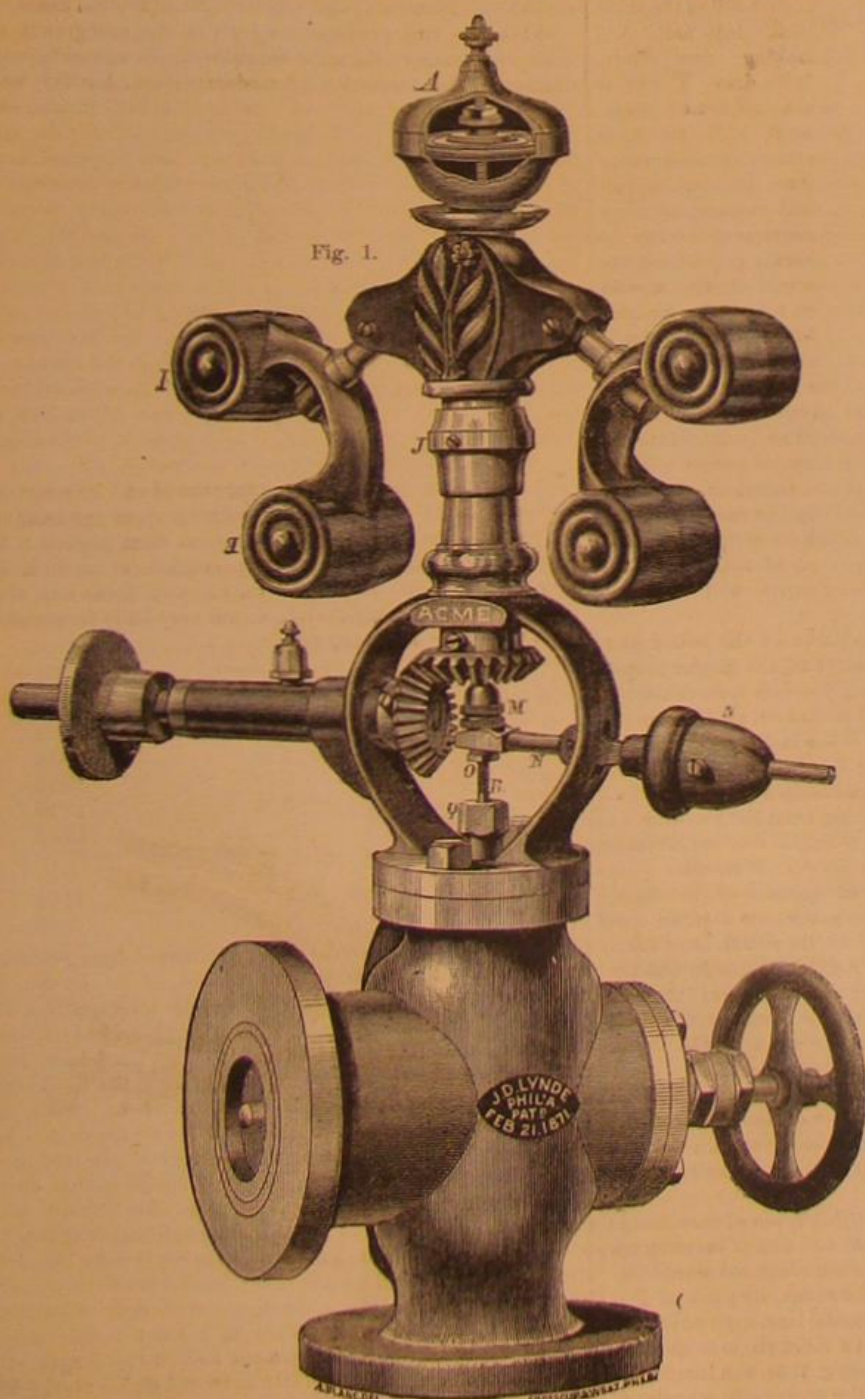
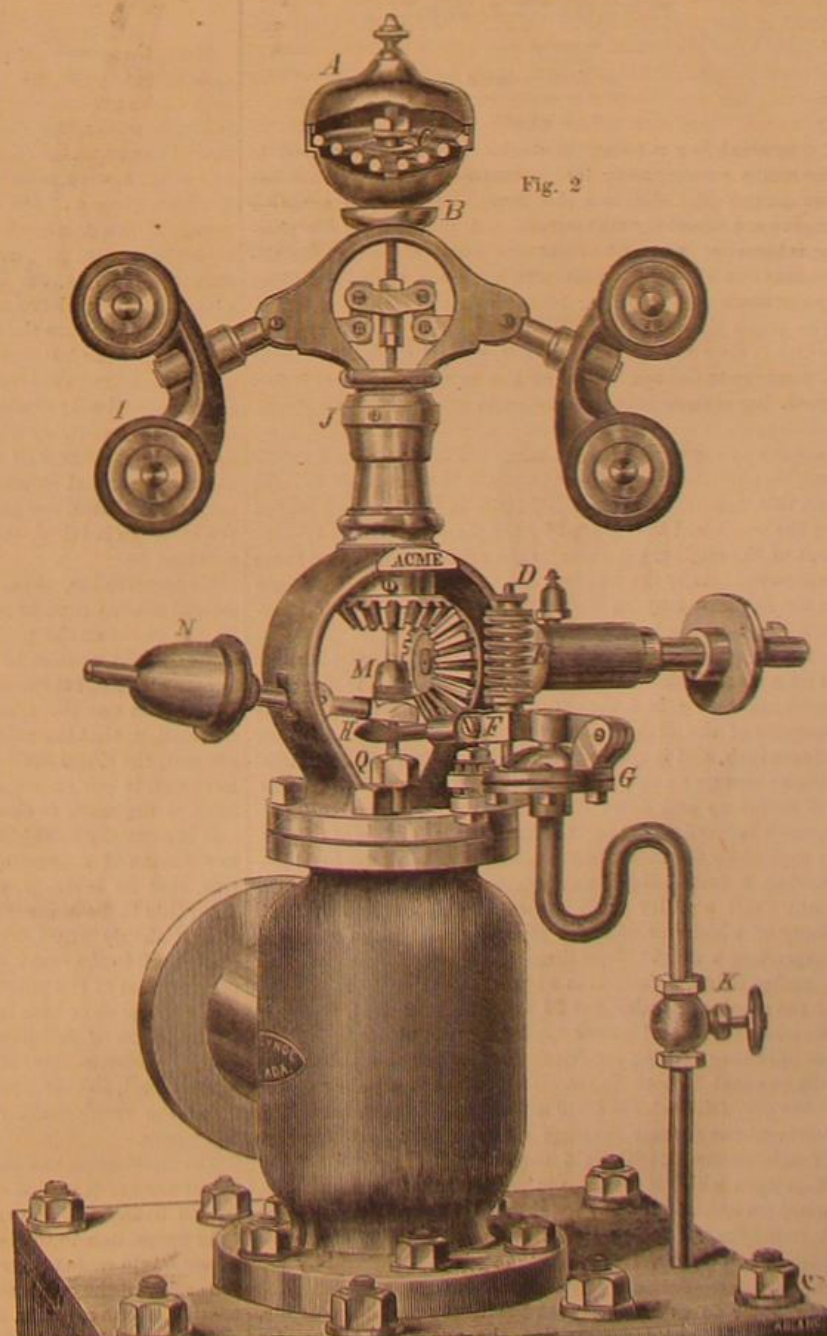


Fig. 2.



LYNDE'S ACME SAFETY GOVERNOR AND STOP VALVE COMBINED

ing valve, and can be reground if necessary with as much precision and in the same manner as when first made. The governing valve is a new device; and it is claimed that, being steam balanced, a much larger valve than heretofore can be used, thus increasing largely the capacity of the governor. The need of this increased capacity of valve will be appreciated by many who have been compelled to purchase a much larger governor than seemed necessary to admit sufficient steam to the engine cylinder. The proprietor states that a size smaller may always be ordered, of the Acme governor, than has heretofore been used, when calculating the size of governor wanted.

Fig. 2 shows the Acme governor (the parts being in about the position they take when running) with the auxiliary attachment, whereby the variable pressure in the engine cylinder is used to assist in regulating the engine; thus reducing the variation of speed, between light and heavy loads, to a minimum.

It is well known that a governor, set to run an engine at a certain speed when light, cannot run it at same speed when full load is put on, without alteration; the engine must go a little slower (from three to ten per cent, according to the governor used) to allow the governor to open its valve. This difficulty is met by the contrivance (lately patented) named above; it has been well tested and is quite novel, the load itself assisting to let on steam to carry it. With this arrangement the engine will run less than one per cent slower, fully loaded, than when light; it takes no power to run it, and needs no oiling, etc.

This instrument is constructed on the same principle as a steam damper regulator, the lever F being held and regulated by a spiral spring, E; its office and operation are as follows: The siphon pipe is attached to the steam chest; and when the valve, K, is open, the pressure in the steam chest will be exerted under a disk of rubber, G, on which stands a piston, having a center point pressing against the lever, F, which is set by the nut and spring, D, so that, when the engine is not loaded, it will have no effect on the governor; but as soon as an increased pressure is felt in the cylinder and chest by the addition of load, the lever, F, is forced up against the lever, H, thus helping to open the governor valve to supply the steam for the increase of load, without perceptible change of speed. Of course as the load changes, the pressure in the chest varies also; and the practicability of this arrangement must be apparent. But it is only necessary where exact speed is required, or where the desire is to do the work with the least possible pressure in the boiler.

For full particulars, circular, and explanatory diagrams, address J. D. Lynde, 405 North Eighth street, Philadelphia, Pa.

PRACTICAL MECHANISM.

NUMBER XIX.

BY JOSHUA ROSE.

THE CRANK.

The crank is a mechanical device, generally employed to convert a reciprocating into a rotative movement, and has proved the most simple and effective mechanical arrangement yet devised for that purpose. It delivers all the power it receives, save and except the usual allowance for the friction due to its movement, which friction varies according to the amount of power or load which the crank transmits. The crank has, it is true, two points in its movement at which it does not transmit power, and (if an engine crank) depends upon the momentum of the fly wheel to carry it forward. But at these points the piston does not receive any steam, hence there is no loss of the power applied. It is true, also, that the power applied to the crank pin is always at a considerable angle to the direction in which the pin itself moves; and this, together with the difference in the distance moved by the crank and that moved by the piston, during a revolution of the engine, gave rise to the common error that there was power lost by the employment of the crank. That such is not the case may be demonstrated by the following propositions:

Let us suppose that we have an engine whose cylinder area is 50 square inches, and its length or stroke 12 inches; the crank, therefore, is 6 inches from center to center. If the pressure of the steam on the piston be taken at 1 lb. per square inch, and is constant throughout the stroke, the total steam pressure on the piston will be 50 lbs.; and as the piston moves up and down the cylinder while the crank performs a revolution, it is self-evident that the amount of power applied by the steam to the piston will be equal to 50 lbs. moving 2 feet. Now, suppose there is attached to the crank shaft a pulley 7-339 inches in diameter, to the periphery of which one end of a rope is attached, the other end suspending a weight of 50 lbs. The circumference of such a pulley being 2 feet, it is apparent that each revolution of the crank will raise the 50 lbs. weight 2 feet, which is the exact amount of power applied by the steam to the piston (allowing nothing for friction), since the element of time will be equal in both cases. The radius of a pulley of the above given diameter is 3-819 inches, which must, therefore, represent the average leverage of the crank: that is to say, a crank, whose length is 6 inches from the center of the shaft upon which it revolves to the center of its crank pin, would (in order to lift the weight as described) require to act all round the stroke at a leverage equal to 3-819 inches, or always in full power, since that is the duty performed by the pulley.

In order to ascertain, in as practical a way as possible, by calculation and demonstration, the average leverage of a crank, we may divide the circle described by the crank pin

into as many divisions as there are inches in its revolution; and then, after measuring the leverage of the crank when it is in each position, we add the whole of them together and divide their sum total by the number of divisions or points at which such leverages were taken. The quotient will then be the average leverage of the whole; and if the result of such a calculation, applied to a crank of the above given dimensions, gives us 3-819 inches, it will demonstrate, if we make no allowance for friction, that the crank delivers all the power it receives.

It will suffice, however, to take nine of such crank positions (instead of one at every inch of movement); this will give a result sufficiently correct for the purpose of illustration, as shown in Fig. 56, which is drawn to one quarter of the full size. *a* represents the circle described by the center of the crank pin. The digits, from 0 to 9, on each side of the above circle, are equidistant points, denoting the positions of the crank at which its leverage is taken; and the lines descending from each digit represent, in each case, the center line of the connecting rod when the crank is at that position. Hence the digits, from 0 to 9, on the parallel line, I, denote the positions, in each case, of the crosshead end of the connecting rod.

It is obvious that, whether the crank stands (at corresponding points) on the right or left half of the circle, the leverage will be the same; so that, if we ascertain the leverage of the crank at points 0, 1, 2, 3, and 4, on the left hand side of the illustration, and points 5, 6, 7, and 8, on the right hand half of the circle, it will be the same as taking the whole nine points on one side of the circle, and will make the lines of the illustration much clearer. The leverage of the crank in any one position is the length that a line, struck at a right angle to the center line of the connecting rod, passing through the center of the crank shaft, will be. When, therefore, the crank is at point, 1, the center line of the connecting rod being denoted by the line, 1 1, the line, *a*, represents the leverage of the crank, and so on through the whole of the positions. Proceeding, then, to demonstrate from the illustration, we have:

Position of crank		Leverage	
No.	line	Inches	nches
0	line		
1	<i>a</i>	3-8	= .375
2	<i>b</i>	23-32	= .72
3	<i>c</i>	1 1-32	= 1.031
4	<i>d</i>	1 5-16	= 1.312
5	<i>e</i>	1 1-2	= 1.50
6	<i>f</i>	1 1-2 bare	= 1.49
7	<i>g</i>	1 3-16	= 1.187
8	<i>h</i>	11-16 bare	= .687
			8.302

Here, then, we have 8-302 inches as the sum of the leverages of nine positions. Dividing this by 9, it gives us 0-922 inch as the average leverage, in the experimental illustration. Since, however, the illustration is only one quarter the full size of the supposed engine (to which the hypothetical pulley and weight were attached), we must multiply this 0-922 by 4, which gives us 3-688 inches as the average (calculated) leverage of the crank. To be absolutely correct, this should be 3-819 inches; and were the leverages taken at a greater number of points, our answer would be more nearly accurate, because we have one dead point in a total of 9; whereas, did we measure the leverage at 40 points of the stroke there would be but one dead point in the total of 40; then again, each crank movement commenced at the minimum of leverage, and only attained the maximum on the completion of the movement, which latter does not, therefore, represent the average leverage of the crank during the movement, but merely the actual leverage of the crank on arriving at each position. Hence, the greater the number of points at which the leverage is taken, the more nearly correct will the result obtained be.

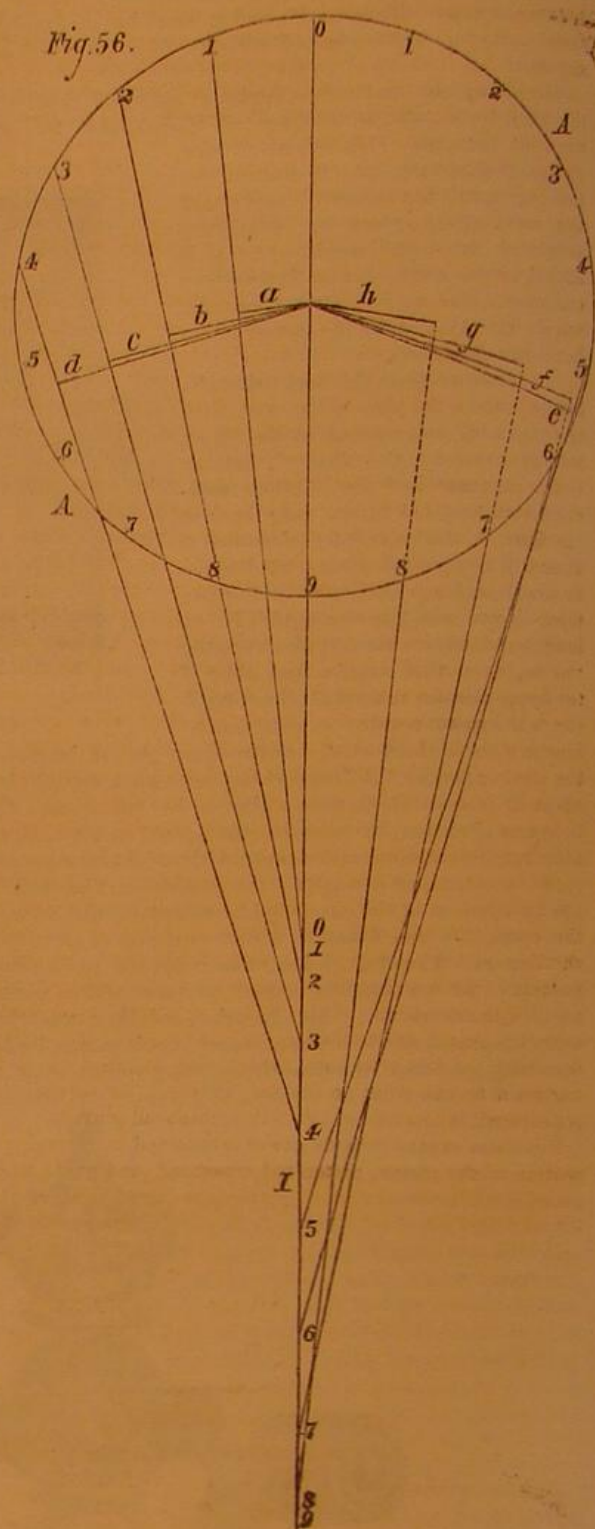
To recapitulate, then, the proposition of the pulley and weight proved that, in order to deliver all the power placed by the steam on the piston, a crank 6 inches from center to center would require to give, by calculation, an average leverage all round the revolution of 3-819 inches, whereas the illustration and the accompanying figures demonstrate, by calculation, that the crank would develop very nearly the amount, the slight discrepancy arising from the fact that we have not, in our example, taken a sufficient number of positions of the crank to obtain a perfectly correct result.

It is certainly an objection to the employment of the crank, as a means of converting a reciprocating into a rotatory motion, that its leverage, and therefore its power, is so variable; this is, however, rectified to a great degree by the action of the fly wheel, which, acting as a reservoir of power, gives back to the crank, when the latter is at and near its dead centers, part of the power which it received from the crank while it was at or near its full leverage or power.

The points of full power are not, it will be observed, on exactly opposite sides of the diameter of the circle of the crank travel, so that a straight line passing through the center of the crank shaft cannot intersect both the points of full power.

The illustration and its accompanying table of movements shows the crank in that case to be at full power between positions 5 and 6; if, however, the connecting rod were longer in proportion to the length of the crank, its point of full power would come nearer to a horizontal line, drawn through the center of the crank shaft and at a right angle to the center line of the cylinder, the rule being that, the longer the connecting rod proportionately is, the nearer will its point of full power be to that point at which the crank stands mid-

way between the two dead centers; and as a consequence, the more regular will the variation of the leverage of the crank be, that is to say (referring to the illustration), the leverages of points 1, 2, 3, and 4 would be greater, and the leverages of points 5, 6, 7, and 8 would be less, and hence the one series of positions would more nearly equal in leverage to the other series.



Let us now consider the crank movement and leverage in relation to the piston movement; and we find, on referring to the diagram, that, while the crank moves from position 0 to position 1, the crank has gained three eighths of an inch of leverage, while the piston has only moved about one sixteenth of an inch, using, therefore, but very little steam, and so on, as per the following table:

Crank movement No.	Leverage gained Inch	Piston movement Inch
0 to 1	3-8	1-16
1 " 2	11-32	3-16
2 " 3	5-16	5-16
3 " 4	9-32	7-16
4 " 5	3-16	17-32
5 " 6	0	17-32
6 " 7	Leverage lost 5-16	1-2
7 " 8	1-2	11-32
8 " 9	11-16	3-32

which shows that, when the crank has moved from position 0 to position 2, which is two ninths of its stroke, it has gained very nearly one half of its full leverage (that is $\frac{3}{8} + \frac{11}{32} = \frac{25}{32}$ or nearly $\frac{3}{4}$ inch), while the piston has moved one twelfth only of its stroke (that is $\frac{1}{16} + \frac{3}{16} = \frac{1}{4}$ inch, the total stroke being three inches). Again when the crank has moved to position 3, which is one third of its stroke, it has gained a little over two thirds of its leverage (that is $\frac{3}{8} + \frac{11}{32} + \frac{5}{16} = \frac{23}{16}$, which is over two thirds of one and one half inches), while the piston has only moved a little over one fifth of its stroke. At both positions, Nos. 5 and 6, the crank remains as nearly as possible at its full length of lever, while at position 7 it has moved seven ninths of its stroke, remaining still a lever equal to over seven tenths of its full length, the piston having moved over seventeen twentieths of its stroke. Even at position 8, the crank is at a leverage approximating to one half its full length, although when in that position it has moved eight ninths of its entire stroke. Thus we find, that the reason, that a crank is equal, all round its revolution, to a lever of more than one

half its length from the center of the crank pin to the center of the crank shaft, is because it moves so quickly into its leverage and retains the same so long, and, furthermore, that the piston movement, and therefore the consumption of steam in the cylinder, during that part of the crank movement in which the crank is at a leverage of less than one half its length, is comparatively very small indeed.

It will be further observed that, as the momentum of the fly wheel causes the crank to travel at (nearly) an equal speed during all parts of the revolution, the piston is traveling much faster at one than at another part of the stroke. For instance, suppose the crank to make a revolution in a second, it will move from each of the divisions (in the diagram) to the next division in the one-eighteenth of a second. The piston, then, while the crank was moving from point 5 to point 6, traveled at the rate of (referring to the table of piston movements) one and one half inches in one eighteenth of a second; while on the other hand, the crank moved from point 1 on one side of the dead center to point 1 on the other side of the dead center, that is two divisions, the piston moved one eighth of an inch only, and had (since the crank moved two divisions) two eightieths or one ninth of a second to do it in; so that the reversal of the direction of the movement of the piston is not so sudden as it would at first sight appear to be, or as to cause any violent shock, or entail any appreciable loss of power.

The difference between the amount of power transmitted to the piston and that delivered by the crank shaft may be appreciated when it is stated that in large engines it is computed at nearly two pounds per square inch of the piston area, and in small engines to from ten to fifteen per cent of the total mean pressure on the piston throughout the stroke; to which must be added the amount of friction due to the load which the engine may be driving, the allowance made for this latter being about seven per cent. This difference is accountable for in the power required to operate the slide valve and other working parts of the engine, although there is no doubt that the strain placed by the blocks upon the guide bars when the crank is at and near its points of full power is also very great, in consequence of the angle at which the center line of the connecting rod stands to the faces of the guide bars.

Not so much power is consumed in moving the connecting rod as might, at first sight, appear, because the movement of the crank pin end, which is the heaviest end of the rod, is circular, and it is only at the very center of the crosshead bearing of the rod that its movement is a purely reciprocating one. The movement of the rod as a whole is, as stated, a circular one at the crank pin end, and an oval one between the crank pin and crosshead, which oval becomes longer and narrower as the point on the rod, at which the movement is considered, is located nearer to the crosshead journal.

But little expenditure of power is involved in reversing the motion of the piston, piston rod, crosshead, and guide blocks, because whatever amount of power is required to move them in the first half of the stroke, during which their speed is accelerated, is delivered back by them in the effort to arrest their movement which takes place during the last half of the stroke; hence we find that there is no foundation for any supposition of a loss of power due to the movement of a crank as applied to an engine.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

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

Positions of Planets for March, 1875.

Mercury.

Mercury has been seen after sunset in the twilight from February 1 to the present time (February 18), and will probably be visible for some few more evenings.

After March 10, it should be looked for in the early morning before sunrise, and on March 28 it should be readily seen, as it is then at its greatest elongation west of the sun.

March 1, Mercury rises at 6h. 23m. A. M., and sets at 5h. 53m. P. M. On the 31st, Mercury rises 4h. 54m. A. M., and sets 3h. 53m. P. M.

Venus.

Venus, although past its greatest brilliancy, is still a beautiful object in the morning. It rises at 4h. 13m. A. M. on March 1, and sets at 1h. 56m. P. M. It passes the meridian about 9 A. M., and to good eyes is still visible at that time.

On the 31st, Venus rises at 4h. 10m. A. M., and sets at 2h. 40m. P. M. On the 27th, Venus is so near Saturn that the latter can be easily found.

Mars.

Mars can be seen in the early morning hours. It rises on March 1 at 1h. 15m. A. M., and sets at 10h. 33m. A. M., being far south in declination, and above our horizon only a little more than nine hours. On the 31st, Mars rises at 0h. 25m. A. M., and sets at 9h. 27m. A. M.

Jupiter.

On March 1, Jupiter rises at 10 in the evening, and sets the next morning at 8h. 42m. On the 31st, Jupiter rises at 7h. 47m. P. M., and sets at 6h. 37m. the next morning. As Jupiter comes into better and better position, the varying phenomena which its satellites present should be carefully noted.

Between 10 P. M. of March 18 and 2 A. M. of the 19th, the third satellite and its shadow and the first satellite and its shadow may be seen projected on the disk of Jupiter.

Saturn.

Saturn rises at 5h. 52m. A. M. on the 1st, and sets at 3h.

54m. P. M. On the 31st, Saturn rises at 4h. 2m. A. M., and sets at 2h. 12m. P. M.

According to the *American Nautical Almanac*, Venus and Saturn are in conjunction (have the same right ascension) on the 27th, Venus being $1^{\circ} 16'$ north of Saturn. As Venus is well known to every one, this position will enable observers to recognize Saturn.

Uranus.

Uranus rises on March 1 at 3h. 14m. P. M., and sets at 5h. 28m. the next morning. On the 31st, Uranus rises at 1h. 12m. A. M., and sets at 3h. 28m. the next morning. Seen through a telescope, Uranus presents the appearance of a small full moon, bluish white in color. Its satellites are seen as exceedingly minute points of light.

Neptune.

Neptune rises and sets so nearly with the sun that it cannot be seen.

Sun Spots.

The record is from January 24 to February 18 inclusive. During this time, on account of cold weather and clouds, only nine photographs have been taken. In the picture of the 24th are two spots of medium size, near the end of their passage across the disk. From this time until February 16 photographs and observations with the telescope show that spots were remarkably few and small. To day (February 18), the preceding day having been cloudy, the photograph shows a very large spot just within the eastern limb. At present the spot appears narrow but of unusual length, and, if it follows the ordinary changes in passing across the disk, must be visible to the naked eye when it reaches the middle of the passage.

Correspondence.

Can Ants Talk?

To the Editor of the Scientific American:

The following may perhaps answer the above question:

During a ramble over the mountains last spring, I was attracted by a low, shrill, squeak close by, when, upon looking in the direction of the sound, I saw on the ground, evidently hastening from me, a large insect of the ant species, about $\frac{1}{2}$ of an inch in length, its hinder part of a bright red color, and covered with hair. I saw nothing peculiar in its shape, it being similar, as nearly as I could tell, to a common ant, only much larger. Struck by the novelty of the sound, I stopped it with my stick, and tantalized it for some minutes, during the whole of which time it emitted its scream, which I can describe in no other way than that it was similar to the sound which one would make when calling the attention of a bird in its cage, and that it was sufficiently loud to have been heard at a distance of 40 or 50 feet. I finally secured the insect and have kept it ever since, preserved in alcohol.

From the above it can be seen that the vocal power of the ant is sometimes far from inaudible; for in proportion to its size, I should estimate that the cry of my ant would exceed the bellow of a bull, or the roar of a lion.

Salt Lake city, Utah.

H. L. A. C.

New Telegraph Alphabet.

To the Editor of the Scientific American:

The ordinary Morse telegraph alphabet, consisting of dots, dashes, and spaces, answers very well when a register is used, and the signals are recorded on paper; but since the sounder instrument has almost entirely superseded the register, this alphabet is defective, as the sound of a dash is very much like the sound of a dot with a succeeding space. This fact suggested to my mind the idea of forming an alphabet which would consist entirely of dots and spaces, and thus lessen the liability to mistakes in transmitting messages by sound. I selected an article in a newspaper, ascertained how many times each letter occurred in it, and arranged them in tabular form, placing the letter which occurred most frequently, first, thus:

E.....	154 times	G.....	25 times
N.....	112 "	F.....	23 "
T.....	108 "	Y.....	22 "
A.....	99 "	P.....	20 "
L.....	82 "	B.....	17 "
S.....	69 "	M.....	17 "
R.....	69 "	W.....	16 "
I.....	57 "	V.....	14 "
C.....	52 "	K.....	5 "
O.....	52 "	J.....	3 "
D.....	51 "	X.....	1 "
H.....	49 "	Q.....	0 "
U.....	40 "	Z.....	0 "

The alphabet was then formed by denoting the first letter in the table by the simplest character possible, that is a single dot; the second one is denoted by two dots, the third one by dot, space, and dot, thus:

E	—	G	— — —
N	— —	F	— — — —
T	— — —	Y	— — — — —
A	— — — —	P	— — — — — —
L	— — — — —	B	— — — — — — —
S	— — — — — —	M	— — — — — — — —
R	— — — — — — —	W	— — — — — — — — —
I	— — — — — — — —	V	— — — — — — — — — —
C	— — — — — — — — —	K	— — — — — — — — — —
O	— — — — — — — — — —	J	— — — — — — — — — — —
D	— — — — — — — — — — —	X	— — — — — — — — — — — —
H	— — — — — — — — — — — —	Q	— — — — — — — — — — — — —
U	— — — — — — — — — — — — — —	Z	— — — — — — — — — — — — — —

Addison, Mich.

JOHN MILLIS.

Utilization of Exhaust Steam.

To the Editor of the Scientific American:

Some mechanics hold that exhaust steam cannot be practically used for heating purposes on account of the back pressure on the engine, which has sometimes resulted in producing greater loss than profit, both mechanically and economically.

Mr. James F. Smith, of this city, a practical engineer, has recently overcome this obstacle by making the heating pipes of the full area of the exhaust. At the end of the building so heated, it is necessary to exhaust upwards, and work down with the drips. It will, of course, require larger piping, and the pipes should be laid with sufficient descent to carry off the waste water. A child can be easily regulate the throttle for each room; and the rough and unsightly crates now in use can be dispensed with.

B.

Orange, N. J.

New Safety Elevator.

We have lately examined, at the shops of the Holake Machine Company, in this city, No. 279 Cherry street, the working operation of their new elevator, for warehouses, stores, offices, and other purposes. One of the distinctive features of the improvement is a novel clutch, by the shifting of which, by the usual cord, the motion of the rope drums is changed, and the elevator made to ascend or descend, as may be desired. Another improvement relates to a safety clamp attached to the elevator platform, so arranged that, in case the lifting ropes should break, the platform instantly locks itself between its guides, and cannot fall. As a practical trial, we saw two men mount the platform and sever the lifting rope while they were upon it; but the platform barely settled four inches before it was solidly locked fast.

Another point of improvement is an additional safety device, for locking the main gears in case the driving belt fails or breaks. The device for this purpose is simple but effective. Altogether the improvements appear to be admirably adapted for practical use, and contain every appliance for safe and reliable operation which the best experience can suggest. All elevators are of course more or less alike. They consist of a platform on which the goods or passengers are to ride, wire lifting ropes to raise and lower the same, winding drums to operate the ropes, and steam power to perform the work. These things being equal, that will be the best elevator which likewise supplies the most effective devices for ensuring safety and preventing accident. In these respects it will probably be difficult to find anything superior to the improvements above described.

Sleeplessness.

To take a hearty meal just before retiring is, of course, injurious, because it is very likely to disturb one's rest and produce nightmare. However, a little food at this time, if one is hungry, is decidedly beneficial; it prevents the gnawing of an empty stomach, with its attendant restlessness and unpleasant dreams, to say nothing of probable headache, or of nervous and other derangements, the next morning. One should no more lie down at night hungry than he should lie down after a very full dinner, the consequence of either being disturbing and harmful. A cracker or two, a bit of bread and butter or cake, a little fruit—something to relieve the sense of vacuity, and so restore the tone of the system—is all that is necessary.

We have known persons, habitual sufferers from restlessness at night, to experience material benefit, even though they were not hungry, by a very light luncheon before bedtime. In place of tossing about for two or three hours as formerly, they would soon grow drowsy, fall asleep, and not wake more than once or twice until sunrise. This mode of treating insomnia has recently been recommended by several distinguished physicians, and the prescription has generally been attended with happy results.—*Scribner's Magazine*

Good Words for the "Science Record."

The following words, from three of our friends in remote places, who have just received the SCIENCE RECORD, express the sentiments of many others, which we refrain from printing on account of our limited space:

"Received SCIENCE RECORDS today; they are a splendid reward for a little work."—*Mary F. Gilbert, Racine, Wis.*

"The SCIENCE RECORD came to hand this morning; upon examination I find that it far exceeds my expectations, and would be a valuable addition to any man's library."—*Jas. D. Hollister, Salisbury, N. C.*

"Many thanks for the SCIENCE RECORD; it is well worthy of going to any trouble to get. I hope I may be able to get you more new subscribers."—*Francis Carroll, Manager, N. O. Gas Works.*

Any person having paid for a volume, or being entitled to one for obtaining new subscribers to this paper, and not having received it, will please notify the publishers at once, as copies have been mailed to all the names upon our order books.

The SCIENCE RECORD for the years 1872, 3, 4, 5,—four volumes—will be mailed on receipt of \$8, or a single copy of either year for \$2.50.

DR. FOTHERGILL says in the *Popular Science Monthly* that the intellect is more than normally brilliant when the person is affected with the first stages of pulmonary consumption or with chronic gout.

THE Suez canal has earned a profit equivalent to seven per cent on its cost, during the year ending in September last.

IMPROVED RAILWAY AXLE BOX.

Hot boxes are one of the many annoyances with which railway mechanics have to contend, railway owners to pay for, and railway passengers to anathematize. Dust will get into brasses, and friction inevitably follows. Then the parts get hotter and hotter, and finally oil and waste burst into flame; the train is delayed, sometimes for hours, and in the end rushes on to its destination with ruined brasses and badly cut journals, looking (after nightfall) to the astonished denizens of way stations, more like a rapid torch-light procession than anything else. The usual means for avoiding the difficulty are: Care in closely fitting brass and journal, the use of alloys, for the former, least liable to cut, and of various lubricating materials claimed to perform their office more effectually than oil. An invention which, like the one which is herewith illustrated, aims at the root of the evil, by preventing altogether the entrance of dust and providing a means to keep the brass cool, has, we believe, hitherto been absent, or, if it existed, no tidings of its success have ever reached us. The present device has, therefore, the merit of novelty and also of being a long step in the right direction. It appears to be practical, and we think that railway mechanics will not hesitate to give the new axle box a fair trial.

It comprises two distinct inventions, the first for keeping out dust, the second for maintaining the brass cool. To gain the former end, the box must be perfectly tight next the wheel, sufficiently so to prevent the leakage of oil, and yet it must allow the axle abundant play in its lateral and other movements. By referring to the sectional view, Fig. 2, the manner in which these ends are accomplished will be seen. A is the back of the box, cast in one piece with the body. A metal guard and bolts secure to the inner side a bellows joint, B, which is stamped out of leather and hence has no seam. The outer portion of this joint is similarly attached to a gun metal ring, C, shown enlarged above. On the axle a ring, D, is shrunk; and just outside of this, another ring, E, of iron, containing spiral springs which tend to push it outward, is placed. The springs serve to take up any wear of the rings. The bellows joint slips directly over these, so that the ring, C, bears against the ring, E. Outside of the ring, C, and also bearing against it, another iron ring, F, is secured rigidly to the axle. It will be seen, therefore, that the leather forms a screen between axle and box, and, as it is attached to both and is flexible, it forms no obstacle to the lateral play of the former. The two rings, E and F, bearing directly against the ring, C, revolve, of course, with the axle; and as the ring, F, is slightly tapered, its natural effect, owing to the centrifugal force due to the revolution, is, it is claimed, to throw the oil away from the joint, and thus to prevent leakage.

This arrangement, the inventor states, can be applied to any railway box at a cost not exceeding fifty cents. He claims that it allows of filling the box to a sufficient depth with oil alone, and thus doing away with packing entirely, so that the axle runs directly in the liquid. A large saving is thus effected, not merely by obviating waste of oil, but also in packing and the time and labor involved in inserting and removing the same.

The apparatus for cooling the journal consists in the peculiar construction of the brass, and in a water receptacle with suitable connecting pipes secured above and outside the box. The brass, shown at G in the sectional cut, is cast with a core, so as to leave within it longitudinal and horizontal channels on each side of the brass. These connect with short tubes on the outer end of the brass; and to the tubes, the flexible rubber pipes, H, which lead to the water reservoir, I (shown in the perspective view, Fig. 1), are attached. It is claimed that, by this device, the brass can never become heated higher than the boiling point of water, even if the lubricating material should be neglected. The reservoir is a simple box of tin, provided with a screw cap, opening to allow of its ready replenishment. It is attached to the box by a simple thumbscrew, so that if broken it may be easily detached. Its cost, the inventor says, need not be over ten cents, while the brasses, he further adds, are no more expensive than those ordinarily employed. In winter the water can be mixed with alcohol or glycerin to prevent freezing.

As an additional precaution against dust, a piece of leather, J, Fig. 2, is attached to the rear of the box by clamps.

The entire device is quite simple, and, as we have already stated, can be readily applied to tracks already in use. If its use in addition yields even a portion of the many important advantages claimed, its economical value will be quickly appreciated.

Patented through the Scientific American Patent Agency, in the United States, Canada, England, and other countries. For further particulars address the patentee, Mr. C. A. Hussey, care of the Mercantile Agency, 335 Broadway, New York city.

A Boy's Idea of Heads.

The Young American brings up a "boy's composition" on heads as follows:

"Heads are of different shapes and sizes. They are full of notions. Large heads do not always hold the most. Some persons can tell just what a person is by the shape of his head. High heads are the best kind. Very knowing people are called long-headed. A man that won't stop for anything or anybody is called hot-headed. If he isn't quite so bright, they call him soft-headed; if he won't be coaxed nor turned, they call him pig-headed. Animals have large heads. The heads of fools slant back. Our heads are all covered with hair, except bald heads. There are other kinds of heads besides our heads. There are barrel heads, heads of sermons

in colors "aye" or "no" on a list sheet at the Speaker's desk. It was a simpler plan than that of Jacquin.

The Institute of Mining Engineers.

This society held a meeting at New Haven, Conn., on February 24 and 25, Professor R. R. Raymond being the President. Various interesting papers were presented.

Professor Raymond introduced the subject of IRON AND STEEL,

with special reference to the decarbonization of spiegel iron by annealing. He exhibited a specimen, the outside of which had been rendered malleable.

An able paper was presented by Mr. Henry M. Howe, of Boston, Mass., on

BLAST FURNACE ECONOMY.

The waste of fuel is mainly due to the reduction of carbonic acid. The proper remedy lies in using lower furnaces with narrower throats, so that the charge may be heated more rapidly on entering the furnace, and that the carbonic acid produced by the reduction of the ore may be formed nearer the tunnel head, and may be exposed for less time and to less fuel before it escapes from the furnace. The waste of fuel is, in all cases, attributable to, first, the reduction of carbonic acid; and second, to the escaping gases carrying off unnecessary sensible heat. A paper on the

METALLURGY OF QUICKSILVER

in North Carolina was read by Professor J. Eggleston, of the School of Mines of New York. The ore is found as cinnabar and native mercury, in dirt washed into the valleys from the decomposition of the cinnabar and serpentine rock. Cinnabar ore is put in the furnace in pieces the size of an egg; ore containing native mercury is made into adobes, the size of a brick, or a half larger. The processes are roasting and precipitation with lime in a retort. Roasting is done in a retort without lime and in shaft furnaces which are intermittent and continuous.

Professor Blake, of New Haven, read a paper on

PROVISIONS FOR THE COMFORT OF MINERS

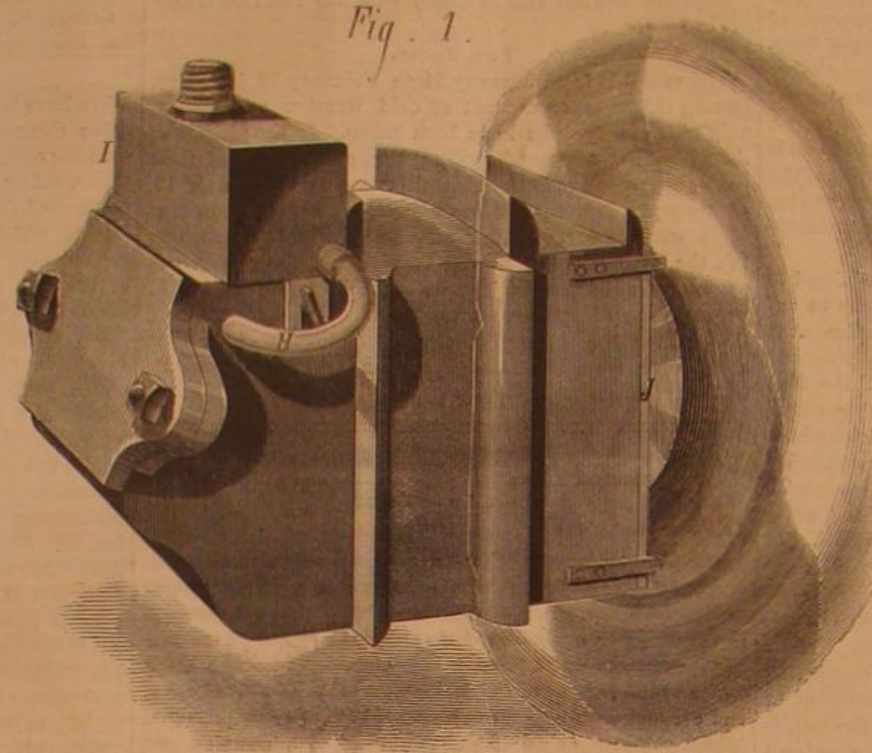
The Hassard colliery, in Belgium, was especially referred to. A comfortable home has been established for the miners near the mouth of the shaft, capable of lodging comfortably 200 men. The success and beneficial results of this experiment may, to a great degree, be regarded as a model for such undertakings, and worthy the attention of our colliers and metallurgical establishments.

Professor Eggleston said that the material comfort of miners is not the only thing that receives attention. Provision is made for their intellectual and moral welfare. At one of the works in Hanover, where a large number of men are employed, the whole question of amusement and instruction is solved better than anywhere else. In England and France sickness is better provided for than in Germany. The children of the miners at this place in Germany are instructed in schools provided for this purpose. The ordinary lager beer garden is provided; also a ball room and theater. The music and acting are carried on by the workmen themselves. The hospital system in England is gratuitous. In France a certain portion of the wages of the workmen goes to a hospital fund. Fines for disorderly conduct go to this fund, which is managed by the workmen. These plans have worked admirably. In this country, difficulties arise from the lack of concerted action on the subject, and from the large number of nationalities to contend with, which is not the case in Europe. A paper on

THE NEWBURYPORT MINES.

by Professor Richards, of the Massachusetts School of Technology, was presented by Professor T. Sterry Hunt, of the same institution. It appears that the first ore discovered here was in the form of loose masses in the drift, but subsequent explorations showed that the source of the ore is a vein having a northeast course, cutting the ancient crystalline soda of the region. Two shafts have been sunk upon it, each of which has now reached a depth of about forty feet. In one, the ore-bearing portion of the vein was six feet in breadth, and in the other, about seven inches. Further explorations are required to determine the breadth of the lodes in these shafts. The ore is a galena, carrying silver, with some copper, yielding, on assay, both gold and silver. Small portions of copper pyrites, zinc blende and native silver have also been found. The treatment of Baulbach, of Newark, of about four tons of the loose ore found in the soil, gave thirty-eight per cent of lead, together with \$58.76 of silver, and \$4.85 of gold, to the ton of ore. Assays of the borings from a portion of the lode showed over fifty per cent of lead, containing silver and some gold, giving to the base bullion a value of about \$300 to the ton.

THE Congress of Mexico offers a reward of \$20,000 to the first mine that produces 500 flasks of quicksilver. The metal is extremely scarce, a fact said to be due to the lack of proper enterprise in procuring it, rather than to any deficiency in its presence.

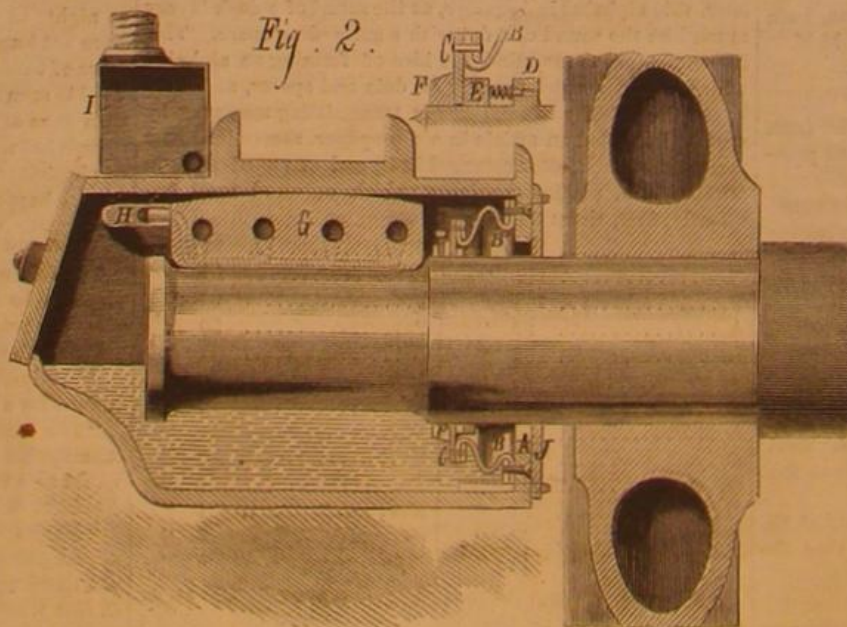


HUSSEY'S RAILWAY AXLE BOX.

—and some ministers used to have fifteen heads to one sermon; pin heads; heads of cattle, as the farmer calls his cows and oxen; head winds; drum heads; cabbage heads; at loggerheads; come to a head, like a boil; heads of chapters; head him off; head of the family; and go ahead—but first be sure you are right."

Recording Votes by Electricity.

A clerk employed in the French government telegraph office (M. Jacquin) has conceived a system for recording votes by electricity. It is thus described: "Before every deputy two ivory buttons are placed, like the buttons of electric bells. If the deputy wishes to vote 'Yes,' he presses the button on his right; if he wishes to vote 'No,' he presses the button on his left. The voter establishes by this means an electric communication, which is transmitted to an apparatus close to the



president and his secretaries. Every time the electric current acts thus it opens the door to a ball, and the ball falls through a tube into the ballot box. The balls are made of glass or ivory, and are strictly identical in weight. The two ballot boxes are then weighed, and the number of balls indicated by the weight. Finally, by turning a handle, all the balls which have not been used are let out, and they give the number of members who have abstained or were absent when the vote was taken. Nothing can be more simple. The inventor has offered to set up his apparatus in the Versailles assembly for the sum of \$12,000."

Mr. Thomas Hall, of Boston, Mass., calls our attention to the patent granted in this country, in 1850, to Albert N. Henderson, of Buffalo, N.Y., for an electrical vote recorder. Henderson's plan was to have a couple of keys on each member's desk, by pressing which the members could instantly print

TWO REMARKABLE PLANTS.

During the frosts of winter, which have this year been so severe and so prolonged, the eye finds unusual pleasure in contemplating the inhabitants of the greenhouse and the hot house; and the vegetation of the tropics appears more than ever beautiful when the weather has bound our soil in an iron chain. Of all the classes of plants which the art of the gardener, aided by artificial heat, can cultivate in our northern climate, the palms exhibit the greatest variety of graceful foliage; and we publish herewith an engraving of the male species of the hardy palm, an ornamental kind exhibiting a remarkable difference between the two genders.

The male kind is known by its large thick trunk which, near the ground, branches out into strong vigorous boughs, thickly covered with spiky foliage of a deep yellow color; these spikelets at first grow out straight from the branches and then incline sharply downwards. It bears innumerable little flowers, growing closely together, of a beautiful deep orange color tipped with yellow. The female is comparatively small, with much thinner branches, the greenish yellow leaves of which grow straighter than those of the male sort, describing no curve or angle till much further from the stem. Its numerous small flowers, of a pale yellow hue, also grow at greater intervals apart. It blooms from April to May, and the seeds ripen from February until April the following season, thus requiring an entire year for complete fruition. As regards display, the preference must be given to the male trees, which may well be pronounced exceedingly ornamental. It is a moot point whether the males or females are most numerous; but certain circumstances would indicate that the males are.

Our second specimen is even a greater curiosity. It comes from Costa Rica, and has a large scarlet spathe, and a twisted spadix, which, when elevated, as they are, on a tall peduncle, have a peculiar aspect, and have gained for this species the name of flamingo plant.

The accompanying illustration has been prepared from a photographic representation of one of the finest specimens of this plant to be found in Europe, and it is also one of the best varieties of this truly beautiful species. The compost in which it has thriven so well consists of peat, charcoal, broken crocks, and moss. The pot is half filled with drainage. The temperature it has all along been grown in is intermediate between that of a stove and a greenhouse. We are indebted to *The Garden* for the two engravings.

Aniline Colors without Arsenic.

Couper, of Paris, was the first to succeed in producing fuchsin by the action, at a suitable temperature, of hydrochloric acid and iron in small quantities on pure aniline and nitrotoluol.

Recently, the Gesellschaft für Anilin Fabrikation, of Berlin, have erected new works, where no arsenic acid is used in the preparation of colors. Not only fuchsin (rubin), but all the colors derived from it which are manufactured by this company, are warranted to be produced without the employment of arsenic, and to be entirely free from this poisonous reagent.

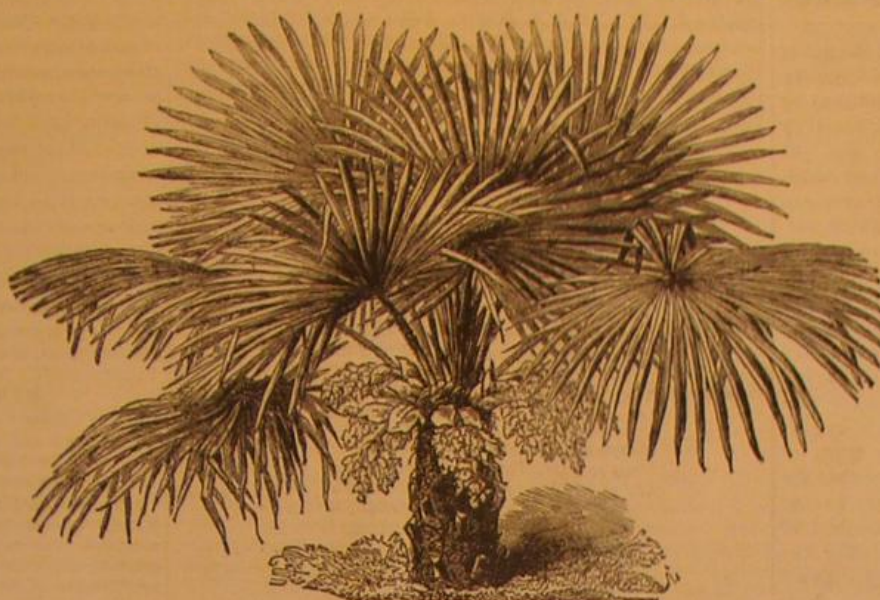
The Berlin company are working Couper's process with several important modifications, and produce from 450 to 675 lbs. of fuchsin per day. Some specimens of fuchsin and other colors manufactured by this company appear to be products of unrivaled beauty, purity, and strength. The fuchsin is stated to be not only purer, but stronger than that made by the aid of arsenic acid, and is the pure hydrochlorate of rosaniline. The rosaniline base, from its great purity, is admirably adapted for the preparation of aniline blue, and is now being very largely used by other manufacturers of aniline colors.

Being free from arsenic, these dyes are not only fitted for coloring sweetmeats, liqueurs, sirups, and pharmaceutical preparations of every description, but may be used in many other industrial purposes where poisonous colors would be more or less dangerous, as in the staining of paper, paperhangings, toys, etc.

It is to be desired that other manufacturers of these dyes will adopt the new method, and relinquish the old arsenic acid process, which, apart from the inconveniences it has caused both manufacturers and consumers, has led to many lamentable accidents.—*Chemical News*.

Autogenous Soldering.

The term autogenous in connection with the process of soldering is strictly applicable to those instances only where the pieces to be joined are united by means of the same kind of metal, and more strictly still in those cases only where the joint is made by melting the surface or edges of the pieces to be united. In shop parlance this is known as "burning," an operation requiring no little skill, but, when satisfactorily



THE MALE HARDY PALM.

accomplished, affording a better joint than can be obtained by the use of alloys, and indeed in some cases the only joint that is practically useful. The term autogenous is, however, applied to a process of soldering in which metals are united by melting the lead or other alloys along the seams by means of the flame of hydrogen, or of that obtained by the combustion of a mixture of hydrogen and common air. The correct or incorrect application of the term is of little moment, as the use of the expression "burning" has become so general and well understood amongst mechanics that its use in connection with the operation of joining metals is scarcely likely to be misunderstood.

The first and most important use of burning is in the con-

struction of the operation depending more upon the quantity and state of the materials than upon the skill of the workmen. Thus if a round or square tank is required, a piece of the sheet lead sufficient in size to form the sides and ends of the tank, or the hoop, if a round one, is bent into shape, the overlapping ends being secured by a few touches of solder or a few nails, driven from the inside, so as to keep the overlapping edges perfectly close. On the outside of the

joint a piece of stout brown paper is pasted, so as to cover the whole of the joint. The hoop, or parts to be joined, are then turned downwards on to the casting floor, and molding sand of good quality packed over the joint to about five or six inches in depth, a piece of wood about three quarters of an inch thick being placed over the junction of the edges, while the sand is being rammed together. This wood is to form the runner or channel for the molten metal, and must be slightly longer than the joint to be made, so that it can be drawn out lengthways. The sand being tolerably firm, cut down to the wood with a trowel, forming a sort of V-shaped groove along nearly the whole length of the intended joint, leaving a few inches of the wood buried at one end, which is also to be completely stopped. When the wood is drawn out, which is the next operation, the other end of the runner is to be stopped up to a greater or lesser height according to the thickness of the metal; about an inch is usually sufficient. It will be understood that we have here, as it were, a broad-mouthed ditch in the sand, stopped at one end, and with a bar one inch deep at the other; and at

the bottom are the overlapping edges of the lead that is to be joined. A quantity of lead is then melted in a furnace, and brought to heat sufficient to melt the two edges of the metal to be joined.

Everything being in readiness, a small quantity of rosin is dusted along the intended joint at the bottom of the runner, and a bar formed to catch the overflow of metal. The latter is then poured in steadily but quickly, giving it as much fall as possible, and keeping up the supply till, by means of a trying stick, it is known that the cold metal of the edges has been melted. The overflow end is then stopped up, and more metal poured in, the molten lead being kept ready to fill up as shrinkage shows itself. When set, the sand is removed, and the runner or the remains of the metal poured on the joint is cut off with a chisel and mallet, and the surface flushed with a scratch brush or wire card. The paper that was pasted over the outside will have fallen off, and will be seen to have left a smooth surface, in which no trace of a joint is visible.

It will be seen that the secret of success lies in having a good bed of sand, plenty of hot metal, and careful attention to the shrinkage. The bottom of the tub or tank is put in by a similar process. The hoop or sides, when the tank is not too deep, being completely sunk in a hole in the casting shop, is filled up with sand inside and out. The sand is then removed from the inside to a depth equal to the thickness required in the bottom of the tank, and smoothed over well with the trowel. The sand outside the tank must be rammed hard, and a bay left all round to take the overflow. As before, rosin is sprinkled over the edge of the metal, and the melting furnace brought close to the work. When the metal is as hot as possible, two or more men take a ladleful and pour along the edge; and when the latter is melted, the molten metal is poured in until it is up to and running over the level of the outside sand all round. The dross is then skimmed off and the metal left to cool, as

it shrinks equally all over and requires no further attention. It is obvious that, instead of making the bottom by pouring on molten metal, a piece of the required size can be cut out of thinner sheet lead, and placed on the top of the inside sand; but we believe the majority of experienced workmen prefer the first mentioned method of burning in a bottom. If the article is of considerable size, however, it is necessary to have more than one workman, as the metal must be poured on as quickly as possible.

This method of lead burning is, it will be seen, considerably troublesome, and is rarely used except when the lead is too thick to be melted conveniently by means of the blowpipe or the oxyhydrogen flame. The latter is, however, always used when possible by those who can accomplish the operation, which requires a much greater degree of skill than the process of lead burning we have described above. The edges to be joined should be scraped clean, and be dusted with rosin. A piece of lead is then laid along the intended joint, and the



THE FLAMINGO PLANT—ANTHURIUM SCHERZERIANUM.

struction of vessels for holding acid or corrosive liquids, which would attack one of the ingredients of ordinary solders; as for instance the leaden vessels, tanks, and chambers employed at chemical works. In vessels subjected to considerable changes of temperature, alloys are frequently of little use in constructing joints, owing to the difference in the amount of their expansion and that of the metals to which they are attached; and in other cases they set up a galvanic action, which more or less speedily destroys the more oxidizable metal. Autogenous soldering is also employed for the sake of appearance in pewterer's and plumber's work—especially in the former, in which, if solder were employed, the joints of angles and the seams would become too apparent to the eye. Burning is also resorted to to remedy defects in castings, and in various jobs in which solder is either inapplicable or objectionable.

The simplest method of burning is that adopted in the manufacture of leaden tubs, tanks, and other vessels, the suc-

flame brought to bear upon it. In many cases the skillful lead burner omits the strip of lead, and obtains a joint by fusing the two edges to be united; but it is only the skillful workman who can accomplish this, as, especially in thin lead, the edges as they approach fusion are apt to run away from one another instead of coalescing. It is always best to use the covering strip of lead, because it is easy to remove superfluous metal from the joint, and failure in the other process involves loss of time. In either case it is only by practice that the amateur or tyro can hope to succeed.

Similar processes are applicable in the case of the other metals. Thus brass may be burned together, by placing the parts to be joined in a sand mold, and pouring a quantity of molten brass on them, afterwards reducing the parts by means of the file, etc., to proper dimensions. The *sine qua non* is plenty of molten metal, made a trifle hotter than usual. Pewter is generally burned by the blowpipe or a very hot copper bit. In angles and where it is bent over sharp corners and in seams, one edge is allowed to stand over the surface of the other, and a strip of the same metal is then laid along the intended junction. The joint is then burned, as mentioned, by melting the surfaces and edges by means of a blowpipe or the hot soldering iron, and the superfluous metal is filed off, leaving the joint, if at an angle, looking as if it had been made out of the solid. The principle of the process is the same whatever be the mode in which it is performed; and when hot metal is used as the sole agent of heat, it is necessary to have plenty of it, and to see that the parts to be joined are clean. It is scarcely necessary to say that the autogenous method is the only proper method of remedying defects in castings, and, notwithstanding the trouble attached to it, should always be attempted with all metals for which it is applicable, and all articles in which it is possible. We do not suppose that trifling defects in iron castings will be remedied by this means, though there is no very great difficulty in accomplishing it, as flanges are often burned on to pipes and wheels; but with the more costly or easily worked metals, the practice of this process would be attended with advantage.—*English Mechanic*.

The Earth—Its Heat and Contraction.

Professor P. M. Duncan, F.R.S., recently delivered at the Royal Institution a course of lectures upon "The Grand Phenomena of Physical Geography." He pointed out that there is strong evidence that the earth is a solid body now cooling, because the deeper man can get in mines or in borings the hotter is the temperature, and if the temperature continues to increase at depths to which man cannot reach, in the same ratio that it does at depths which he can reach, a temperature of 3,680° would be found at a depth of 45 miles. At this temperature granites and lavas fuse. Assuming, then, the earth to be a hot body now cooling, as it cools the rocks must contract; moreover, those rocks which are rich in silica will not contract so rapidly on cooling as others, consequently herein is a source of change of shape of the earth. It is well known that surface changes are going on, that some large areas of land are in course of slow upheaval, while others are slowly sinking, and that at one geological period there was a great upheaval of the larger portion of the continent of North America. The globe, therefore, is cooling unequally. The radiation from some parts is greater than at others, so in this there is a further source of disturbance. Sir William Thomson has calculated that every year 92 horse power of work—for heat means work—is got rid of from every 247 acres of the surface of the globe. The dissipation of energy and the contraction of rocks not being uniform, the effect of these disturbing causes is to produce horizontal thrusts, which form mountain ranges by crumpling up the earth, for mountains are formed by this crumpling action, and not usually by direct volcanic or other upheaval. The changes produced by the contraction are slow, and there is every reason to believe that our present sea floors and our present continents are extremely old, geographically speaking, so far as their present forms are concerned. He said that the upper part of Snowdon consists of sea sand, fossil sea fishes, and volcanic ashes, all mixed together; in fact it appears to have been at one time in the same condition that the Bay of Naples is in at present, that is to say, volcanic ashes fell into it and sometimes buried fish. The lower part of Snowdon consists of vast streams of old lava. At some geological period the crumpling action already mentioned took place below the Bay of Snowdon; consequently the bottom of the bay was elevated and became the top of the highest mountain in Wales. Rain, and rivers, and atmospheric changes then played upon it during the course of long ages, sculpturing out the beautiful mountain scenery which characterizes the Snowdon range.

Beef Steak Electricity.

The six Christmas lectures for juvenile listeners at the Royal Institution, were delivered by Dr. J. H. Gladstone, F.R.S. He chose for his subject "The Voltaic Battery." Most of the experiments and teachings were of course too elementary to interest the readers of these pages, but one of the experiments revealed a fact not generally known. He said that in daily life weak electrical currents are at work where their presence is often little suspected; for instance, supposing a person at dinner to have a silver fork in one hand and a finger upon the steel part of a knife held in the other, it follows that, when he plunges the knife and fork into a beef steak, two dissimilar metals are thereby placed in a moist conducting substance, consequently a voltaic circuit is formed and an electric current flows through the body of the individual between the knife and fork. To prove that this was really the case, he connected a reflecting galvanometer with the knife and fork by means of wires; he then proceeded to cut a beef steak, and the current thus generated deflected the needle of the galvanometer, so that the spot of light which it reflected was seen traveling along the screen by all the observers.

Steam Boat Poetry.

At a meeting of the Institution of Engineers and Shipbuilders in Scotland, held in Glasgow, on Wednesday, December 4, 1867, Mr. J. A. Napier, F.R.S., submitted the following verses, written by Wm. Muir, saddler, Kirkintilloch, March, 1868, "on seeing the new-invented Steamboat pass through the great Canal, dragging two vessels behind it fully loaded."

THE STEAM BARGE, OR NAUTICAL NOVELTY

When first by labor Forth and Clyde
Were taught o'er Scotia's hills to ride
In a Canal long, deep, and wide,
Naebody thoct
That winders without win' or tide
Would o'er be wrocht.

To gar them true that boats would sail
Thro' fields o' Corn or beds o' Kail,
An' turn o'er Glens their rudder's tail,
Like weathercocks,
Was dootrine that would needed bail
Wi' common folks

They ca'd it nonsense, till at last
They saw boats travel east and wast,
Wi' sails and streamers at their mast,
Syne, without jeering,
They were convinced the blustering blast
Was worth the hearing.

For mony a year, wi' little clatter,
An' naething said about the matter,
The horses hauled them through the water
Frae Forth to Clyde;
Or the reverse, wi' weary splatter,
And aweaty hide.

Then wi' believed, poor silly bodies,
Wha' naething ken o' learned studies,
That horses' hoofs and hempen woodies
Best still to draw them;
An' cursing callins clad in duds,
To swear and ca' them.

But little think wi' what's in noddles,
Whar science sits an' gapes and gudies,
Syne darklins forth frae drumly puddles
Brings things to view
That the weak penetration fuddles,
O' me an' you.

For lately we have seen a lighter,
An' in her doup a fanner's flighter,
May old boat-baulers a' gae dight her,
Black sooty vent
Than half a dozen horse she's wigher
By ten per cent.

Wi' something that the learned ca' steam,
That drives at heughs the wa'ken' beam
O' huge engines to draw coal seam
Or carry hutchies,
She in her breast swells sic a feum
As has few matches.

By it she through the water plashes,
An' out the stream behind her dashes,
At sic a rate baith frogs and fishes
Are forced to scud,
Like ducks and drakes among the rasches,
To shun the mud.

When first I saw her in a tether
Draw twa sloops after ane anither,
Regardless o' the win' an' weather
Athwart her bearin',
I thought frae h—ll she had come hither
A privateering;

An' that the pair she had in tow
Were prizes, struck me, sae I vow:
I cried when fixed to their prow
I saw her cable—
"In Satan's furnace now they'll bow
Among the rabble."

It was sae odd to see her pulling,
An' win' an' weather baith unwilling,
Yet d—l may care she onward sculling,
Defy'd them baith,
As constant as a mill that füllin'
Gude English clath.

Can o'er, thought I, a flame o' reek,
Or boiling water's cauldron sneek,
Tho' it war kept for a week,
Perform sic wonders,
As quite surprises maist the folks
O' gazing hunders?

But facts wi' canna well dispute them
Altho' wi' little ken about them;
When prejudice inclines to doubt them,
Wi' a' her might,
Plain demonstration deep can root them,
An' set us right.

Or lang gae now wi' whirligigs,
An' steam engines will plough our rigs,
An' gang about on easy legs,
Wi' nought to pain us,
But fit in tethers, needlessness
That us'd to hain us.

Draw news indeed for man and beast,
They'll then hae nought to do but rest,
An' on their former labors feast,
Wi' cheerful hearts,
When thus they see warin steam insist
To play their parts.

[The boat referred to, we presume, was the Charlotte Dundas, built by William Symington, a native of Falkirk, for whom the honor of first applying steam to navigation is claimed.]

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The publishers of the SCIENTIFIC AMERICAN are prepared to execute illustrations, in the best style of the engraver's art, for this paper only, of all civil and engineering enterprises, such as New Bridges, Docks, Furnaces, Rolling mills, and all kinds of Manufacturing Works, including Wood and Iron Working Machines, Lathes, Shears, Steam Boilers, Engines, Pumps, Governors, Railroad Improvements, Agricultural Implements, Architectural Works, Conservatories, etc. Engravings may be made from good photographs or well executed drawings, or 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 and contractors of having their machines, inventions, or engineering works illustrated in a paper of such large circulation as the SCIENTIFIC AMERICAN, which not only extends to nearly every manufacturing establishment in this country and Canada, but has an extensive circulation abroad, is obvious.

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NEW BOOKS AND PUBLICATIONS.

BETON COIGNET: A Description of the Material and its Uses in France and America. Published by John C. Goodridge, Jr., New York and Long Island Coignet Stone Company, Third Avenue, near Third Street, Brooklyn, N. Y.

Engineers, builders, and architects will find in this pamphlet complete information regarding one of the most successful artificial stones now manufactured. The work comprises a large number of valuable reports upon practical tests of the material, prepared by well known experts, and also the specifications of the ten patents under which it is made. A profusion of excellent engravings of completed structures, in which the beton Coignet is used, embellish the text. An advertisement of the pamphlet will be found on another page.

THE PROGRESSIVE SHIP BUILDER. By John W. Griffiths, Editor of the Nautical Magazine, etc. etc. Illustrated. Published by the Author, New York, P. O. Box 5125.

This is the first volume of an extended treatise upon ship-building, which inasmuch as it embodies the results of the author's experience of fifty-two years in the art, cannot but be of great practical value. Certainly, a work which aims to circulate broader ideas regarding a calling which (though on the noblest, and at the same time one which our great seaboard, it might be thought, would render one of the first to the country in industrial importance) has of late assumed proportions far too inconsiderable deserves an honest welcome. The book is written in clear and plain language, and is copiously illustrated. It will doubtless prove a useful contribution to literature on the subject.

THE MICROSCOPE AND ITS REVELATIONS. By William B. Carpenter, M.D., LL.D., F.R.S., &c. Illustrated with twenty-five plates and 449 wood engravings. Fifth Edition. Lindsay & Blakiston, Philadelphia, Pa.

This is a thoroughly revised edition of probably the best, certainly the most exhaustive, work on microscopy extant. The book is eminently practical; and for this reason, perhaps above all others, we can heartily commend it to students—while the very distinguished position of its author in the scientific world is an ample guarantee that nothing, in the already wide though constantly widening field through which he aims to conduct the reader, has been omitted or slighted. His endeavor clearly is throughout to make the student investigate for himself, or, to quote from the preface, "being satisfied that there is a large quantity of valuable microscope power at present running to waste," he hopes to direct this power to more systematic labors. The original work included chapters on the principles and construction of the microscope, accessory apparatus, management of the instrument, collecting and mounting of objects, and elaborate description of microscopic forms of life. These general topics in the volume before us have been brought down to the latest dates, and descriptions have been added of the newest inventions as well as discoveries in the science. The publishers deserve much credit for the excellent appearance of the very numerous illustrations, as well as of the book in general. Price \$8.50. For sale in this city by D. Van Nostrand.

We have recently received an exceptionally handsome chrome calendar from Messrs. Schumacher & Ettlinger, of Nos. 13 & 15 Murray Street, in this city. The work, which is a neat flower design representing a fan, is executed in gold and a variety of brilliant colors, making it a very attractive show card.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

THE RUBBER TIP PENCIL COMPANY, APPELLANT, vs. SAMUEL E. HOWAR, HENRY RANGER, MICHAEL SNOW, AND RICHARD BUTLER.

[Appeal from the circuit court of the United States for the southern district of New York.—October term, 1874.]

On the 23d of July, 1867, James B. Blair, claiming to be the original and first inventor or discoverer of "a new and useful rubber head for lead pencils," received a patent for his invention. He claimed "as a new article of manufacture an elastic erasable pencil head made substantially in manner as described." The "nature of his invention," he said, was "to be found in a new and useful or improved rubber or erasable head for lead pencils, etc., and consists in making the said head of any convenient external form, and forming a socket longitudinally in the same to receive one end of a lead pencil or a tenon extending from it." "This socket is to be cylindrical or of any other proper shape. Usually, the inventor says, he made it so as to extend part way through the head, but, if desirable, it might be extended entirely through. It must be within one end, but any particular location at the end is not made essential. This clearly is no more than providing that the piece of rubber to be used must have an opening leading from one end into or through it. This opening may be of any form and of any extent longitudinally. The form, therefore, of the inside cavity is no more the subject of the patent than the external shape. Any piece of rubber with a hole in it is all that is required thus far to meet the calls of the specifications, and thus far there is nothing new, therefore in the invention. "The small opening in the piece of rubber not limited in form or shape was not patentable, neither was the elasticity of the rubber. What, therefore, is left for this patentee but the idea that if a pencil is inserted into a cavity in a piece of rubber smaller than itself the rubber will attach itself to pencil, and, when so attached, become convenient for use as an eraser?" An idea of itself is not patentable, but a new device by which it may be made practically useful is. The idea of this patentee was a good one, but his device to give it effect, though useful, was not new. Consequently he took nothing by his patent.

The decree of the circuit court is affirmed.

(John S. Washington, for appellant.)

F. H. Bates and S. W. Kellogg, for appellees.]

Mr. Chief Justice Waite delivered the opinion of the court.

United States Circuit Court,—Northern District of Illinois.

JOHN M. TURNBULL et al. vs. THE WEIR FLOW COMPANY.

[In equity.—Before Drummond, J.]

This was a bill for an injunction to restrain the alleged infringement of letters patent for an improvement in cultivators, granted to Thomas McQuinn, October 18, 1859, and renewed May 16, 1871, and for an account. McQuinn having in the year 1860 assigned away the exclusive right under his patent in and for the counties of Warren and Henderson, in the State of Illinois, and having, on the 18th day of November, 1870, and prior to the recording of such first deed, executed a second assignment, conveying to another party "all my (his) right, title, and interest in and to the said letters patent in the following described territory," in which was included the State of Illinois, "as fully and entirely as the same would have been held and enjoyed by me (him) if this assignment had not been made." Held: That, as there was an interest left in the patentee's hands upon which the second assignment could fairly be said to operate independently, also, that the first assignment was operative, and that a plea to the bill, setting up the second assignment in bar of complainant's right of action, they claiming by virtue of the earlier assignment, must be overruled. The provisions of the 26th section of the Patent Act of 1870, with regard to the recording of assignments of patents, are substantially the same as those of the 11th section of the act of 1836, as construed by the courts. (William Marshall, James L. High, and R. Mason, for complainants. West and Bond, for defendant.)

Recent American and Foreign Patents.

Improved Extension Table Slide.

Abraham S. Bowen, Rushville, Ind.—The invention consists in a novel mode of improving the adjustable slides of extension tables, by combining a recessed and apertured slide with a casting having a fit that fits in the aperture, so as to avoid the use of screws and enable an ignorant workman to properly adjust the casting in the slide; also in providing the tenoned slides with straps and the castings with grooves, cavity and shoulder, so that the slides will freely move upon each other, but without the possibility of separation.

Improved Combined Hitching Strap and Nail.

Ernst Ohm, Terre Haute, Ind.—The invention relates to devices by which horses may be conveniently, quickly, and securely hitched in close proximity to a residence, and consists in a hitching nail consisting of a body and detachable cap having a notched flange.

Improved Hand Potato Planter.

Josiah Sawyer, Tremont, Ill.—A tube is made in sections sliding into each other, so that its length may be readily adjusted according to the height of the person carrying the dropper. To the lower end is attached a flexible tube of rubber, and of such a length as to touch the ground when the box is carried in position for use, so that the potatoes will not roll when they reach the ground, but will lie exactly where dropped. In using the dropper, the potatoes are cut into pieces of the desired size and placed in the box. The person using it measures off the ground by his steps, and at the proper time he raises enough seed for a hill from the box, and drops it into the tube. When the dropper is set down, the tube rises through the hole in the box, and again slips down into place when the box is raised from the ground.

Improved Saw Gummer.

S. Leo Tibbals, Osakis, Minn.—The presser bar is made with a spring at the attached end, so that it will raise itself from the die, and is perforated to receive the punch. It also carries a perforated guide. The saw is placed on the face of the die, and the bar is brought down on it and held in position by a cam lever. This cam lever is provided with journals, and engages with a slotted hook, within which the end of the bar works.

Improved Car Seat.

Edwin G. Wellman, Canandaigua, N. Y.—This car back is detached from the seat, and is secured by staples to horizontal bars which extend across the ends of the seat. It may thus be readily slid from one edge of the latter to the other, when it is desired to reverse the same. This invention was described and illustrated on page 118 of our current volume.

Improved Coffin Clamp.

William H. Houck and John B. Fox, Quincy, Ill.—This invention relates to an improved coffin clamp for hearses, by which any size or shape of coffin may be firmly secured in the hearse in a quick and convenient manner. Upright standards slide in guide slots of the body of the hearse, and retain the coffin by oscillating clamping pads. The standards are moved in connection with nuts traveling on a right and left hand screw bolt, which is so constructed that the front and rear clamps may be moved together, or one pair separately, for being thereby adjusted to any coffin. The clamps are previously set to the shape of the coffin, which facilitates the clamping, and allows the almost instant locking of the same when the coffin is placed on the hearse by the pall bearers, so as to avoid thereby the annoying delay occasioned by the present modes of clamping the coffins to the hearse. For further particulars address the inventors, P. O. box 2,225, Quincy, Ill.

Improved Horse Hay Rake.

Peter Mast, Waterville, Ohio.—This is an independent shifting lever, interposed between the regular teeth-setting lever mechanism and the pivoted tooth bar, for the purpose of controlling and governing the rake teeth instantly during the progress of raking without changing the position of the adjusting lever, so as to adapt the rake thereby to unevenness of the ground, and increase the facility and efficacy of working the same.

Improved Gas Retort.

Samuel P. Parham, New York city.—This retort has a clay shell and a wrought metal lining, the two being provided with an air space that will admit of expansion. Both ends are open, and the terminals of the lining extend beyond the shell, and on these extensions support end tubes. The latter have outwardly projecting flanges, against which abut the ends of the clay shell, and keep it firmly in place, the shell, lining, and tubes being all simply cemented together. Naphtha liquid is forced or caused to flow through an aperture into the initial tube, and thence drawn through the lining, wherein it loses its liquid form, assumes that of a gas, and is drawn through the outlet by an exhaustor. This has been found in practice to produce a very rich gas, sufficiently pure for mixing with the purified coal gas.

Improved Hog Trap.

Peter Lane, Elwood, Ind.—This invention is an improvement upon the hog trap for which letters patent were granted to Overshiner, May 19, 1874. It seizes the animal, throws it on its side, and holds it in convenient position during the operation of spaying.

Improved Mosquito Bar Frame.

William F. Howe, Galveston, Tex.—This is an arrangement of posts and cords, so combined that by withdrawing the pins from the posts, and slipping the cord from the ends of the bars, and detaching the posts from the bedsteads, the bars may be folded together, and they and the post tied into a small and compact roll.

Improved Map Exhibitor.

Sebastian C. Adams, Cincinnati, O.—The chart to be exhibited is attached to two rollers, so that it can be wound from one to the other of the rollers by turning them by means of cranks. The journals of the rollers revolve in spring clips, which press against the ends of the rollers, and thus hold said rollers in any position into which they may be turned, and also keep the chart taut while being wound. The bars to which the clips are attached are halved to the two cross bars, and are secured detachably to said bars by screws, so that they can readily be detached and packed into a compact bundle for storage or transportation.

Improved Ventilating and Warming Drum.

Peter H. Carman, Brooklyn, N. Y.—This ventilator is placed in any position where it can be connected with a flue or chimney of a furnace or fire. It forms a box in which are horizontal and vertical partitions. Tubes, of greater diameter at the bottom than at the top, extend from the lower partition to the upper partition, all passing through the central partition, with the exception of the outside tier. This central partition is cut short to allow the heat to pass from the lower compartment to the upper compartment by means of flues. Above and below the horizontal partitions are two compartments. There are six tiers of tubes, half of which connect one set of compartments, and half connect the other set. The fresh air is admitted into a compartment, and passes up through the left hand tiers of tubes, by means of which the air is heated and discharged into the chamber, whence it is conveyed to the apartment. At the same time, the foul air at the bottom of the apartment is drawn into another chamber, an upward draft being induced by the heat with which the tubes are surrounded, and is discharged into a chimney or flue, and conducted from the building.

Improved Tanning Apparatus.

Harvey Reed, Atlanta, Ga.—This invention consists of tan vats contrived with removable partitions and sliding and removable racks for supporting the skins; also with an arrangement for circulating the liquor through the leaches and vats in an endless course, so that the skins may be put in at the end of a series of vats, out of which the liquor is forced into the leaches again and shifted along, from time to time, to the other end. Into the latter the liquor flows again after being renewed in the leaches, and thence the tanned batches are lifted into the drying house. The leaches are arranged in a series and introduced into the endless channel for the liquor at one end with new material, and shifted along to and removed with the spent material at the other end. The exhausted liquor thus enters the oldest leach as it comes from the vats, and passes to the newest in going back to the vats, and thus extract the tannin and applies it to the skins most effectually. The invention also consists of a softening and scouring wheel contrived to produce the current of liquor, and having outwardly projecting floats to act on the water, and inwardly projecting floats to scour and rub the hides placed in it, while the liquor is pumped up into it as it revolves.

Improved Middlings Purifier.

Edwin W. Johnson, Foreston, Ill., assignor to himself and Joseph U. Knodle, of same place.—The meal is acted upon by a continual spreading out, as produced in a series of vertically disposed saucers with great facility, by a strong upward current of air, caused by the suction fan through side apertures, near the bottom of the separating chamber, so that thereby the bran and other impurities are separated from the flour and carried partly around the saucers, by the central apertures of the valve chamber and fan casing, to the discharge conductor, and partly through a suitable number of side channels at the inner circumference of the separating chamber, to the valve chamber and the exit conductor.

Improved Chain Gripe and Tightener.

John N. Ackerman and George J. Ackerman, Hackensack, N. J.—A cast iron frame has a pivoted sheave. A lever has an end yoked so as to receive the aforesaid frame, and is pivoted thereto by the same bolt. A pawl is pivoted on the yoke of the lever, and a spring keeps it in position. To operate this device, the flat side of the frame is placed against the load, and the chain is thrown over. The chain is next passed up over the sheave, and then down through the yoke of the lever; then, by pulling the said lever downward, it will cause the pawl to gripe the chain and draw it through, and another pawl, resting on the sheave above the chain, will gripe and hold it while the lever is being raised in position for a fresh gripe.

Improved Bee Hive.

Monroe Davis, Arcola, Mo.—The essential feature of this invention is a moth trap, composed of a nest of curved plates, which prevent the insects from entering the hive, or from returning thereto after having once emerged.

Improved Screw Propeller.

Elbert B. Porter, Havana, Cuba.—The invention consists of a screw propeller with semi-elliptic or otherwise bent and twisted blades attached at one or both ends of shaft, and provided with interior and exterior auxiliary wings of sufficient size and twist. The propeller is made of rolled metal plates, each auxiliary and main blade being separately attached, so that any part may be repaired without interfering with the other parts.

Improved Potato Digger and Cultivator.

Alden Crosby, Gray, N. Y.—The forward ends of three beams are spread apart, and are connected by a curved bar. The forward ends of the said beams may be adjusted closer together or farther apart, as may be desired. To the beams are attached the plow standards, which carry the plow plates. The forward plow plates are made with teeth upon the outer part of their lower edges, and their inner parts or wings are so formed as to throw the soil toward and around the plants, and round it up into a ridge. The rear plow plates are so formed as to move the soil farther inward, and complete the formation of a ridge around the plants. When the machine is to be used as a potato digger, the plow plates are so adjusted as to remove the soil from the sides of the ridge; and to the center beam is attached a standard, to which is attached a sharp-pointed plow, which opens up the hills and throws out the potatoes. Another device rakes over the soil thrown up by the plow, and thus separate the potatoes from it, leaving the said potatoes lying upon the top of the soil.

Improved Electric Fuse.

Charles A. Browne and Isaac S. Browne, North Adams, Mass.—The invention relates to electric fuses, consisting of a shell having wires in packing, and attached to a second shell or cup containing the explosive compound. It consists in preparing these for transportation and subsequent consumption, so that the outer or second cap containing the fulminate charge can be shipped in a wet state, and then dried and attached by the consumer to the independent fuse.

Improved Arm Fracture Apparatus.

David Bissell, Detroit, Mich.—The arm splint comprises two pairs of clamping plates, one for the arm and the other for the fore arm, the plates being of concavo-convex form, whereby they are adapted to envelop the arm, or nearly so. They are also made double, and contrived to lengthen and shorten, and may be adjusted toward and from each other, to shift along the arm, as may be required. The upper plates of each pair are detachably connected to the others, so as to be taken off and put on readily, in applying the splint to and removing it from the arm; and the part to be applied to the fore arm is provided with flexible springs, with adjusting screws for applying the pressure to the arm. The object is to conform the pressing device to the shape of the arm for regulating the pressure on the different parts, and to hold the arm in the requisite shape. The clamping plates are made of zinc, and a zinc plate is used in front of the pressure springs for the benefit of its cooling nature, and to facilitate the application of electricity.

Improved Street Railway Car Truck.

Henry C. Bull, New York city, assignor to himself and M. A. Southworth, New Orleans, La.—This consists in connecting the sections of the tubular truck frame of a street railway car by tubular joints, thus forming a continuous passage therein. Thus constructed, the entire frame is adapted for use as a water tank for supplying the boiler, and may be of any size found necessary or practicable.

Improved Wheel for Vehicles.

Abraham B. King, Camden, O., assignor to Catherine King, Rome, Ga.—The interior of the hub is in three divisions or chambers, for containing the nut and washer on the arm of the axle, the rubber or metallic springs around the pipe box, and the extension for the spoke tenons. Stops which enter grooves in the springs hold the latter stationary. Confined as these springs are around the pipe box or axle, a degree of elasticity is imparted to the axle and wheel which counteracts the usual jarring and concussion, and renders the motion of the vehicle soft and easy.

Improved Spring Bed Bottom.

George W. Hatch, Fond du Lac, Wis.—In this bed bottom the wire springs are each formed of a series of bands, having an upward inclination, straight connecting portions, and eyes, said springs being arranged lengthwise of the slats.

Improved Safety Valve.

Henry C. Bull, New York city, assignor to himself and M. A. Southworth, New Orleans, La.—The first invention consists of a piston of large area, subject to the pressure of the steam, which pressure holds the valve closed through the medium of a spring until the set point for blowing-off is reached. The pressure is then caused, by means of a rod and lever, to react on the spring, and to open the valve and allow the steam to escape. The invention also consists in the arrangement of an adjustable collar for varying the set point at which the valve shall open and allow escape of steam.

Improved Washing Machine.

Horace G. Williams, Hamilton, Iowa.—This consists in the peculiar construction and arrangement of the devices for operating a vertically moving and horizontally oscillating plunger. In using the machine the clothes are placed upon the bottom of the tub, a sufficient quantity of soap and water is put in, and the free end of a lever is worked up and down, which alternately presses the water out of the clothes, and allows them to again become saturated. As the lever is being worked up and down, it is, at the same time, moved to one or the other side, so that the presser may strike the clothes each time in a new place.

Improved Spring Seat Support.

Frank A. Hawley and Amos Pearsall, McGregor, Iowa.—The seat is supported, by means of brackets, on a compound spring frame, which is constructed partly of wood and partly of steel springs. The wooden spring part is of slightly curved shape, and applied under suitable upward inclination to the front part of the perch. The brackets are attached to the wooden spring part of the frame, which is laterally braced by a stiffening piece. The steel springs are of inverted C shape, and applied with or without straps to the upper ends of wood spring pieces.

Improved Grain Cradle.

John W. Settle, Glasgow, Ky.—Upon each finger, at the point where the rod usually passes through, is placed a socket, which is secured detachably to the fingers by a small screw passing through said socket and into or through the fingers. By this construction, the fingers are not weakened by having holes formed through them for the passage of the cross rod, and are thus less liable to break at that point, while the sockets allow any finger to be conveniently removed and replaced with a new one.

Improved Leg Fracture Apparatus.

David Bissell, Detroit, Mich.—This is composed essentially of two fracture boxes for the leg and thigh, respectively, with an adjustable and extensible bed in the leg box for the leg to rest on; also adjustable, extensible, and removable pressure pads for the sides and top of the leg and thigh; also means for extending the limb; also means for adjusting them to crook the leg at the knee; also means for effecting extension from the shoulder, and certain other contrivances.

Improved Steam Generator.

Henry C. Bull, New York city, assignor to himself and M. A. Southworth, New Orleans, La.—This is a new steam generator composed of three distinct shells or walls, separated so as to leave spaces. A fan assists the chimney in drawing the exterior air through openings into the open space, and causing it to ascend to the top of the furnace, where it passes through openings in the middle shell and into another space in which it descends to the openings beneath the grate. In passing down through the spaces, the air becomes heated and is delivered to the fuel in the condition of a hot blast. Devices are included in the boiler whereby a constant separation of sedimentary and foreign matters contained in the water is made to take place, resulting in great advantages in preserving the interior surfaces of the water-heating tubes in a clean and efficient condition.

Improved Iron Bridge.

Edwin I. Farnsworth, Leavenworth, Kan.—This invention consists of an improved construction of girder or arch for bridges, of two vertical (edgewise) channel or π beams, with a flat plate riveted on top, transverse plates under side at the posts and feet of the arch, and diagonal or lattice bracing intermediate to the transverse plates. This affords greater strength for resisting the crushing effect on the feet of the arch where the greatest strain exists, and also greater lateral strength along the arch. It also enables the inside of the arch to be painted.

Improved Middlings Purifier.

Joseph W. Wilson, Warsaw, Ill.—The spout, through which the middlings are passed into a stationary box, incloses a fan, to the outer edges of which are attached brushes, for the purpose of agitating the middlings. The fan takes the air around the shaft at the bottom, and forces it, together with middlings and impurities, out into a chamber, where there is a current of air passing upward to another fan which carries the impurities up and out into a dust room. The middlings are allowed to fall to a sweep which discharges them on a horizontal belt. The latter has a jarring longitudinal motion, together with a quivering motion, which keeps the middlings constantly agitated over the cloth, and also keeps the cloth clean without the aid of knockers or brushes.

Improved Corpse-Preserving Casket.

Bartholomew Hartwell, Baltimore, Md.—The invention relates to burial caskets, in which the body of a deceased person is placed after death, and preserved by ice from decomposition. The invention consists in preventing any liquid from coming in contact with the body and in making the cooler in sections that may be easily filled and carried into the house by a single man. A lining is used to go around the inside to hide the joints where the ice cans come together.

Improved Cotton Seed Planter.

B. F. Cadenhead, Bolingbroke, Ga.—The invention relates to the construction of cotton planters so that they may be simple, efficient, and at the same time obtainable at a small cost. It consists in a seed wheel having feed recesses at regular intervals between the periphery and hub, and in a box slotted in front, rear, and bottom, and provided with stirrers turned by friction.

Improved Cut-Off Adjusting Device.

Henry C. Bull, New York city, assignor to himself and M. A. Southworth, New Orleans, La.—This consists of two cut-off valves, one for each port of the slide valve, having independent rods extending out through the steam chest, one within another, and connected with an adjusting nut, one by a right hand and the other by a left hand screw, so that the sleeve, which is swiveled to the eccentric rod, being turned right or left, will shift the valves toward or from each other simultaneously and alike.

Improved Bag Fastener.

James Macphail, Laporte City, Iowa.—This is a fastening string attached to the sack, passed in a loop through holes of an elastic disk and metal button, and secured by a knot to retain the disk and button in position. The string is then wound around the bag end, and securely fastened thereon by being wedged intermediately between disk and button.

Improved Car Coupling.

B. F. Cadenhead, Bolingbroke, Ga.—The invention consists in an automatic car coupling, consisting of a link slotted at each end and pivoted drop-catches combined with a laterally perforated drawhead and removable crossbar, also in combining cross pieces and a draw pin with the cross bar, and in using a presser pin with a drawhead having rear perforations.

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Prize Essay on the Balance Spring and its Isochronal Adjustments. By Morris Immisch. \$2.00, mail free. E. & F. N. Spon, 446 Broome Street, New York.

Advertiser, having the best Patent Wrench in the United States and Canada, desires some party with Capital to join him in Manufacturing the same for Market. Address, stating amount to invest, to Charles Steel, 62 Lorimer Street, Greenpoint, L. I., Brooklyn, N. Y.

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An old established responsible House wishes, in connection with their different European Offices, to take the exclusive European Agency for first class special Machinery. Only established firms, who can guarantee their wares, need address D. & W., Box 2630, New York.

For small size Screw Cutting Engine Lathes and Drill Lathes, address Star Tool Co., Providence, R. I.

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Advertising—Geo. P. Rowell & Co., New York. This is, perhaps, the most enterprising and reliable, as it is the largest Advertising Agency in the United States. Their offices in the Times building contain files of papers published in all parts of the Union, and they have a system of classifying newspapers for advertisers that is as unique as it is useful. [N. Y. Daily Star, Dec. 15, 1870.]

Wood-working Machinery, 2d H'd, for Sale—In good working order: 24 ft. Circular Saw-mill, Set Works, 45 in. Saw, all the Belting, with drawing-in Rope, \$380; 25 ft. Daniel's Planer, wide bed, \$175; Side Jointer, planes 16 ft. long by 16 in. sgr., \$130; 300 ft. 3/4 in. wire iron chain, 4c. per lb.; 1 Iron Pellet Machine, \$50; No. 1 H. P. Smith 4-sided Moulder, \$210. New Wood-working Machinery, all kinds, a specialty. Address Forsyth & Co., Manchester, N. H.

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Dickinson's Patent Shaped Diamond Carbon Points and adjustable holder for working Stone, dressing Emery Wheels, Grindstones, &c. 64 Nassau St., N. Y.

Engines, 2 to 8 H. P. N. Twiss, New Haven, Ct. Miller's Brick Presses for fire and red brick. Factory, 309 South Fifth Street, Philadelphia, Pa.

To Machinists.—For Sale, Cheap—A partially finished Engine Lathe, 11 feet bed, 28 inch swing. For further particulars, call on or address Clark, Smith & Co., Fort Plain, N. Y.

Send stamp for specimen copy of the Sheet-Metal Builder; all about Galvanized Iron Corridors. Published monthly. Address Sheet-Metal Builder, Salem, Ohio.

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Mechanical Expert in Patent Cases. T. D. Stetson, 25 Murray St., New York.

All Fruit-can Tools, Ferracuts, Bridgeton, N. J.

Notes & Queries

A. B. L. can cement emery to wood by using the best glue.—R. B. K. is informed that French polish is generally used on pianofortes. See p. 11, vol. 32.—W. D. will find a recipe for a gold lacquer on p. 362, vol. 30.—H. C. Y. can purify his garments by burying them for a while in the ground.—H. T. D. and many others are informed that Mr. Seth Green's address is Rochester, N. Y.—A. D. should keep his preparation for preserving hides, etc., covered with a thin layer of glycerin in a well corked bottle.—L. V. R. ought to know better than to try to construct a perpetual motion.—J. C. should consult a physician.—Mrs. S. C. Jr. and J. M. S. will find a description of a fountain on p. 405, vol. 29.—E. C. C. will find an exposure of the motor in question on p. 273, vol. 30.—E. R. T. will find a recipe for treating moles on p. 331, vol. 32.—F. T. W. can blue steel by the process described on p. 123, vol. 32.—J. H. P. will find a good recipe for baking powder on p. 123, vol. 32.—P. D. and others who inquire about the cultivation of sumac should address the Commissioner of Agriculture, Washington, D. C.—S. B. can dress buffalo skins by the method described on p. 266, vol. 26.—C. B. F. will find a recipe for indelible ink on p. 112, vol. 27. Solder for silver is described on p. 251, vol. 28.—C. L. V. can make a rubber varnish by the process given on p. 11, vol. 32.—F. P. will find directions on p. 388, vol. 29, for keeping moths out of clothes.—W. R. M. can cement leather to rubber by using the preparation given on p. 119, vol. 28.—J. W. will find directions for browning gun barrels on p. 11, vol. 32.—G. F. will find instructions for vulcanizing rubber on p. 378, vol. 28.—G. R. D. can etch steel saw blades by the process described on p. 250, vol. 27.—J. M. McC. will find a recipe for diamond cement (cementing whalebone, etc.) on p. 90, vol. 30.—D. F. (diameter of pipes), H. W. G. (dividing a board), J. E. S. (steam pipes), and H. L. L. (boilers and engines), do not send sufficient data.

(1) B. P. D. asks: 1. Would a common cast iron, such as is used for making plows, answer for an engine cylinder 2 x 4 inches? A. It will be better to make the cylinder of brass. 2. What size of boiler would be necessary to run the engine for one or two hours daily, or would a horizontal or upright be best? A. A boiler such as is used in connection with a water back will answer very well, and you can get all necessary information from a plumber. 3. How much pressure would be best? A. Carry a pressure of 15 or 20 lbs.

(2) J. G. asks: What proportion of heat will a pound of iron, completely burnt, yield compared with a pound of anthracite coal? A. About one fifth as much.

(3) J. W. F. says: P. M. B. says that a boat screw, 4 feet in diameter and of 6 feet pitch, run at 120 revolutions, makes 9 knots, thus showing a negative slip of 91 per cent. What kind of a screw does he use to give this result? A. Probably he is in error, either as to speed of boat or pitch of screw. What is called 9 miles an hour is sometimes only a guess.

(4) F. C. says: I am working a vacuum engine close to a boiler, with 3/4 inch pipe, giving ample steam. I wish to remove the engine to a distance of about 600 feet. The pipe will have to be run partly in the open air, partly through a long shed, and partly under a street, and I would like to know the best description of covering, size of pipe, etc., and if it will be necessary to put a steam trap near the engine. A. Use a pipe about 1 inch in diameter, well felted, and attach a trap near the engine. Avoid as much as possible abrupt changes in the direction of the pipe.

(5) B. C. & Co. ask: How can we separate silver from tin and lead? A. Cupel the alloy.

(6) I. H. F., of Flekkefjord, Norway, asks: Are oak bark ashes (from under the boiler in a tannery) considered as good as wood ashes for fertilizing purposes? A. Yes.

(7) E. H. asks: What is the cause of what is called the sun's "drawing water"? It is an appearance of lines running from the sun to the horizon. A. The sun's rays passing through the interspaces of clouds. When reflected, the rays sometimes converge.

(8) G. F. P. S. asks: 1. Is the plane of the moon's orbit always parallel to itself? A. No. 2. When does the line formed by the intersection of the moon's and earth's orbits point to the sun? A. When the new or full moon is at one of its nodes. 3. Does not the moon have the greatest altitude at night in winter when passing the meridian? A. No. Greatest meridian altitude of the moon is 77° 18', at summer solstice. Least, 20° 6', occurs at winter solstice.

(9) N. P. asks: Will the lenses of a magic lantern answer for a small telescope for night use? A. Not well. To try any two lenses as a spyglass, the one of longest focus is to be placed in one end of a paper tube as objective, the other is placed in a paper tube which slides within the first. Separate the two lenses the sum of their focal lengths, then contract the aperture by cardboard stops until you get some kind of definition.

(10) J. P. asks: Has the earth two or three motions? A. An infinite number of perturbing forces vary the earth's motion. Each periodic movement in the solar system communicates its rhythmic oscillation to all its members, whether sun, planet, or meteorite.

(11) R. R. D. says: I wish to make a translucent covering for hotbeds, of cloth instead of glass. One man recommends covering with 2 ozs. lime water, 4 ozs. linseed oil, 3 ozs. fresh eggs. Another recommends 1 quart linseed oil, 1 oz. pulverized sugar of lead, 4 ozs. pulverized rosin. These are to make the cloth waterproof and airtight. Which is the best of the two? A. The latter.

(12) K. asks: How many books did Euclid write? A. There were 13 of the original books written or arranged by Euclid. Most modern works on geometry contain the substance of the original work.

How arose the inequality in the number of days in the different months? A. It has been taken from the reckoning of the Romans, by whom it was fixed in the time of Julius Caesar.

Would it be necessary to steam the planks for building a boat 17 feet long by 4 feet wide, of cypress, 1/2 inch thick? A. No.

(13) C. B. H. says: 1. The journals of the rollers in rolling mills are usually kept wet by a constant stream of water running upon them. A kind of oil or roll grease is used on such journals, and it is capable of withstanding the action of the water. What is its composition? A. It must be some kind of grease, such as tallow, that is solid at ordinary temperatures. 2. I have a well which produces the best quality of lubricating oil; can I use this oil to produce the above roll grease for wet journals? A. It is doubtful if you can.

My well produces an abundance of gas, which, when confined, gives 30 or 40 lbs. pressure; can I utilize this gas in running an engine, using the gas instead of steam? A. An ordinary steam engine will answer if it is well made. If, however, the gas when mixed with air forms an explosive compound, we advise you not to try the experiment.

(14) C. H. S. asks: How fast can cut cog gearing be run? A. The sudden acceleration and retardation of the wheel make trouble with these gears. It is not possible to definitely answer your question.

(15) C. B. W. says: 1. We have a 1 inch pipe, 1,800 feet long, through which we get water. We have about 80 feet head, and lift the water 15 feet with a siphon, 400 feet of the pipe forming the siphon. If the 400 feet of the pipe forming the siphon were larger, would we get any more water delivered through the 1 inch pipe in the same time? A. There is not likely to be any advantage in changing the pipe. 2. How much pressure would this head of water give? A. A head of 80 feet corresponds to a pressure of nearly 35 lbs. per square inch.

(16) J. O. C. asks: What is the use in making the face of a pulley crowned? Are not pulleys frequently made flat? When two shafts with their pulleys are properly ranged with each other, the faces of the pulleys being flat, will not the belt run evenly on them, and no more to one side than the other? If the faces are crowned, and the shafts not parallel, the crowning will not keep the belt even on the pulleys. A. The object of crowning pulleys is to correct slight inaccuracies in lining the shafting, and those arising from the belt being crooked. It is true, however, that there are very many places in which flat pulleys are used with good satisfaction.

(17) K. asks: 1. What size, pattern, and pitch should a propeller be for a 625 engine in a boat 30 feet long x 8 feet beam of good model, drawing 2 1/2 feet astern? A. Three blades, 30 to 32 inches diameter, 40 to 42 inches pitch. 2. What number of revolutions of such an engine, well constructed, would give the best result? A. About 800. 3. What speed ought I to get in smooth water? A. From 8 to 9 miles an hour.

(18) G. F. asks: What is the amount of moisture contained in a cubic foot of air on a warm damp day? A. About 0.0559 of 1 lb.

(19) B. E. E. asks: 1. Can the solution described on p. 55 of vol. 32 be used to preserve the hull of a yacht? A. Yes. 2. Can it be put on after the yacht is built? A. No, as the wood requires to be steeped for some time in the solution

in order that it may become thoroughly impregnated by absorption of the liquid. 3. Can I paint over it? A. Yes.

(20) M. B. L. asks: 1. I have a 12 inch 4 ply belt, driving a shaft 35 feet distant. I have occasion frequently to reverse, and I find that often, when it is working true, the belt has a strong tendency to run off on reversing. How can I correct this? A. It is probable that the belt is crooked, or the shafts are not in line. 2. What is the best plan of putting a large belt together where it has to be uncoupled frequently, saving of time and an effectual joint being the objects? A. We do not know of any fastening that will answer all of these questions. 3. What would you suggest as the best means of conveying power from a saw mandrel, 30 to 35 feet, to drive a propelling wheel of a boat, speed of mandrel being 300 or 400 and of wheel 30 or 40? A. A chain running over suitable pulleys would be the best.

(21) A. B. says: 1. We have a new boiler and cistern beneath the door of our engine house, built of brick and coated with water lime. Beside furnishing steam for heating our factory, the boiler supplies steam for running the engine, and the exhaust steam from the cylinder passes up through the factory (by a system of pipes separate from that used for heating direct from the boiler) and thence into the cistern beneath the level of the water. By this arrangement little of the heat is lost except what passes out of the smoke stack. As no water is wasted, it is used over and over, and will become practically as pure as distilled water, and so leave no sediment or incrustation on the boiler. The water in the cistern is now quite hard by reason of the fresh lime, and this will for a time cause a deposit of lime in the boiler. What will soften the water or cause the precipitation of the lime before the water is pumped into the boiler? A. Mechanical means, such as a heater with sediment collector, would probably be the best. If, however, your cistern is arranged to be supplied by drainage from the roof when it rains, introduce a little soda with the feed into the boiler, and blow off frequently, until the cistern becomes filled with soft water. 2. What gases are produced by an explosion of gun cotton, and are they of a nature to injure a metallic surface? A. The products of the explosion vary greatly according to circumstances, but they are not ordinarily injurious to a metallic surface.

(22) C. W. N. says: Please explain your reply to Z. as to the expansion of gases by heat. If the gas increases its volume 2 1/3 part for each degree C. of the rise in the temperature, it would double the volume existing at zero at a less temperature than 273°, on the principle of compound interest. If at 273° below zero, the gas is all gone, what will be the result when you heat up again? Supposing you reduce the temperature to -136 1/2°, in accordance to your answer to Z. you will have half the volume that you commenced with. Now you must (according to Z.) increase the temperature 273° to recover the half you lost by reducing 136 1/2°, that is, to double the volume attained by reducing the temperature. A. It is true that some contradiction is involved in the statement generally given in text books on physics. It is only within finite limits that it is correct to say that the volume is increased or diminished 2 1/3 for such change of temperature of 1° C. A more correct method of stating the law is as follows: If the product of the pressure and volume of a gas at 0° C. is given, the product of these two elements will be increased by 2 1/3 of the amount at zero, for each increase of temperature of 1° C., and will be diminished in like proportion for each diminution in temperature of 1°. It will be observed that the increase or decrease is referred to the pressure and volume of the gas at a temperature of 0° C. Below is given the analytical statement of the law: p=pressure of the gas in pounds per square inch, at a temperature of 0° C. P=pressure at temperature T° C. v=volume of a given weight of the gas in cubic feet, at a temperature of 0° C. V=volume of same weight, at temperature of T° C.
$$P \times V = p \times v \times \frac{273}{273 + T}$$
 Now if T= 273°, P×V=0,

a condition that does not involve the annihilation of matter, and merely expresses that the gas no longer exists as gas. (This also answers J. J. T.)

(23) C. W. N. says: 1. You advise H. M. to use a 2 feet diameter wheel with a 3 feet lead for 300 revolutions per minute. We are using a 28 inch wheel with 55 inches lead (4 buckets) on a boat 36 feet long and of 6 feet 6 inches beam. Our cylinder is 6x5, and with 90 lbs. of steam we have run our wheel at over 310 revolutions per minute. We find, however, that this is a great waste of power, as the wheel appears to lose most of its propelling force and does nothing but churn the water into a foam, and the speed is not so good as when we turn 200 to 230 revolutions. Next spring it is our intention to put on a three bucket wheel, same diameter, with 6 foot lead, which we think we can turn up faster (as it will take all the water that comes to it, through larger openings between the buckets) and will drive the boat faster. Let us have your opinion on the subject. A. This will be an improvement. 2. Where should we cut off steam on this engine, and how much should it be open after the center is past? A. At from 5/8 to 3/4 of the stroke, with a lead about 1/8 inch on each end.

Is the pressure on a steam boiler alike all over? A. It is greatest at the lowest point.

Is an injector practicable on a marine boiler? A. Yes.

(24) F. C. G. asks: Is taking the tin off tin scraps a successful business? A. During the past ten years, we have had the history of more than a dozen attempts, aided by ample money capital, to make a business out of tin scrap, which resulted disastrously. Last summer there were in this neighborhood five independent tin scrap establishments; now there is but one, and its proprietors are reticent.

(25) J. W. H. says: Fire balloons made of tissue paper occasionally take fire from the blaze of the alcohol. How can the lower part of the balloon be made fireproof? A. Try steeping the paper in a solution of tungstate of soda. See article on p. 55, vol. 32.

(26) E. B. McG. asks: 1. How can I bring tin to a liquid condition? A. We do not know of any method better than melting it. 2. How can I powder tin? A. Tin may be very finely granulated by first heating to bright redness and immediately pouring from some high into a vessel of cold water through a wet broom or sieve.

(27) M. V. O. says: In your reply to C. W., you say that the water in the drive well rises by the pressure due to a higher source of supply. If this is true, what need is there of any pump at all, and why does not the water flow over the top of the pipe? A. Your view is correct; but our correspondent's question referred to the cause of the water rising up to the level from which it was taken by the pump.

(28) O. C. asks: 1. What is the difference between the composition of gunpowder and blasting powder? A. There is no essential difference. 2. Which wood makes the best charcoal for powder, balm of Gilead, cedar, soft maple, or willow? A. Willow.

Is ivory black anything but burnt bones? A. No.

(29) W. M. G. asks: Will water or any other liquid boil away faster in the night than in the daytime? A. Not if the other conditions are the same.

What is meant by the multiplication of the cube? A. Give an example to illustrate your meaning.

1. I saw it stated that the cylinders of the Great Eastern were 14 feet in length; should it not be 4 feet? A. No. Fourteen feet is correct. 2. Was there ever an engine with 14 feet stroke? A. There have been quite a number.

Will a water wheel run with more force in the night than in the daytime? A. No.

(30) A. B. D. asks: If a tank has a pipe, $\frac{1}{2}$ inch, running in, and a siphon, $\frac{3}{4}$ inch, running out, the tank being empty, when the pipe running in was opened, when would the water begin to run out? A. As soon as the water level was up to the highest point in the siphon.

I am making a small steam engine, 3 inches stroke by $1\frac{1}{2}$ inches bore. Would a boiler 28 inches high and 12 inches in diameter do, and of what thickness and metal should it be? A. Make it about twice as large, of $\frac{3}{8}$ copper.

How can I remove Indian ink marks from my arm? A. We are not sure that there is any safe method. See p. 331, vol. 30.

How can I bronze a gun barrel? A. Rust the surface with chloride of antimony, or dilute muriatic acid. Then clean it, polish with wax, and apply shellac varnish.

(31) L. B. C. asks: 1. Would a 10 horse power engine raise enough water to run an overshot wheel that would give 30 horse power? A. No. 2. Would a 3 inch stream on a 10 foot overshot wheel force an inch stream up a hill 100 feet? A. No.

(32) H. S. asks: What is the shortest correct rule for getting the amount of 1 inch lumber in a log, given the diameter and the length? A. We doubt whether any general rule can be given. Of course it is easy to find how much can be cut from the log after it is squared, but frequently there are several slab boards taken off in squaring. Lumbermen, however, by a little observation, can readily construct tables, by which to estimate the contents of any log.

(33) J. C. B. asks: In driving a pipe for a well, how do you determine when you have arrived at water? A. By applying a pump, or sounding.

Will sulphur answer as well as lead to secure iron to rock? A. Yes.

(34) D. H. W. asks: 1. To what class of mechanical power does the wagon wheel belong? A. It is a lever, as in the case of a locomotive. 2. Which runs the lightest, an iron axle or a thimble-skinned wagon? The iron axle is $1\frac{1}{2}$ inches in diameter, and the thimble-skinned axle 3 inches. A. Probably the question cannot be answered in a general manner, as it depends upon the friction between the wheel and the axle, and consequently upon the fit. 3. Which is the fulcrum, the axle or the ground? A. In the case of a wagon propelled from within, as a locomotive, the axle is the fulcrum. If it is moved by the application of a force from without, and the wheels revolve, the ground may be regarded as the fulcrum. It is evident, in this case, that the wagon could be moved without revolving the wheels.

(35) M. G. asks: Which will resist most pressure, a $1\frac{1}{2}$ gas pipe, or a $1\frac{1}{2}$ inch solid rod? A. The solid rod, if the material were of the same quality in each, because the section to resist rupture would be greater.

(36) G. P. asks: What causes a lathe to chatter? A. The springing of the tool or of the bar. It may be that the lathe is too light for the work.

(37) W. H. H. G. asks: Will a four-ply rubber belt be suitable for a fish elevator, the belt coming into contact with salt water and fish slime? A. We think not.

What is the process of deodorizing kerosene with chloride of lime? A. The oil is mixed with lime and heated, then treated with sulphuric acid, and washed with water.

(38) J. N. M. says: Some years ago, experiments were tried in running horse cars by means of compressed air, which was supplied in a strong reservoir at the beginning of the route. Why might not the power of a windmill be applied to condensing air into a large receiver, and the supply of condensed air used as a regular and constant motor for light or heavy machinery? A. The

idea seems good. The only way to settle definitely, whether it is so or not, is to try it.

(39) J. H. S. asks: 1. Would a cast iron tank of 1 cubic foot capacity or less, to be heated over a forge, do for melting zinc for galvanizing? A. Yes. 2. What should be used to keep the zinc from oxidizing and vaporizing? A. Use sal ammoniac with the zinc. 3. Would a hemispherical tank answer best? A. Yes.

(40) J. F. G. says: Our water reservoir is 2 miles distant, and 160 feet above our mill. What size of pipe must be laid from the reservoir to the mill, so that the natural pressure of water (at the mill) will throw a stream of water 100 feet high by the use of 50 feet of $2\frac{1}{2}$ inch hose and a $1\frac{1}{2}$ inch nozzle? A. It will depend upon the way the pipe is laid. If it is generally straight and free from abrupt changes of direction, it should be from 5 to 6 inches in diameter.

(41) F. L. K. asks: What wood makes the best patterns for light castings? A. Pine, covered with shellac, answers very well. Mahogany can be used for very nice work.

If small copper tubes be fixed in a mold, and melted brass be poured upon them, will the tubes melt or collapse? A. They would be very apt to melt.

Is there an injector that uses the exhaust steam? A. We do not know of any.

1. What are the holes through the side of the fire-box of a locomotive for? A. To admit air into the combustion chamber. 2. How can small leaks at seams and stays be stopped? A. By caulking. It is well to attend to small leaks promptly. 3. Would not the electric light be used as a head light for locomotives? A. It would not be desirable, but it might be done. 4. How much coal will a 40 ton engine burn (on a level) to the mile, pulling a train of 20 cars weighing 10 tons each, the diameters of the drivers being 4 or 5 feet? A. From 40 to 50 lbs. 5. Why is zero on the Fahrenheit scale 32° below the freezing point of water? A. Because Fahrenheit considered the zero of his scale to be the greatest cold that could be produced.

(42) R. A. I. says: I read that steam at high pressure will not scald. Is this true? A. The statement is to be taken with considerable allowance; but the steam issuing from a tea kettle is far more likely to scald than the same quantity coming from a high pressure boiler.

(43) J. A. V. says: In your answer to W. C. R. (who asks whether, if he should take a cylinder of air with 100 lbs. pressure to the square inch, place it on a small boat, and let the air escape, the air on the outside traveling in the same direction and at the same speed as that coming out of the cylinder, it would move the boat or not) you say that the boat would move. What would make it do so? A. The unbalanced pressure opposite the place of discharge.

(44) W. M. C. asks: 1. The cylinder of my engine is of $2\frac{1}{2}$ inches bore and 4 inches stroke. By carrying 80 lbs. steam, making 150 revolutions per minute, how large a yacht can be propelled? A. Make the boat from 20 to 25 feet long. 2. How large a screw ought to be used? A. From 2 to $2\frac{1}{2}$ feet in diameter. 3. Ought the boiler to be vertical or horizontal? A. Vertical.

(45) H. W. asks: Can I ascertain the power of a locomotive from the diameter of cylinder, length of stroke, diameter of driving wheel, number of wheels connected, and weight of engine? A. No. The weight on the drivers must be given. If you suppose, however, that the adhesion is greater than the tractive force, the solution is very simple. We give the rule by which you can make the necessary calculations. The tractive force in pounds is found by multiplying together the square of the diameter of the piston in inches, the length of stroke in inches, and the pressure of steam in lbs. per square inch, and dividing the product by the diameter of the driving wheel in inches.

(46) H. L. N.—You cannot restore the peculiar finish to a knife unless you employ the original mechanism by which it was produced, namely, an emery grinding wheel and a walrus leather polishing wheel.—W.

(47) J. N. P. says: 1. I am making a small engine, of which the dimensions are as follows: Diameter of cylinder 3 inches, stroke 4 inches, with cut-off at crank angle of 135° , with lead. Exhaust closes at crank angle of $157^\circ 5'$, and opens at extremity of the stroke. Ratio of crank to connecting rod is 1 to $5\frac{1}{2}$. I propose to use steam at 50 lbs. pressure; what would be the proper dimensions and style of a boiler for the engine, to make steam quick and use the minimum of coal? A. You should have a boiler with from 60 to 70 square feet of efficient heating surface. 2. What do you think of the dimensions of the engine? A. They are well proportioned. 3. I have discarded the slide valve, and am going to have two cylinders side by side, and use two pistons in the smaller to take the place of the slide valve; I thereby will save a greater part of the steam lost in the long ways incident to the slide valve, and avoid the enormous friction of the same. It has probably never occurred to many that, in order to move an ordinary slide valve $8\frac{1}{2}$ by 10 inches with steam at 80 lbs. pressure, it would require two draft horses doing their best, if attached directly to the valve stem, with no lubricant under the valve. A. We think this idea is in general very good. 4. I want to use an injector and indicator; can these instruments be used on so small an engine, and do I need verbal instruction as to their use? A. You can probably learn how to apply and use them by practice, and by studying the theory of their action. 5. How many revolutions will the engine make with 50 lbs. pressure, and no load except the friction of the engine? A. The engine might make 500 or 600 revolutions a minute.

(48) R. T. M. asks: 1. How much per cent of alcohol does lager beer contain? A. The strength of beer varies according to the quality

and quantity of the malt and hops used, and the mode of conducting each stage of the process, but especially the fermentation. If the first fermentation be stopped at an early stage, the beer will contain a considerable quantity of sugar and comparatively little alcohol; it will be mild, and if bottled will acquire the property of effervescing strongly when the bottle is opened. If, on the other hand, the fermentation be allowed to go on in the vats or casks till nearly all the sugar is converted into alcohol, and the carbonic acid escapes, the beer becomes more alcoholic. For these reasons, lager beer varies in its amount of alcohol from 2 to 10 per cent. 2. Can a grown person drink a pint of alcohol without being hurt? A. It would probably cause death.

(49) W. M. R. asks: Will strong sulphuric acid injure leather? A. Yes.

(50) H. J. S. says: Wells, in his "Philosophy," defines sound as produced by impressions made on the tympanum or drum of the ear by the vibrations of the air. If a cannon be fired far out of the hearing of any animal with the sense of hearing, would there be any sound therefrom? A. Certainly not, under the above definition of sound.

(51) O. W. B. asks: 1. Does soaking a flute in olive oil benefit it in any respect? A. We think it might possibly prevent the wood from becoming dry and cracking or warping. 2. Why are flutes with ivory heads and blow joints better than those with wood? A. The ivory prevents the instrument from getting out of tune by preserving the blow and key holes at a constant diameter. The common wooden instruments, in many cases, in a short time become utterly useless from the contraction and expansion of the wood.

(52) S. L. M. asks: What is the amount of expansion of an iron rod $1\frac{1}{4}$ inches in diameter and 35 feet long, when the thermometer rises from 10° to 75° Fahr.? A. About $\frac{1}{8}$ of an inch.

(53) L. V. R. asks: How can I ascertain the number of degrees of heat required to reduce a certain metal to fusion? A. One method is the use of the pyrometer. As mercury boils at about 660° , we cannot use the mercurial thermometer for higher temperatures. The pyrometer consists of a hollow case of black lead or plumbago, into which is dropped a bar of platinum, secured to its place by a strap of platinum and a wedge of porcelain. The whole is then heated, as, for instance, by placing it in a pot of molten silver, whose temperature we wish to ascertain. The metal bar expands much more than the case of black lead, and, being confined from moving in any but an upward direction, drives forward the arm of a lever over a graduated arc, on which we read the degrees of Fahrenheit's scale. There are several forms of pyrometer, but their use for delicate work is not customary now. The arrangements now used for the determination of high melting points with the greatest accuracy are either based upon the expansion of gases and vapors, or on the electrical properties of bodies. For details, consult Ganot's "Physics."

(54) S. P. asks: Will petroleum gas answer as well as coal gas in forming a lime light? A. Yes.

(55) J. S. asks: 1. What coloring is put into spirits of wine for use in thermometers? A. The coloring made use of generally for this purpose is, we believe, annatto. 2. How can I make an alcohol thermometer? A. Obtain a glass tube having a very small even bore, and having a coil at its lower end. Fill the coil and a portion of the stem of the thermometer with the colored liquid, and boil until the air is completely expelled from the tube, which should then be hermetically sealed with the blowpipe. These thermometers are usually graduated by placing them in baths of different temperatures together with a standard mercurial thermometer, and marking on the alcohol thermometer the temperature indicated by the mercurial thermometer.

How can I mend rubber shoes? A. See p. 233, vol. 30.

(56) C. G. M. asks: 1. To whom should I apply for a license to run a steam engine? A. If it is for a license to manage a steamboat engine, you should apply to the United States Inspector. If it is for a stationary engine, there is probably a State or city inspector in your city. The customs vary in different States. 2. What are the usual questions asked by the examiner? A. The questions ordinarily refer to the applicant's previous experience, and his knowledge of the construction and management of engines and boilers.

(57) J. C. asks: What is the standard of comparison in the determination of the calorific value of fuel, and upon whose investigations is it based? In different books I find it stated that, by the combustion of one pound of carbon, sufficient heat is produced to increase the temperature of from 13,000 lbs. to nearly 20,000 lbs. of water 1° Fahr. By some authors it is stated at 8,000, 8,080, etc., C. What is the present acknowledged standard? A. The unit usually employed is that first used by Rumford, who estimated the calorific power by the number of parts, by weight, of water which one part, by weight, of the body would, on perfect combustion, raise 1° in temperature. Thus one part, by weight, of charcoal, in combining with $2\frac{1}{2}$ parts of oxygen to form carbonic acid, will evolve heat sufficient to raise the temperature of 8,080 parts, by weight, of water 1° C. Estimates of this character are also made by what is known as Berthier's and Stromeyer's reduction methods. These processes consist in determining the quantity of either cupric or plumbic oxides reduced by a given quantity of the fuel.

(58) J. A. S. J. asks: How can I stain pine coffins black, to dry quickly? A. Steep the wood for two or three days in lukewarm water, in which a little alum has been dissolved, then put a handful of logwood, cut small, into a pint of water, and boil down to less than $\frac{1}{2}$ pint. If a little indigo is

added, the color will be more beautiful. Spread a layer of this liquid quite hot upon the wood with a soft brush, which will give it a violet color. When it is dry, spread on it another layer; dry it again and give it a third; then boil verdigris at discretion in its own vinegar, and spread a layer of it on the wood; when it is dry rub it with a brush and then with oiled chamols skin. This gives a fine black, and imitates perfectly the color of ebony.

(59) J. H. M. says: I have a small boat 48 inches from stern to bow, and 8 inches wide. How large an engine would it take to propel it? A. An engine with cylinder of one inch diameter will answer.

(60) E. M. asks: What will remove grease stains from marble? A. Try chloroform.

What will remove a beard from the face without using soap or razor? A. A depilatory will destroy the beard so that no future growth will take place. See p. 229, vol. 28.

(61) B. F. W. asks: 1. What is the reaction by which hydrogen is evolved when metallic zinc is boiled with KOH, and what chemical compounds are formed? A. By the action of a boiling solution of potash on zinc, hydrogen is liberated, while oxide of zinc is formed and dissolved in the alkaline solution. 2. What effect does the presence of an arsenious compound (As_2O_3) have on the reaction and the resulting compounds? A. The arsenious acid would speedily be absorbed by the potash to form arsenite of potash.

(62) C. M. F. asks: What is a good recipe for boot blacking? A. Ivory black and molasses, each 3 ozs., spermaceti oil 1 oz., white wine vinegar, 1 pint. Mix.

Can I obtain back volumes of the *Science Record*? A. Yes.

(63) S. A. E. asks: How are artesian wells bored? A. For a full description of the method of boring these wells we must refer you to some work on the subject. The instruments used for this purpose principally consist of long augers, chisels, gouges, etc., each one being about 7 feet long. As the hole deepens, fresh lengths are screwed on until the desired stream is reached. The most remarkable example of an artesian well is that recently formed at Grenelle, a suburb at the southwest of Paris, France, which cost eight years of difficult labor to perforate. The depth reached was about 1,800 feet. The water rose to the surface, and discharged itself at the rate of 600,000 gallons per hour. The artesian wells of Elbeuf and Tours, which were formed many years ago, overflow in never-varying streams; and the ancient artesian well at Lillers, in the Pas de Calais, has for seven centuries furnished a constant and equable supply.

How is salt obtained from brine? A. Evaporating pans are constructed of well riveted boiler plate, the shape being rectangular, the length about 30 feet, the width about 20 feet, and the depth 2 feet. These pans are supported by masonry, which also serves to separate the flues by which the pans are heated. Professor Cook's analysis of Onondaga brine gives the following percentage of dry impure salt in the brine: Syracuse 18-54, Salina 14-55, Liverpool 15-86, an average of about 16-41 per cent.

(64) G. W. S. asks: 1. How can I make a cheap paint as nearly like white lead as possible? A. Use white oxide of zinc; this may be readily obtained by burning zinc with a full supply of air. 2. How can I bring it to a flesh color? A. Use carmine or vermillion.

(65) G. E. W. says: I cut to pieces a 2 cent piece and tried to melt it between two pieces of charcoal with a blowpipe and alcohol lamp, and failed. I tried borax with it and failed again. How can I melt it? A. If you use some filings of the coin and mix it with four times its weight of carbonate of soda, you should, if you are a good blowpiper, succeed with an alcohol lamp.

How can I make putty powder? A. It is readily obtained by treating metallic tin with nitric acid; violent action, attended with the extrication of nitrous fumes, occurs, and the tin is converted into a white, crystalline, insoluble mass, which is hydrated metastannic acid; after washing it with cold water, the acid, when dried and ignited, becomes anhydrous, and of a pale buff color; in this form it possesses the properties of the native oxide, and constitutes the putty powder employed for polishing plate, etc. It is also largely used for giving whiteness and opacity to enamels.

(66) G. W. W.—The reward offered by the State of New York for improved means of canal navigation expired and was settled over a year ago. No offer of reward now exists that we know of.

(67) R. D. A. says, in reply to J. G. S. who asked for a cheap paste for putting up paper exposed out of doors: Take 1 lb. white glue, soak in 1 pint water for 12 hours, lib. chalk 2 ozs., common resin 1 oz., white lead 2 ozs., all thoroughly pulverized and mixed. After the glue has stood the required time, dissolve it by gentle heat, then rub into it, in a mortar, the other ingredients, using only water enough to make a thick paste, in order to facilitate their union. Then add 1 pint more of water and let it boil for 10 minutes; after which add water to bring the paste to the required consistence for use. It will require to be kept warm while using.

C. H. S. asks: At what velocity must a cannon ball leave the earth so as never to return to it?—E. F. W. asks: How can I make carbons for electric lights?—J. H. asks: How can I blue lamp chimneys?—J. R. G. asks: How can I construct a cheap oxyhydrogen blowpipe?—O. F. asks: What formula is used to find the power of a wedge, having the width of the head, length of one side, and the blow in pounds given?—A. C. asks: What is the composition of percan marble?

COMMUNICATIONS RECEIVED.

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

On Spiritualism. By G. W.
On Mathematical Facts. By P. J. D.
On Past Railway Trains. By E. H. W.
On Aerial Flight. By M. N.
On Setting Locomotive Valves. By F. G. W.
On a Calculating Machine. By E. K. W.
On the Generation of the Wicked. By R. S. F.
On Dressing Mill Burrs. By S. B. W.
On Early Steam Navigation. By P. L. V. H.

Also enquiries and answers from the following:

J. F. E. - J. T. C. - W. H. W. - C. E. H. - C. H. H. -
R. A. B. - G. T. C. - R. H. L. - R. D. - H. H. H. - J. B. M. B. -
- D. D. H. - G. M. C. - L. K. D. - P. T. P. - H. S. S. -
- J. H. P. - J. R. G. - C. M. - E. H. - F. J. K. - C. W. W. -
- W. S. D. - P. M. - H. J. E. - H. B. - E. A. 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 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: "Who makes the best leather for hydrostatic press packing? Who makes springs suitable for running a model locomotive weighing 250 lbs.? Who makes a centrifugal power? Who makes steam engines of one dog power? Where can the drovers and other carnivorous plants be obtained? Who publishes a good book on steam engines, etc., suitable for beginners? Who makes apparatus for producing illuminating gas from crude petroleum?" 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
February 9, 1875,
AND EACH BEARING THAT DATE.
[Those marked (r) are renewed patents.]

Animal shearing machine, W. C. Harlow.....	159,547
Awning hook, Z. M. Lane.....	159,548
Atle lubricator, Parker and Kivett.....	159,549
Baby jumper, B. F. Burgess.....	159,550
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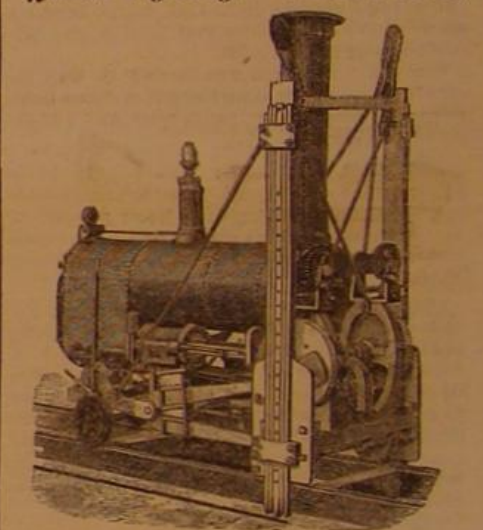
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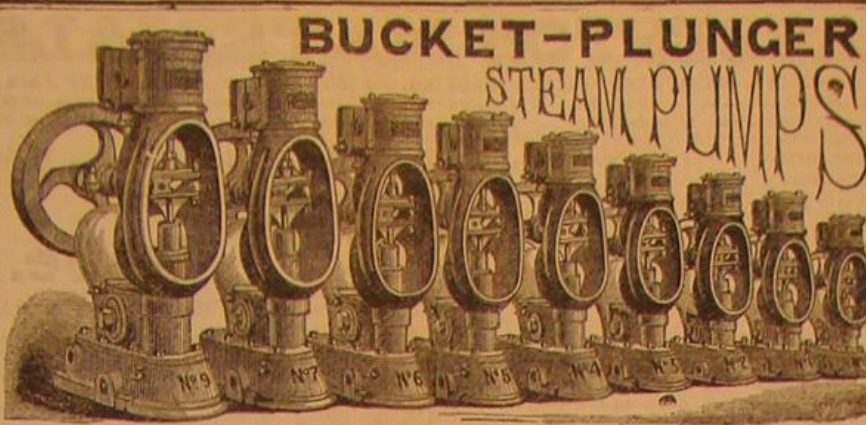
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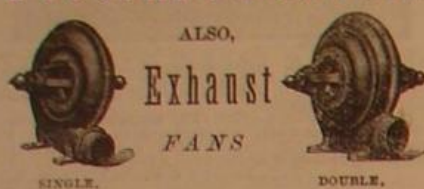
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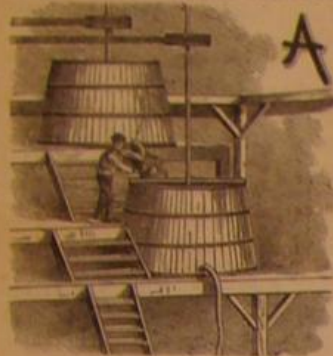
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PORCELAIN MANUFACTURE IN NEW YORK.



Augustus II., Elector of Saxony, was of a scientific turn of mind. He loved Science, however, not for its own sake but for his own; in other words, for what he could make out of it. Consequently, when the staid citizens of Berlin drove from their city an unfortunate apothecary's assistant, whose mysterious operations with retort and crucible savored of the black art, he

was remarkably heavy, an annoyance, in fact, which interfered with his cogitations over his pet problem. So he removed the covering and, at the same time, whitened his fingers with the powder. He looked at the stuff for an instant, noticed its greasy feeling, and then the thought flashed through his mind: "Why not try this for porcelain?" The next paste that entered his kiln contained the ingredient, and that paste emerged white porcelain. The riddle was solved.

At once every workman was sworn to secrecy under penalty of death. "*Geheim bis ins Grab*" (be secret to the grave) appeared in large letters on the wall of every work room. Even the Elector took the oath, which the laborers repeated monthly, and the factory at Meissen became a fortress fully garrisoned and armed. This was in 1715. One man, however, escaped to Vienna, and betrayed the secret. At once

exceeding the actual weights of the articles in gold. We eliminate a century's labor abroad, then, to come at once to the introduction of the manufacture into this country sixty-five years ago, when we find the first record of a company being chartered to manufacture the material from kaolin found in Vermont. Later still, in 1819, Dr. H. Mead began porcelain manufacture in New York, and in 1827 William Ellis Tucker had established a porcelain factory in Philadelphia; while another of considerable extent, employing one hundred persons, had sprung up in Jersey city. Since then the manufacture has been continued, and at the present time the porcelain produced in the neighborhood of this city is, in many respects, equal to the best imported ware.

We now proceed to describe the processes as carried out in one of the oldest and largest establishments in the United States, premising, however, with a few words as to

received the outcast with open arms, and shut him up in a laboratory with instructions to fill up the somewhat depleted electoral coffers with gold produced by the aid of the philosopher's stone, at his earliest possible convenience. John Frederic Bottcher, for that was the exile's name, had learned by experience the futility of such speculations; but, in obedience to the sovereign command, he undertook it, and began operations by making some new crucibles from the clay nearest at hand. When these vessels were fired, to his astonishment he recognized in them the appearance of oriental porcelain, and lost no time in communicating his discoveries to his patron. That business-like individual, promptly appreciating the fact that there was more gold to be made in selling the ware than in hunting the marvelous stone, at once locked up Herr Bottcher and his secret in the strong fortress of Albrechtsburg, and then and there embarked in the pottery trade. Now, like every other inventor, be-



Fig. 3.—THE MAGNETS.

fore or since, Bottcher was dissatisfied. He could produce red and white stoneware of great fineness, resembling porcelain, but true porcelain baffled his efforts, and such porcelain, he argued, he must produce or remain unhappy.

Meanwhile there lived in the neighborhood an ironmaster named Schnorr. Schnorr's horse one day, while his master was on his back, came to a standstill with all four feet stuck in the mud, causing Schnorr to dismount and, doubtless with sundry hearty Teutonic objurgations, to extricate him. Schnorr was not so angry, however, as to prevent his noticing that the mud was pure white, although astonishingly sticky, and it occurred to him that, if he could make the material into a powder, there was the stuff for the wigs of the gentry and, at the same time, the basis of a fortune for him. This idea he put in practice; the powder sold well, and in the course of time fell into the hands of Bottcher's valet, and thence upon the head of Bottcher himself. Bottcher one day, after an application of the substance, discovered that his wig

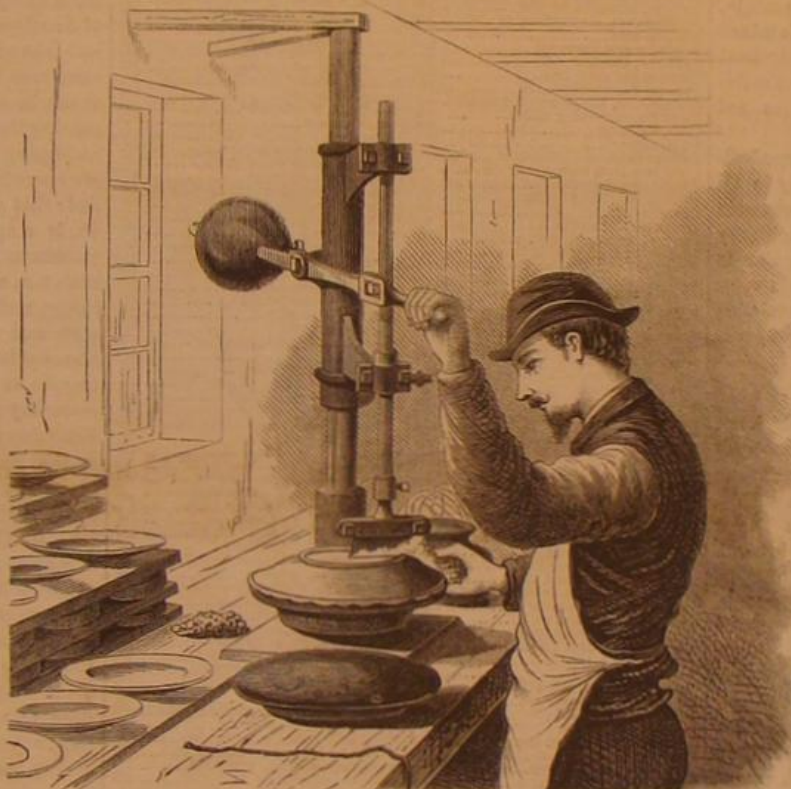


Fig. 1.—MOLDING THE WARE.



Fig. 2.—PRESSING AND TURNING SMALL WARE.

other factories sprung up, and their numbers extended throughout German Europe. France looked on with undisguised jealousy, and set her chemists hard at work. It was reserved for a woman to do that in which the wise men failed. The wife of a surgeon, living near Limoges, ran short of soap for her week's washing. She was too poor to buy more, and hence attempted to use a white unctuous earth found in a ravine hard by. Her husband showed the strange clay to the village apothecary, and he in turn told the chemists, who recognized in it the kaolin of which they were in search. Thus sprang up the great factory at Limoges, and then that of Sevres, both famous to this day.

To trace the course of the porcelain industry for the last hundred years would cause us far to transcend our present limits. Suffice it to say that it is now one of the first in the world, and that the earlier products have been made the subjects of manias which have run their value up to sums far

THE MATERIAL OF WHICH PORCELAIN IS MADE.

Porcelain clay or kaolin (the word is derived from the name of a mountain in China where the substance abounds) is a silicate of alumina, and has an average composition of 47 per cent silica, 40 of alumina, and 13 of water. It comes from granite rock which, by natural causes, is decomposed, so that the felspar and quartz are separated. The potash extracted from the felspar leaves the kaolin in a soft unctuous condition, white and opaque, and with a characteristic odor when breathed upon. In this condition, it is exported hither from certain districts of England, and is combined in suitable proportions with felspar and quartz. It is unfortunate for the industry here that the necessity exists of obtaining the ingredient from foreign sources, as there is no reasonable doubt but that ample beds of the material exist within our own borders, which careful search and careful development might soon render available.

THE FACTORY

which we recently visited is located in Greenpoint, Long Island, opposite this city, is known as the Union Porcelain Works, and is owned by Messrs. T. C. Smith & Sons.

MIXING THE SLIP.

After the kaolin has been combined, as above noted, with felspar and quartz, it is thrown into a huge vat, and there mingled with water to the consistence of a thin paste. This operation we found in process in a lofty lower story. Inside the vat a vertical shaft, supporting a number of radial arms, kept the slip, as it is technically termed, in a state of constant agitation, as the liquid slowly escaped from an orifice beneath into a sieve held by a workman there stationed. The sieve was constantly shaken, and the slip continued its sluggish course down a short channel and between two sets of horseshoe magnets, some horizontal, others perpendicular. The object of these, we were told, is to remove every fine particle of iron which the mixture may contain, for, as we afterwards saw, each speck of the metal, however minute, appears as a black spot on the snowy surface of the finished china. From the magnets (Fig. 3) the liquid ran into a second sieve held by the same man, faucets suitably located enabling him to check the flow at pleasure, and thence into a second vat located on a lower level, where similar apparatus to that already noted kept it stirred. With the initial letter which heads this article, there is a small drawing which shows the arrangement of the vats, after escaping



Fig. 5.



Fig. 6.—THE SEGGARS.

from the last of which the slip is led into storage bins or tanks. The next operation is



Fig. 4.—PRESSING THE WATER FROM THE SLIP.

SQUEEZING THE WATER FROM THE SLIP.

and to this end the paste is pumped from the bins and into a peculiar press which is represented in Fig. 4. This may be compared to a series of heavy wooden trays set up on end and held together by strong iron bands. Between each pair of trays is a cloth bag, and with each bag a supply pipe communicates. A powerful force pump drives the slip into the bags under a heavy pressure, and an ingenious valve, which may be weighted as required, regulates the backward tending force, and by lifting at the proper time prevents the bursting of the bags. The result is that a large quantity of water is expelled, and the material emerges a heavy dough. This is worked and kept for some time before using as ageing is said to improve it. The Chinese, by the way, have a tradition that the material for their old porcelain was stored away for a hundred years before use. The French missionaries, translating the words "for a hundred years" into their own language, "pour cent années," afterwards corrupted the latter phrase into the word "porcelain."

Passing from the press room to another apartment, we were shown an immense heap of smashed crockery. All this, we were told, is utilized, and in fact made over again. The fragments are ground to a coarse powder under two huge revolving burr stones, each weighing some two tons. This powder is again ground in an ordinary mill, and in its fine state, is mixed with water to go through the regular process. The operation of

MAKING SEGARS

next claimed our attention. A "seggar" (Fig. 6) is a tray of common baked Jersey red mud. It has no cover, and its depth varies according to the piece of ware it is to contain, during the baking of the same in the kiln. The clay is mixed to a thick plastic mass in a pug mill and subsequently pressed in molds to any desired form. Baking follows, and the finished seggar emerges looking like a piece of coarse red earthenware.

Leaving the lower stories, we ascended through large brilliantly lighted rooms and past tier on tier of crockery in all stages of manufacture. Scrupulous cleanliness pervaded everywhere, and, save the slight whizzing sound of machinery no noise was heard. The workmen—and, very singular to add, girls too—labored silently, obeying the placards commanding stillness, which, appearing on the walls, reminded us of the stern warning in the old German workshop a century ago.

MOLDING THE WARE.

"The potter's lathe," said our guide, "is obsolete here. We abolished that antique apparatus long since," and leading us to a long table, he showed us a row of men, each one stationed before a horizontal revolving disk (Fig. 1). This, by a mere pressure of the knee on a lever, which threw friction gearing into operation, could be set spinning around. Beside each man was what appeared to be a number of short tubes (Fig. 5), irregularly shaped and made of the clay dough. The disk or rotating head being at rest, the workman placed thereon a mold, the interior of which was of the exact form of the exterior of a bowl. Into this he inserted one of his dough tubes, and set the disk in motion, pressing the plastic mass with his fingers, at the same time, out against the side of the cavity. Then he brought down into the latter a counterpoised metal blade, as shown in Fig. 1, which was so adjusted and shaped as to remove exactly enough material to leave the bowl of the requisite thickness, and at the same time to form its interior. The article, we were told, is subsequently put aside to dry, and, thus completed, is removed from the mold and is ready for baking.

There are very many objects which do not require the use of the revolving head, and are simply pressed into molds, some by machinery, others by hand alone. The machine used for door knobs, for example, is simply a screw press which forces the clay in the condition of moist powder into a properly shaped die. The knob, however, on emerging, is not everywhere round, and is therefore placed on a horizontal revolving spindle and turned. These operations on the knob are shown in Fig. 2. China heads for nails, casters, speaking tube mouths, and an immense variety of other porcelain goods for the hardware trade are made in similar manner.

(To be concluded in our next.)

A New White Pigment.

A Mr. Orr, of Glasgow, has recently taken out a patent for a white pigment, which he has endeavored to obtain by forming a compound of zinc and barium. For this purpose he takes crude barium sulphide, and lixiviates it. The supernatant liquid is then drawn off, and divided into two or more equal portions. To one, an equivalent of zinc chloride is added, and to this again zinc sulphate is added, and afterwards another portion of barium sulphide, the result being an intimate mixture of 1 equivalent barium sulphate and 2 of zinc sulphide. The precipitates, composed of zinc and barium, are collected and pressed to expedite drying, after which they are placed in retorts and brought to a red heat. While still hot, they are drawn into water, preferably cold, which, it seems, has the effect of increasing their density and imparting body to the paint to be made from them. They are subsequently washed and ground in water to a fine powder, or they may be first dried and then ground. The inventor states that, by increasing the number of additions of zinc sulphate, the quality may be varied. The pigment thus prepared is to be used in the ordinary way; and if it does but possess the covering power of white lead, and can be sold as cheaply, it will be undoubtedly a useful product, for zinc white retains its color better than any other white pigment in ordinary use.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS.

One copy, one year, postage included.....\$3 20
One copy, six months, postage included.....1 60

Club Rates.

Ten copies, one year, each \$2 70, postage included.....\$27 00
Over ten copies, same rate each, postage included.....2 70

By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise they will be entered from January 1st, 1875. In case of changing residence state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXII, No. 12. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, MARCH 20, 1875.

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CROSSING THE BOUNDARY OF THE EXPERIMENTAL EVIDENCE.

It is amusing to see how zealously the non-scientific world insists on the restriction of Science to verified fact, especially when we remember that the sole basis on which its opposition to Science rests is a stupendous hypothesis, not only unverified, but confessedly beyond the reach of human verification, the hypothesis of Divine revelation—something supernatural, superhuman, miraculous.

Professor Tyndall speaks of crossing the boundary of the experimental evidence in pursuit of an explanation of visible phenomena, and straightway a great cry is raised that he is no true friend of Science, or, at best, that he has been betrayed into a false and "unscientific" step in the heat of oratory and by the sympathies of his audience. The speaker disclaims any such apology, assuring his volunteer defenders that he said nothing in heat or haste; that he crossed the boundary deliberately, and said just what he meant to say.

The reply all but breaks the heart of these would-be guardians of the integrity of Science. The admission of imprudence and haste would have simply damaged Professor Tyndall's reputation as a scientist. The avowal of deliberate intention, they fear, will utterly destroy the claims of Science in popular estimation! If years of scientific training and investigation, they say, can produce no better result than to make a professor of Science carry his scientific teachings straight to conclusions in the regions of the absolutely unknowable, what becomes of the boasted virtues of the scientific habit and its supposed effects upon the human judgment and intelligence?

A sufficient reply to this objection would be that one of the chief virtues of a scientific training is, not to keep the mind's action wholly within the bounds of experimental evidence, for that would block all progress, but to enable it to cross that boundary when occasion demands, properly restrained by a knowledge of what is known and a conviction that what is unknown is certain—so far as experience goes—to be in harmony with the known. For this reason the hypotheses of a true scientist are to those of the unscientific or anti-scientific as the speculations of a wise man are to those of a theologian. In the one case the hypothesis, unverifiable though it be, has a basis in reason and reality; in the other

it is very apt to fly in the face of fact, and set faith above reason. He would be a curious disciple of Science who should say: "I cannot understand, therefore I believe!"

Fortunately the anti-scientist cannot be unreasonable in all things. In the common affairs of life his mind works like other men's. It is only when his religious prejudices are involved that he kicks at the scientific method. Thus if he should find on his doorstep some morning an infant, with no discoverable clue to its origin, he would be as ready as Darwin himself to pronounce it a human child, born of human parents in the ordinary way, and placed there by human hands, though, under the circumstances, not one of these assumptions would be other than an unverifiable hypothesis.

In no case could we think of a true scientist as deciding otherwise. It is quite possible, however, to suppose that an ecclesiastic might hold a different opinion. "What has happened may happen." If one child, as he devoutly believes, came into the world without a human father, it is possible that this might have had a similar origin. Still more, if his church decreed it, he could not deny that the child was, like the progenitors of the human race, according to his theory, a direct product of creative power, with no parent but the Almighty. Under the supposed circumstances, this would be no less possible of verification than the scientist's hypothesis of human parentage; the two differ simply in the fact that the one has all the verifiable facts we have to support it, while the other has all known facts against it. The great virtue of Science training is to keep men from such unsupported vagaries, not to chain them down to demonstrable fact.

In his late review of Haeckel's "Anthropoginie," Professor Huxley touches this point in defense of the hypothesis of development as applied to living creatures, man included, and shows how few scientific problems, even those which have been and are being most successfully solved, have been or can be approached in any other way than by speculations passing the bounds of positively verifiable fact. "Our views respecting the nature of the planets, of the sun, and stars are speculations which are not and cannot be directly verified; that great instrument of research, the atomic hypothesis, is a speculation which cannot be directly verified; the statement that an extinct animal, of which we know only the skeleton, and never can know any more, had a heart and lungs, and gave birth to young which were developed in such and such a fashion, may be one which admits of no reasonable doubt, but it is an unverifiable hypothesis. I may be as sure as I can be of anything that I had a thought yesterday morning which I took care neither to utter nor to write down, but my conviction is an unverifiable hypothesis. So that unverified and even unverifiable hypothesis may be great aids to the progress of knowledge—may have a right to be believed with a high degree of assurance. And therefore, if it is to be admitted that the evolution hypothesis is, in a great measure, beyond the reach of verification, it by no means follows that it is not true, still less that it is not of the utmost value and importance."

The like is true of other current hypotheses in Science. They may or may not be ultimately demonstrated; many of them may be, and in all probability will be, supplanted in time by new hypotheses having a wider basis in verified fact; nevertheless, they are to be accepted provisionally, as giving the best expression and interpretation of phenomena as we know them, and used as "instruments of research" until something better is found. If the world of thought had waited for absolute truth before going ahead, it would never have got even so far as the crude hypothesis of the books of Genesis. To wait is to go to waste. As Professor Huxley has well said: "Active error may advance knowledge in its efforts to establish itself; and nothing is more remarkable than the number of great things, from the discovery of America to that of the antiquity of man, which have been brought about by the attempt to establish erroneous views. But sitting still and being afraid to stir, for fear of making mistakes, is certain to end in ruin, in Science as in practical life."

FOREIGN EXHIBITORS AT THE CENTENNIAL.

So far from there being a prospective lack of foreign exhibitors at the Centennial, it now appears that so many desire to avail themselves of the advantages offered that it will be impossible to accommodate all in the spaces allotted. The commissioners of several nations have already made requisition for greater areas than have been set aside for their respective countries, and applications, they state, are being constantly received. The German Empire, it is said, will make by far the finest display, both in kind and extent; Austria will follow closely, and her products, comprising the exquisite articles of *certa* from Vienna, Moravian cloths, Bohemian glass, and Styrian and Carinthian iron, will together constitute an exhibit of great industrial interest. The marked eagerness with which each nation desires to secure prominent representation is noticeable on the part of the small countries, some of which have been assigned in couples to certain spaces. Thus, Holland objects to being assigned floor space conjointly with Denmark, and asserts through her commissioner that she can fill every inch of the space allowed, alone. Hungary will probably insist on a separate department, and refuse to be overshadowed by the Austrian display. Norway declines to be joined with Sweden, and both Scandinavian countries assure very interesting exhibits of iron, furs, and matches. Denmark offers a good display of Copenhagen manufactures, besides collections illustrating the manners, customs, and industries of Greenland and Iceland.

France will also crowd her space with silks, velvets, lace, jewelry, and the thousand productions in which her artisans

are unrivaled. It is said that the French display will be the best organized and regulated in the Exposition. Italy has not yet appointed a commission, but it is understood that she will shortly do so. Her exhibit will be principally mosaics, cameos, corals, statuary, Venetian glass, Genoese silk, and other specimens of industrial art. Fine displays from Greece and Portugal are expected, and Switzerland has promised a complete exhibit of her watches, mathematical instruments, lace, and wood carvings.

Russia is holding off, and as yet her government has made no overtures toward participation. It is rumored that this position will be maintained, and that the country will be represented solely by voluntary contributions sent by individuals.

England and all her colonies are manifesting a largely increased interest in the enterprise, and leading manufacturers are well advanced in extended preparations. The Canadian government has appropriated \$250,000 to pay expenses of the Dominion commission, and British India, Australia, New Zealand, and the Cape of Good Hope have promised full displays. All of the South American countries have applied for space, and the commissions of several are already organized. Brazil and Chili will take the lead in point of extent of exhibits, but from all contributions are expected, far larger than those sent by them to previous World's Fairs. Mexico, the Central American States, and Hawaii are likewise preparing. In the East, from Egypt and Japan magnificent displays have been promised; Turkey, Persia, Siam, and China are as yet unheard from.

Altogether, the prospects are that the Centennial will outshine all previous expositions in the completeness of the exhibits which each country will furnish. This is well evidenced by the ready response which all have made to the invitations sent them to participate, and the celerity with which they appointed commissions and set about the necessary preparations. The combined foreign exhibits will occupy 340,432 square feet out of the 485,000 feet available. The United States has 123,160 square feet, and there is an area of 21,408 square feet reserved for contingencies.

AMERICAN PORCELAIN.

We commence on the front page of this issue an elaborate illustrated article detailing all the various processes of the manufacture of porcelain as practised in this country. There is no question but that this industry has become a very important American manufacturing interest, and one which, before many years, will enter into sharp rivalry with the work of European producers. It holds the unfortunate position now, however, of being practically unrecognized. That is to say, the popular prejudice is so strong in favor of foreign goods that American wares have to be and are largely sold as French or English products in order to induce people to buy them. This is alike destitute of sense or justice. The fact remains that porcelain from our own factories is bought and liked, and therefore no valid reason exists why it should not be put on the market for what it is. We are gratified to notice that a meeting of the pottery trade, held in Philadelphia a month or two ago, recognized this very plainly, and the convention voted, among other resolutions, to the effect "that we have sufficient talent in this country to originate new designs, more elegant and suitable to the wants of the American people, and that such procedure on our part will the sooner enable us to give our products the stamp of a national product and a distinct character."

We also wish to direct especial attention to the fact that we import kaolin from England, and that none, as we are informed, has as yet been discovered in this country suitable for the finer porcelain. There are beds, we believe, in Brandon, Vt., but the clay is put to base uses in adulterating paper, paint, and other products. We have no record of its being tested for porcelain. There is a tariff of \$5 a ton on the imported material, from which our citizens reap no benefits, and which offers a further incentive to discover the kaolin. It seems to us that, unless some effort in this direction shortly appears, it would be good policy to encourage the industry by remitting the tariff altogether, and entering the kaolin free as a raw material.

In our inspection of the machinery, at the establishment described, we were impressed with its simplicity and efficiency everywhere except in one particular. That was in the means used for making the small articles, such as nail heads, castors, and other hardware trimmings, of which the factory produces an enormous quantity. The reader will find the apparatus illustrated in Fig. on page and it will be perceived to consist merely of a screw press, which forces the damp powder into a die, the latter being removed by hand and filled for each article. There is very clearly work for an inventor here; and it seems to us that a little ingenuity could speedily contrive an apparatus which would fill the die, hold it in place, and run down the screw, automatically. Now it requires one workman to each machine. With suitable apparatus, one man ought to control half a dozen if not more, and produce the articles far more quickly as well as of more uniform shape.

We notice that the Potters' Association offer three prizes of one hundred, fifty, and twenty-five dollars respectively, for the handsomest design of pottery ware to be exhibited at the Centennial. If we may judge from the efforts being made at the factory visited by us, our American potters are thoroughly imbued with a spirit of emulation, not of course to gain the small sums above mentioned, but to produce a display at the Centennial well calculated to arouse the world to a sense of the progress we have made in the ceramic art. We were shown some remarkably beautiful vessels, of unique shape, the exteriors of which were molded with national em-

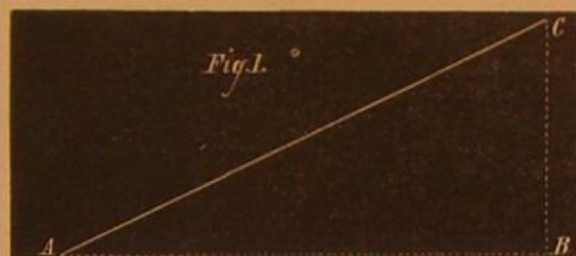
blems and bas-reliefs of events in American history, which when complete will, we think, compare favorably with some of the finest vases and other evidences of skill produced by European factories.

A VARIABLE SCREW.

A correspondent asks how to lay out an increased twist on a wooden cylinder. We do not know that this information is published in a form that is generally accessible to our readers; and as the construction is also applicable to the guide plates for screw propulsion, we here present it in simple form.

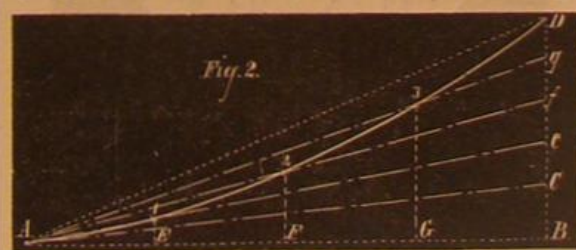
The line forming the intersection of any two faces of a screw thread is called a helix, and can be described, on a cylinder having the same diameter as the thread, by the motion of a point which goes around the cylinder, and, at the same time, advances in the direction parallel to the axis. If all the helices of the intersections of the faces of the screw are determined, we have the boundaries of the thread, and it is the method of making the determination that our correspondent desires to have explained. The pitch of a helix is the distance that the generating point moves along the cylinder in passing once around it. If this axial motion is the same for all parts of the revolution, the helix has a constant pitch; but if the motion varies at different parts of the revolution, the helix is said to have a variable pitch—increasing if the axial motion of the point is greater for each successive equal interval of the revolution, and decreasing if the axial motion continually grows smaller. The simplest manner of drawing either of these helices is by the aid of a graphical construction; and the methods employed in the three cases are represented in the accompanying sketches:

1. Helix with constant pitch, Fig. 1: Provide a cylinder of the same diameter as the required helix. Draw a horizontal line, A B, equal to the circumference of the cylinder; and at the point, B, erect a perpendicular, B C, equal to the pitch; connect the points, A and C, by a straight line; cut out the figure so constructed, and wrap it around the cylinder, with B C parallel to the axis. Then A C will be the required he-



lix, which can be traced on the cylinder by using the edge, A C, of the paper as a guide. If the helix is to be constructed for only a portion of a revolution, make A C equal to that fraction of the circumference, and B C equal to that fraction of the pitch. Similarly, if the helix is to make several revolutions, A B must be the length of the circumference of the cylinder multiplied by that number of revolutions, and B C, the pitch multiplied by the same number.

2. Helix with increasing pitch, Fig. 2: Provide a cylinder, as before, and make A B equal to the circumference. Erect a perpendicular at B, and make B C equal to the initial pitch of the helix, and B D equal to the sum of the initial and final pitch divided by two. Divide C D into any number of equal parts, and A B into the same number. Draw straight



lines to A, from the points of division of C D, and perpendiculars to A B from the points of division of that line; mark the points in which these perpendiculars cut the corresponding lines drawn from the points of division of C D, and draw a curve, A 1 2 3 D, through these points and A and D, cut out the figure, and wrap it around the cylinder as before, when the required helix can be traced with A 1 2 3 D as a guide. If the helix make more or less than one revolution, A B must be made equal to the length of the same part of the circumference of the cylinder, B C to the same part of the initial pitch, and B D to the same part of the half sum of the initial and final pitch. In the figure, only a few points of the guide curve are constructed, as it is merely given for the sake of illustration; but in any practical case, it is well to construct as many points as convenient. Some examples are added to still further illustrate the construction.

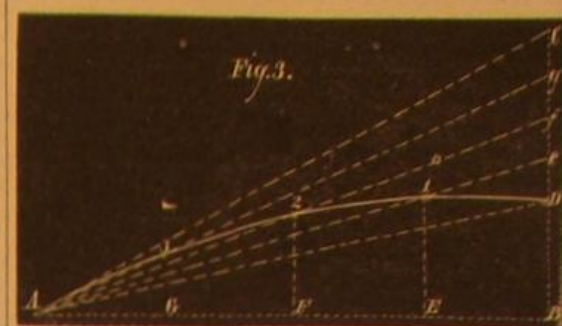
Example 1.—To construct the guide for one revolution of a helix, 4 inches in diameter, and with pitch increasing from 4 to 12 inches: A B is 12.566 inches, B C is 4 inches, and B D, $(4 + 12) \div 2$, or 8 inches.

Example 2.—Guide for a helix making six revolutions, having a diameter of half an inch, starting with a pitch of 3 and ending with a pitch of 15 inches. In this case, A B is 6×1.5708 , or 9.425 inches, B C is 6×3 , or 18 inches, and B D is $6 \times (15 + 3) \div 2$, or 54 inches.

Example 3.—Guide for the circumferential helix of one blade of a screw propeller, the diameter of the screw being 18 feet, one eighth of the pitch being used, and the pitch expanding from 24 feet at the forward edge of the blade to 32 feet at the after edge. A B is $\frac{1}{8}$ of 56×549 , or 7.069 feet. B C is $\frac{1}{8}$ of 24, or 3 feet. B D is $\frac{1}{8}$ of $(24 + 32) \div 2$, or 3 $\frac{1}{2}$ feet.

3. Helix with decreasing pitch, Fig. 3: The guide is con-

structed in a similar manner to that already described. A B is the circumference of the cylinder on which the helix is to be drawn; B C, perpendicular to A B, is the initial pitch, and



B D is equal to half the sum of the initial and final pitch. Divide C D and A B, each into the same number of equal parts, and mark the points of intersection of lines drawn from the divisions of C D, to A, with the perpendiculars erected at the corresponding points of A B. A curve, D 1 2 3 A, drawn through these points and D and A, will be the guide, by means of which the required helix can be traced upon the given cylinder.

THE METALLURGY OF IRIIDIUM.

When it was decided to make the standard meter, of which a description appeared in our issue of September 10, of an alloy of platinum and iridium, the preparation of the latter metal presented the greatest difficulty. Platinum resists the action of oxygen, and is only acted upon by aqua regia; for its fusion it requires the highest heat attainable by the oxyhydrogen blowpipe. The alloy of osmium and iridium, in which form the latter is only found in Nature, is unaffected either by aqua regia or the blowpipe. Small grains of iridosmine are found mixed with the sand in which platinum ore is found. This mixture of platinum, sand, and iridosmine was first treated with aqua regia, which, of course, dissolved the platinum, leaving the iridosmine in small grains and scales, mixed with sixty to seventy-five per cent of sand. By fusing this mixture with litharge, silica and a little charcoal, the same unites with the litharge and silica to form a glass; the iridosmine, being heavier, falls into the reduced lead below. It is isolated in metallic granules by dissolving the lead in nitric acid; next the iridium must be separated from the osmium.

Iridosmine can only be attacked and rendered soluble by treating it with alkalis combined with powerful oxidizing agents. For this purpose, it must be reduced to a fine powder, which cannot, however, be accomplished by pulverization in a mortar, for the iridosmine is very tough and hard. The object was accomplished by fusion with zinc, with which it forms an alloy. On distilling off the zinc, it is left in the state of a very fine powder. This powder is heated with nitrate of baryta as a flux, whereby it is converted into oxide of iridium and osmate of barium. The resulting mass is soluble in nitric acid; and when the solution is distilled the osmic acid, which is volatile at 212° Fah., is obtained in large, white crystals. This operation requires special caution, as the osmic acid is very poisonous, the most so of any known substance. It, therefore, has to be kept in tubes hermetically sealed.

The red liquid, which remains after distilling off the osmic acid, contains nitrate of baryta and oxide of iridium. The latter is precipitated by adding baryta. The precipitated oxide of iridium is dissolved in aqua regia and precipitated by the addition of sal ammoniac, in the form of a double chloride of iridium and ammonia, $NH_4Cl + IrCl_2$. When ignited, this yields the crude iridium sponge, which also contains some platinum, ruthenium, and a little rhodium. This is refined by fusion with saltpeter, which oxidizes the ruthenium and other metals. The resulting mass is treated with water, which dissolves the ruthenate of potash with a yellow color. The residue is fused with lead, which separates the metals. On cooling, pure iridium crystallizes from the lead. The lead is dissolved by nitric acid, and the platinum by aqua regia, which does not attack the iridium.

The invention of a method of working up iridosmine, although somewhat difficult and dangerous, so as to obtain the iridium in a metallic state for the preparation of very refractory alloys, will probably render valuable a hitherto waste product in the working of platinum ores.

The dangerous character of its companion, osmium, of which it is said that twenty pounds would kill all the inhabitants of the world, will prevent its finding a use in the arts.

New Screw Propeller Experiments.

We have alluded to the experiments of the veteran screw propeller inventor, Mr. Griffiths, who has shown that in some cases there is a loss of 60 per cent of engine power in the use of screws. He now proposes, as an improvement, the use of small screws, one at the bow and the other at the stern. The British Admiralty have placed the Bruiser steamer at Mr. Griffiths' disposal for trial of the new plans, and the results, which may soon be expected, will be studied with interest.

At the New Albany (Ind.) Plate Glass Works, the other day, several men were standing on an elevator, steadying a very heavy load of plate glass, worth some \$2,500, when the cog wheel which propelled the windlass broke suddenly, just as the elevator reached the topmost floor, and the men and their charge were precipitated together a distance of thirty feet. The glass was broken in fragments, which almost buried the men. Three of the latter were seriously wounded.

THE FIREMAN'S RESPIRATOR.

In a paper read by Captain Shaw, of the Metropolitan Fire Brigade, at the Society of Arts, on January 19, an ingenious apparatus was described for enabling persons to breathe in dense smoke or poisonous vapors. It consists essentially of a close-fitting hood, with a respirator, holding a filter, the



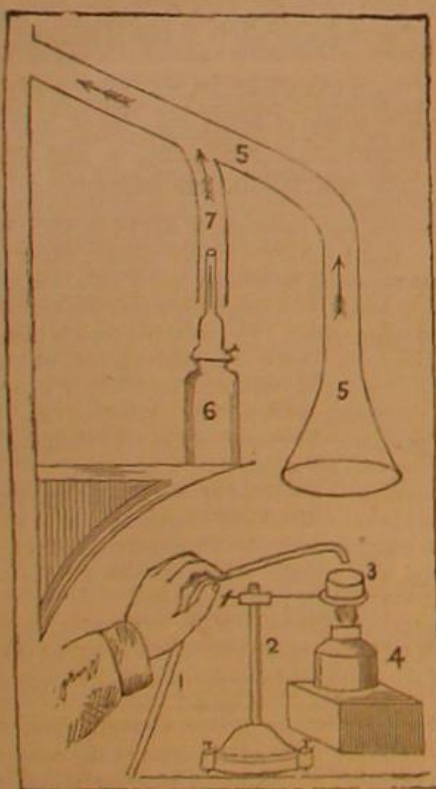
vention of Professor Tyndall, which consists of a valve chamber and filter tube about 4 inches long screwed on outside, with access to it from the inside by a wooden mouthpiece. The charge for the filter consists of the following materials, which are put in with the tube turned upside down, and the lower valve removed: Half an inch deep of dry cotton wool, an inch deep of the same wool saturated with glycerin, a thin layer of dry wool, half an inch deep of fragments of charcoal, half an inch deep of dry wool, half an inch deep of fragments of lime, and about an inch of dry wool. The whole can be put on and adjusted in a few seconds by the wearer.—*Science Record*.

A New Light.

We described, not long ago, the new light for photographic purposes, produced by the combustion of bisulphide of carbon and binoxide of nitrogen. The only drawback to the utility of the light was the danger of explosion. Further experiments in the same path have recently been made, and Messrs. Riche and Bardy communicate to the French Academy the details of the apparatus, by which a new light, having an actinic power superior to the oxyhydrogen light, is produced, with economy and safety. The light is made by melting sulphur in an open vessel; and when the sulphur is in flames, a jet of oxygen gas is directed upon it, producing a bluish light of great actinic power.

Another method, which produces a brilliant white light, but of less actinic power than the other, consists in filling the vessel with nitrate of potassium, and heating until the salt begins to decompose, then throwing small pieces of sulphur upon the surface of the salt.

The following is the apparatus for the sulpho-oxygen light:



No. 1, a glass tube connecting the gas bag with burners No. 2, an iron stand to hold the small crucible. No. 3, a crucible. No. 4, a small alcohol lamp to ignite the sulphur. No. 5, a funnel to receive the product of combustion. No. 6, a petroleum lamp employed to establish a current of air in the chimney. No. 7, a shaft connected with the chimney, in which the current of air is formed by means of gas or a lamp.

It is not necessary, says Professor E. Stebbing, in the *British Journal of Photography*, to employ the oxygen under much pressure, for with too much of that gas the flame is white instead of blue, and therefore less photogenic.

PROFESSOR FORSTER, of Berlin, discovered, on February 25, a new planet of the twelfth magnitude.

THE NEW REVELATIONS OF A SNOW FLAKE.

It is difficult to believe that the pure white flake, which settles noiselessly upon the earth, and which seems, even when moderately magnified, but a mass of exquisite white ice crystals, is, after all, but a scavenger of the atmosphere. But such, nevertheless, is the fact, and henceforth we must regard the snow drops but as so many sponges which absorb into their porous substance the myriads of microscopic bodies which form that peculiar atmospheric dust, found near the surface of the earth, and most largely in the vicinity of cities. This dust is itself a queer mixture of heterogeneous substances. M. Gaston Tissandier, who has been making a



Fig. 1.—Corpuscles suspended in a drop of snow water.

number of very interesting investigations on the snow, states that, in a drop of water obtained from a single flake and magnified 500 times, he found pieces of coal, fragments of cloth, grains of starch, sandy matter, and an immense variety of other substances, not a fragment of which exceeded in diameter three ten-thousandths of an inch. Some idea of the numbers in which these infinitesimal particles must exist in the snow can be gained from Fig. 1, which represents a drop of snow water gathered at the summit of Notre Dame towers, in Paris, and magnified under the microscope 500 diameters. The fibers of fabrics and bits of coal are easily recognized.



Fig. 2.—Crystals obtained by evaporating a drop of snow water.

By examining large volumes of snow water, M. Tissandier has been able to determine the weights of these corpuscles. A quart of water collected in the city and evaporated gave 3.2 grains of residue, and the same quantity obtained in the country yielded about half that weight. The residue is an impalpable pulverulent gray powder, composed, in round numbers, of 70 per cent mineral and 30 per cent organic substances. It is very rich in carbon, burns brilliantly, and con-

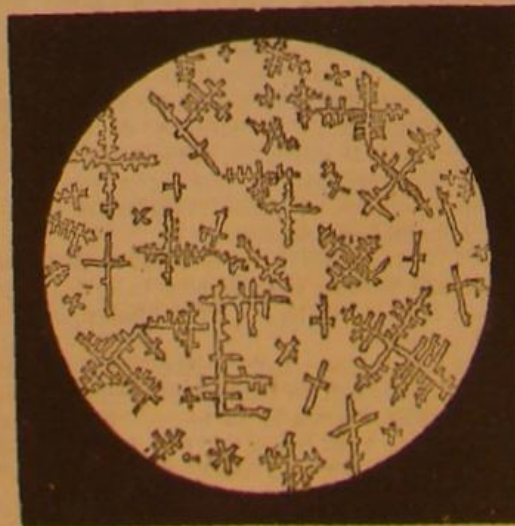


Fig. 3.—Crystals obtained by evaporating a drop of snow water.

tains certain chlorides and sulphates in appreciable quantities, besides carbonate of lime, alumina, siliceous, and sufficient iron to be readily recognized by reagents. Nitrate of ammo-

nia is also detected in the proportion of about 0.015 grains per quart of water.

M. Tissandier states that, by evaporating a drop of snow water, in dry air on a glass slide, and examining subsequently with the microscope, crystals, some needle-like, some prismatic, and others star-shaped, as represented in Fig. 2, were observed to form. During the course of one experiment, however, he remarked a noticeable difference in the crystallization. The crystals appeared to ramify, throw off other needles, these last others again, until the slide under the lens presented the beautiful appearance represented in Fig. 3.

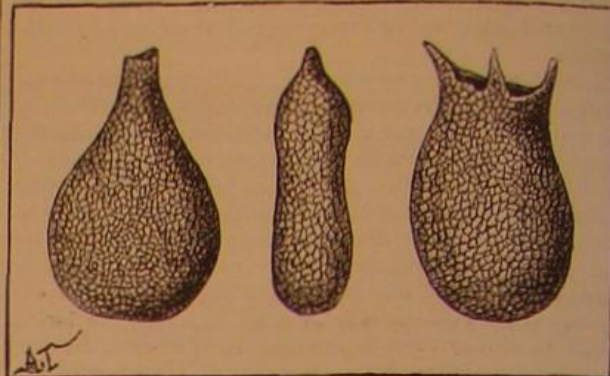


Fig. 4.—Microscopic aerolites (largely magnified).

Under the influence of a high temperature, these new crystals evaporated, but it was not difficult to prove them to be the nitrate of ammonia, the presence of which chemical analysis had previously indicated. Further investigation showed also that, among the nitrate of ammonia crystals, were scattered others of different form and totally unlike those of the rhomboidal system. Some were cubical, indicating them to be probably sea salt, others resembled the sulphate of soda crystals. The last probability was rendered quite certain by throwing a few flakes into a supersaturated solution of sulphate of soda, in which they immediately caused crystallization to take place. All the crystals, it appears, formed on the edges of the drop, while the corpuscles formed a dense group in the center.

As regards the particles of iron found, while it is very possible that they came from the surface of the soil, it is not improbable that they may have reached the atmosphere from without the same, and therefore be due to the disaggregation of aerolites, destroyed on entering the aerial ocean. Nordenskjöld has collected, on the great snow fields of the arctic regions, a dust which contains iron, carbon, nickel, cobalt, and phosphorus, elements especially characteristic of extraterrestrial bodies. Ehrenberg, the celebrated German microscopist, has examined the ferruginous dust, which, to the naked eye, appears to be but an agglomeration of minute grains, as represented in Fig. 5. When very highly magnified, however, the curious shape of the particles becomes clearly apparent (Fig. 4), showing that, at some time, they must have been in a state of fusion, and hence very probably due to some mass of meteoric iron rendered incandescent and melted by friction with our atmosphere.

The iron and other particles in the snow probably are not without some effect upon vegetation, the exact nature of which future investigation will determine. Certainly, however, it appears that heavy snow falls, besides protecting the ground against excessive cold, serve to fertilize the same through the nitrate of ammonia, conveyed to the soil by the melting of the snow.

New and Valuable Printing Press.

A new printing press made in Liverpool, Eng., by Duncan and Wilson, for the *Christian Union* newspaper of this city, is a remarkable novelty in this class of mechanism. It prints, folds, pastes, and binds the paper inside of a cover, which it also prints; and delivers the numbers, thus completed, at the rate of 5,000 copies per hour, and may be worked up to 6,000 per hour. The paper is drawn from a roll. The whole machine is 27 feet long, 7 feet high, and the cost is \$20,000. The folding apparatus may be disconnected whenever necessary, and the machine used to print without folding. Various attempts have been heretofore made to attach folding machines to printing presses; but this, we believe, is the first successful example of the kind.

Rather Cold.

A correspondent of the *Toronto Globe* wrote from Bridge Creek, British Columbia, on February 19: "The thermometer at this place was frozen up, so we could not tell how cold it was. A bottle of good brandy and a bottle containing two pounds of mercury were put out as a test on February 14. In the morning both were frozen solid. This cold snap has lasted for more than two weeks, with no signs of mild weather. The mercury in the thermometer has been frozen every night."

German Locomotives.

The sixth annual report of the artisans of the German railway administration states that locomotive boilers made of sheets of cast steel have not fulfilled the expectations entertained for them, although it is hoped that more favorable results will be obtained when improvements have been made in the manufacture of steel plates. Copper bolts are recommended for the first row; steel ones are only to be employed when the feed water and fuel are both good.

IMPROVED LEWIS.

At the present time it is no uncommon thing to use, in the formation of breakwaters, piers, and other similar structures, blocks weighing from twenty to thirty tons each, and it is found that, with suitable plant and machinery, masses of this weight can be moved readily and safely.

The ordinary lewises, by which large concrete and artificial blocks have hitherto been lifted and deposited, consist of a pair of round bars with a T end on each, and a ring at the top to receive the hook or shackle of the setting crane or traveler, suitable holes, with boxes and pieces of hard wood at the lower ends, being formed in the blocks for the reception of the bars. When a block has been lowered, say for subaqueous work, divers are required to turn these T bars around, and to draw them out of the holes preparatory to their being lifted up with the slack chain of the crane or traveler. For heavy blocks the weights of these bars must of necessity be great, and the process of turning and lifting them by divers is consequently expensive. It is the object of the lewis which we herewith illustrate, and which has been invented by William Matthews, of England, to provide for disengaging from above water, so that, when no longer required, the lewises shall free themselves and be drawn out of the holes in the blocks by means of the setting machine, and lifted with the slack chain to the surface.

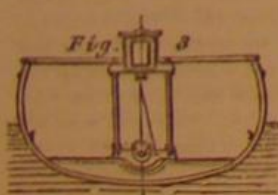
The holes, instead of being parallel as in the ordinary cases, are made dovetailed; they are formed in the blocks by means of core pieces. The apparatus consists of two lewises, each formed of two wrought iron square bars linked so as to open in a dovetail shape. At the top of one bar of each lewis there is a shackle which is passed over the hook of the beam, the other bar being attached to the underside of the beam by means of a short piece of chain and a spring hook. Fig. 1 shows the lewis in the act of lowering a block; when the block has been set and adjusted, the beam is lowered from three to six inches, and the bridle rope, A A, drawn up from the top upon which the shackles, B B, are thrown over so as to clear the ends of the beam; the apparatus is then lifted by means of the setting machine, and, as the chains, C C, are tightened, the lewises fold and come clear out of the holes in the block.

Fig. 2 shows the lewises when disengaged and in the act of being lifted. Fig. 3 shows the construction of the bars and links, from which it will be seen that the bars of the ends of the latter have a solid bearing against rounded recesses in the former, so as to avoid strain on the pins. If considered desirable, the disengaging levers might be omitted, in which case the shackles, B B, would be thrown back by the divers employed in setting the work, and the lewises would then disengage and free themselves as before. It will be seen from the illustration that provision has been made for dealing with blocks of different sizes.

The apparatus has been in successful operation for some months on the new harbor of St. Heliers, Jersey, and is about to be introduced on many other important works. It is claimed for the invention that it effects a saving of an expensive description of labor, namely, divers' work.

A NEW STEAM LAUNCH.

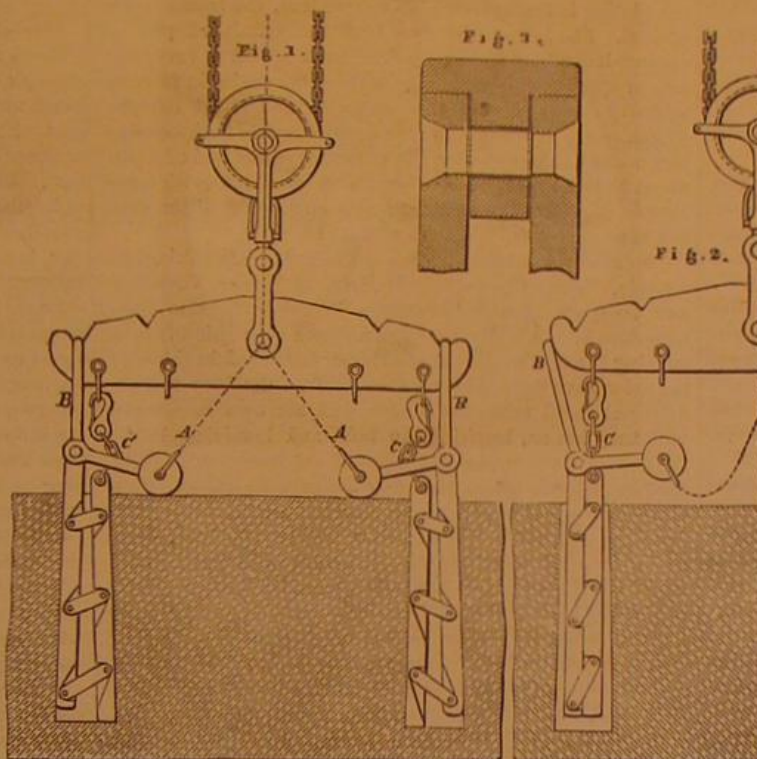
Mr. George Baird, an engineer residing at St. Petersburg, Russia, has recently constructed a high speed boat, which has proved a remarkable success. Her outer shell is entirely constructed of Muntz metal, an alloy of great durability, much used in Europe for sheathing wooden vessels and for axle bearings, etc. At a recent trial, against one of Messrs. Thornycroft's fast boats, the Mab was victorious, accomplishing 19 miles per hour. The Mab is 48 feet long at the load line, and has 6 feet 6 inches beam and 3 feet 6 inches depth of hold, while her mean draft is 1 foot 9 inches. She is fitted with a beautifully made pair of compound engines, driving a screw 2 feet 9 inches in diameter and 3 feet 4 inches in pitch. During the trials the engines made an average speed of 593 revolutions per minute, working with steam at 100 lbs. per square inch in the boiler. The general arrangement of this very successful boat, says *Engineering*, will be better explained by reference to our engravings than by any verbal description.



struction, but differ somewhat in dimensions and in some points of detail, as well as in the arrangement of the driving machinery. The compressors at Airolo have been constructed in three groups, each consisting of three compressors.

The three compressors in each group have each a cylinder 18.11 inches in diameter and 17.72 inches stroke, and they are driven so as to have a mean piston speed of about 265 feet per minute. The pistons are coupled by connecting rods to a three-throw crankshaft, this shaft having its three cranks set at an angle of 120° with each other. The arrangement of bedplate, main bearings, crosshead guides, etc., is neat and substantial.

The leading feature in the Colladon system of air com-



MATTHEWS' DISENGAGING LEWIS.

pressors consists in the arrangements made for the efficient cooling not only of the barrel of the cylinder, but also of the piston and piston rod. The cylinder is enveloped in a jacket through which water is made to circulate. The piston and piston rods are made hollow and water is caused to circulate through them.

In addition to the cooling action of the currents of water already mentioned, the air, during compression, is further cooled by the injection into the cylinder of a small quantity of "pulverized" water admitted through suitable injection nozzles in the cylinder covers. The compressors are driven by turbines.

New Life-Preserving Dress.

For some time past Captain Boyton has used this dress with wonderful success at Atlantic City, N. J., where he held the post of Captain of the Camden and Atlantic Life Guards, a corps of gallant men whose business it is to save life at dangerous sea-bathing places.

It is simply a dress composed of the best india rubber,

thoroughly inflated in a few minutes by any one who has had a little previous practice. Being made in so many different air chambers, there is no danger should one or more parts get injured, as the chamber at the back of the head alone is sufficient to float the heaviest man. The total weight of the dress is about 15 lbs.

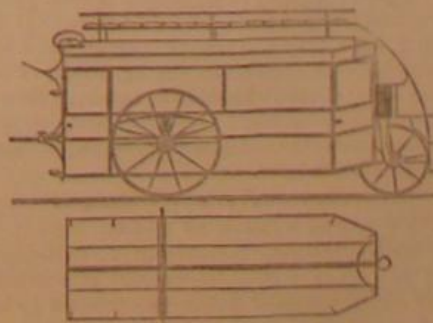
On the 10th of October, 1874, in accordance with his previous public announcements in our city papers, Captain Boyton left New York in the National steamship Queen, intending to go overboard when about 250 miles distant from America and return to the coast at the nearest point he could reach. However, when he came on deck in his curious dress and told Captain Bragg that he was going back to America, asking him at the same time to "slow" the ship so as to let him get into the ocean comfortably, he was very properly ordered to go below, and was told that if he attempted to leave the steamer he would be put in irons. Greatly disappointed, he was compelled to remove his dress and remain on board content. But on the night of the 20th of October, at half past nine o'clock, when about two and a half miles distant from Cape Clear, the southern extremity of Ireland, he left the steamer, having obtained the reluctant consent of Captain Bragg. His departure is thus described in the *London Examiner* by a passenger: "A loud cheer greeted him as he plunged into the waves, which were then heavy, as the breeze at the time amounted to half a gale. 'All right, captain,' he shouted, 'go on!' as the ship left him behind. The captain gave orders to go ahead, full speed, and in a moment the daring adventurer was lost to sight."

He had taken with him, in his waterproof and airtight sack or traveling bag, food and water sufficient for three days, besides other articles, such as a compass, lantern, signal rockets, bowie knife, axe, American flag, and his indispensable paddle. His intention was to make for Baltimore, distant about seven miles, but owing to the roughness of the weather he was driven as far as Frefaska Bight, some miles east and south of Baltimore, after having been seven hours on the water and having traveled about thirty miles. His trials on that night—a night which will be long remembered on account of the numerous shipwrecks which took place during it, and the heavy gale blowing—must have been most severe, and no other form of life buoy could possibly have saved his life. So tremendous was the sea and violent the storm that, notwithstanding his confidence in his dress, Boyton's heart nearly failed him when the steamer disappeared from his sight and he was left a solitary waif on the ocean.

For hours through that wild dark night, so stormy that no mail steamers crossed the Irish Channel, Boyton lay on his back tossed about, unable to use his paddle, and quite at the mercy of the sea and wind, but, thanks to his dress, dry and warm. About one o'clock the wind changed, blowing on to the land, and about three he saw land "under his lee." With such a sea his danger was greater than before, and he narrowly escaped death. More by luck than anything else, however, he got ashore safely and made his way to the coast-guard station. Since then he has exhibited his apparatus in many places in England, proving how thoroughly adapted it is to its purpose.—*Hunt's Yachting Magazine*.

A THREE-WHEELED OMNIBUS.

The upper figure in our illustration shows the elevation, and the lower figure the plan, of a three-wheeled omnibus which is claimed to secure economy in cost and draft, as well as comfort for riders, by reason of the four side entrances, and one step in from the road, and a staircase behind on to the roof seats. On some routes such vehicles might supplement the present rolling traffic of our public streets. Dispensing with an under carriage and one wheel must prove a material economy; the triadic bearing of the wheels on the ground would favor the draft. The bulk of the weight, being on the large wheels and partly suspended beneath the axle, would also tend to diminish draft as well as enable a



wider and lighter body to be used than in an ordinary omnibus, the total weight of which ranges from 20 to 24 cwt. for 26 passengers; for the same number of passengers, a three-wheeled omnibus might be made to weigh from 14 to 16 cwt. The obvious simplicity of construction makes any technical detailed statement unnecessary, beyond saying that the hind wheel turns round freely in an upright axle box, fitted with a coil spring round the spindle.—*Carriage Builders' Gazette*.

St. Gothard Tunnel Air Compressors.

In the case of the St. Gothard Tunnel, dry compressors are employed for furnishing the necessary supply of compressed air, these compressors being constructed on the system of M. Colladon, of Geneva. The sets of compressors employed at the two ends of the tunnel are alike in general con-

Useful Recipes for the Shop, the Household, and the Farm.

An old gun loaded with a heavy charge of powder and hung near the rafters, in a barn or in any dangerous locality about the house, makes an excellent fire alarm. The explosion is caused by the heat.

The following alloy of copper will attach itself firmly to surfaces of metal, glass, or porcelain: 20 to 30 parts finely blended copper (made by reduction of oxide of copper with hydrogen or precipitation from solution of its sulphate with zinc) are made into a paste with oil of vitriol. To this add 70 parts mercury and triturate well; then wash out the acid with boiling water and allow the compound to cool. In ten or twelve hours, it becomes sufficiently hard to receive a brilliant polish and to scratch the surface of tin or gold. When heated it becomes plastic, but does not contract on cooling.

To preserve anatomical specimens, immerse in a saturated solution of 100 parts alum with 2 parts saltpeter. The article at first loses color, but regains it again in a few days, when it is removed from the liquid and kept in a saturated solution of alum and water only.

An excellent, well recommended pickle for curing hams, is made of 1½ lbs. of salt, ½ lb. of sugar, ¼ oz. of saltpeter, and ½ oz. of potash. Boil all together till the dirt from the sugar has risen to the top and is skimmed. Pour it over the meat and leave the latter in the solution for four or five weeks.

Save the soot that falls from the chimneys, when the latter are cleaned. Twelve quarts of soot to a hoghead of water makes a good liquid manure, to be applied to the roots of plants.

A folded newspaper placed over the chest inside the vest, on going out during the present raw spring weather, constitutes an excellent protector for the lungs.

There is no rule of health more important than "keep the feet dry and warm and the head cool."

Do not allow a grindstone to stand in water when not in use. Clean off all grease from tools before sharpening, as grease or oil destroys the grit. When you get a stone that suits your purpose, send a sample to the dealer to select by; a half ounce sample is enough, and can be sent by mail.

To clean a watch, even if it be of the lowest grade, the barrel or mainspring box should always be taken apart and cleaned, fresh oil being applied before the cover is replaced. Naphtha is the best stuff to clean with.

The simplest, and perhaps best, paint to prevent buried wood from decaying is made of boiled linseed oil, into which charcoal is stirred until the whole is of proper consistence. Apply with an ordinary paint brush.

To silver the inside of hollow glass vessels, globes, convex mirrors, etc., the following amalgam, which becomes fluid at a low heat and adheres to glass, may be used: Lead and tin, of each 2 ozs.; bismuth 2 ozs.; mercury 4 ozs. Add the mercury to the rest in a melted state, and remove from the fire; mix with an iron rod.

The elevation of temperature produced by the friction of a journal is sometimes used as an experimental test of the quality of unguents. When the velocity of rubbing is about four or five feet per second, the elevation of temperature with good fatty and soapy unguents is 40° to 50° Fah., with good mineral unguents 30°.

A tablespoonful of niter (per gallon of milk) dissolved in as much water as it will take and put in the pail before milking will lessen the taste of turnips or other vegetables in the milk.

Carbolic acid, combined with glycerin or linseed oil in the proportion of 1 to 20, is a good application to wounds of horses.

The germination of seeds can be watched at every stage of its progress by laying the seeds between moist towels and placing the latter between plates. The towels can be lifted without damage to the tender sprouts.

To remove clinkers from stoves and ranges, mix a few oyster shells with the coal or put them upon the coals while the fire is burning freely. An occasional application of this kind will keep the grate free and the cook good-natured.

Two thicknesses of paper are better than a pair of blankets, and much lighter for those who dislike heavy bed-clothes. A spread made of double layers of paper tacked together, between a covering of chintz or calico, is really a desirable household article. Soft paper is the best, but newspapers will answer.

Owing to irregularities of surface, it often happens that considerable difficulty is encountered in putting a good polish on articles of brass or copper. If, however, they be immersed in a bath composed of aquafortis 1 part, spirits of salt 6 parts, and water 2 parts, for a few minutes if small, or 20 or 30 if large, they will become covered with a kind of black mud, which, on removal by rinsing, displays a beautiful lustrous undersurface. Should the luster be deemed insufficient, the immersion may be repeated, care always being taken to rinse thoroughly. All articles cleaned in this manner should be dried in hot dry sawdust.

The Transit of Venus.

At the Stevens Institute, Hoboken, N. J., Professor C. A. Young, of Dartmouth University, recently gave an interesting lecture on the transit of Venus, as witnessed by him at Peking, China.

"In obtaining photographs, instead of a telescope opening upon the sun, we had," said the lecturer, "the object glass of the telescope fixed with a focal distance of forty feet. By means of mechanism we were enabled to throw the sun's rays through the lens. The manipulation of the instrument was very simple; it only required that a person standing near the post of the instrument should throw the light up the post upon a screen, and, as the image was formed, by turning a

spring to one side, he caused a slit to open, making an exposure of about one quarter of a second.

We obtained one hundred pictures, of which a dozen or fifteen are good for nothing, a few are tolerable, and the rest are very good, so that we are very well satisfied. I imagine that the results will not be worked up as fully as they ought to be until eight years from now, when the next transit of Venus takes place. That is a very important transit, as it is to be visible all along the Atlantic coast."

High Speed Torpedo Launches.

A trial was lately made of a new steam launch, built by Messrs. Yarrow & Hedley, Isle of Dogs, Eng., for the Argentine Republic. The little vessel is 55 feet long, and 7 feet beam; the plating is throughout of Lowmoor iron, the frame being of steel. She is propelled by a beautifully finished pair of engines indicating 60 horse power, with which a very high rate of speed is obtained. The torpedo resembles in form an ordinary elongated projectile, and will hold about 100 lbs. of gun cotton, estimated to give an effect equal to three times that weight of gunpowder. It is carried at the end of a pole about 25 feet long, and the launch is provided with steel shields to protect the crew from rifle shot. The little craft is a most successful specimen of boat building.

The most remarkable feature is the system of igniting the torpedo, designed by Captain McEvoy, of Messrs. Vavasseur and Company, London Ordnance Works. Hitherto these torpedoes have usually been ignited by a concussion fuze on striking the ship's side. It is evident that, used in this way, the crew have little chance of escape, as the boat must be driven at speed against the ship, and her own momentum will carry her on, breaking the hole, and involving her in the results of the explosion; while if she does not go right, head on, the concussion fuze may not explode at all. Captain McEvoy gets over this objection by carrying three wires down the pole and into the torpedo, within which is placed a very simple detonating fuze. A brass cap is fitted to the torpedo, and a suitable battery is placed in the launch. A very slight blow will drive home the brass cap and "make contact," when the charge explodes. Besides this, the third wire is so arranged that contact can be made in the boat and the charge exploded at any time. Thus a launch might steal alongside a ship, and, by just touching her, explode the torpedo at the instant that her engines are turned full speed astern to back the launch off; and if she does not come square on and so make contact, the torpedo can be exploded by the auxiliary gear without trouble. We may add that Messrs. Yarrow and Hedley propose to build torpedo launches 100 feet long with a speed of twenty-five miles an hour. No ironclad afloat could run away from such craft, and two or three of them would constitute a most dangerous force.

The Electric Telegraph.

Mr. Latimer Clark, in a recent address before the Society of Telegraph Engineers, states that, on the 1st of February, 1758, a Scotchman, Charles Marshall, of Paisley, published in the "Scots Magazine" a full and clear description of a practicable electric telegraph, and suggested the coating of his wires with an insulating material. Mr. Clark thinks that Marshall may therefore be considered, in a sense, the inventor of the telegraph.

"In 1816 our late lamented member Sir Francis Ronalds produced his electric telegraph, and at great expense and trouble erected a considerable length in his garden at Hammersmith. He employed frictional electricity and only one wire, and exhibited his signals by the divergence of pith balls, combined with rotating dials working synchronously, a system afterwards brought to great perfection in the printing telegraph of Professor Hughes. Sir Francis Ronalds will always take a high position in the history of the telegraph, not so much on account of the excellence or originality of his invention, as on account of the confidence and ardor with which he pursued his experiments and endeavored to bring them to the notice of his countrymen. With wonderful prevision he fully perceived its value and foretold its destiny. His "Description of an Electrical Telegraph," which was published in 1823, the first book ever published on the subject of electric telegraphy, might almost serve for a description of a telegraphic system at the present day. He proposed the establishment of telegraph offices throughout the kingdom, and pointed out the benefits which the government would derive from their existence. He described methods of insulating the wires, either on poles or underground, with all the details of tubes, joints, and testing boxes, testing stations, line men, and inspectors, as at the present day. But the most interesting and singular point, to my mind, is the clearness with which he foresaw and explained the phenomenon of retardation of the electric current by induction in underground wires, a phenomenon which has so greatly engaged the attention of electricians in the present day.

The influence of this is so great that on our Atlantic cables we do not transmit messages at a greater rate than fifteen or twenty words per minute, whereas, if the effects of induction could be removed, we might transmit three or four hundred words per minute.

There can be no doubt that if Ronalds had worked in the days of railways and joint stock enterprise, his energy and skill would have triumphed over every difficulty, and he would have stood forth as the practical introducer of the telegraph. But he was thirty years before his age, and the world was not ready for him.

Having completed his arrangements, he modestly invited Lord Melville on July 11, 1816, to witness his experiments, in order that he might demonstrate the nature and merits of his invention.

The reply he eventually received was eminently charac-

teristic of the neglect and even contempt with which Science and scientific men were, and to some extent still are, regarded by statesmen.

"Mr. Barrow presents his compliments to Mr. Ronalds, and acquaints him, with reference to his note of the 3d instant, that telegraphs of any kind are now wholly unnecessary, and that no other than the one now in use will be adopted.—Colonial Office, August 5, 1816."

Phosphor Bronze.

The latest and most succinct information on this new and valuable compound we find in a letter of Mr. Stanislas Delalot, chemist, of Sheffield, England, to the *Moniteur Industriel Belge*. M. Delalot embodies a great many useful facts in very terse phrases, which we translate literally.

True phosphor bronze is not an alloy. It is a combination, without intermediaries, of copper with phosphorus. It is simply a phosphide of copper in definite proportions. The metal unites with the metalloids by either a cold or hot process. For certain applications of phosphor bronze the cold suffices. M. Delalot prefers it to combinations produced by heat. Phosphor bronze by the hot process excludes all introduction of simple bodies other than the metal and the metalloids. Copper exempt from arsenic, antimony, iron, or zinc, is required; it must be commercially pure. The manufacturer can take his choice from three kinds of phosphorus, ordinary, amorphous, and all the earthy bisulphates. Amorphous phosphorus is the most expensive, but the best. The secret of good phosphor bronze lies in the furnace and in practice. The following are the best combinations in definite proportions. The minimum and maximum percentages of phosphorus in phosphor bronze are 2 and 4. Between these there is an infinity of degrees. Five sorts of phosphor bronze, however, answer all requirements of industrial application:

0. Ordinary phosphor bronze. 2 per cent of phosphorus.

1. Good " " 2½ " "

These two numbers are superior to ordinary bronze and steel in all cases.

2. Superior phosphor bronze, 3 per cent of phosphorus.

3. Extra " " 3½ " "

4. Maximum " " 4 " "

These three, according to M. Delalot, are superior to any other metal or alloy. Above No. 4, phosphor bronze is useless; below 0, it is inferior to common bronze and steel. The price of phosphor bronze unworked, for all numbers, should not exceed that of copper plus ten per cent. Nos. 3 and 4 are to a certain degree unoxidizable.

An Ingenious Device.

A capillary correspondence was recently attempted between a notorious Parisian thief in durance vile and his comrades outside. The prisoner was sent a letter from his *fiancée*, containing merely a lock of hair wrapped in the leaf of a book. The jailor did not consider the souvenir important enough to be delivered, but a few days came a similar enclosure, and yet another. This aroused suspicion, and the governor took the matter in hand. He examined the leaf of the book; it was that of a common novel, twenty-six lines on a page. Then he studied the hair, and noticed the small quantity of the gift. Counting the hairs he found them of unequal length, and twenty-six in number, the same as the lines of the page. Struck with the coincidence, he laid the hairs along the line of the page which they respectively reached, beginning at the top with the smallest hair. After some trouble he found that the end of each hair pointed to a different letter, and that these letters combined formed a slang sentence, which informed the prisoner that his friends were on the watch, and the next time he left the prison, to be examined, an attempt would be made to rescue him. The governor laid his plans accordingly; the attempt was made, but the rescuers fell into their own trap.

Fumigating Greenhouses.

Some years ago, while in charge of the Botanical Gardens here, I experienced considerable difficulty with the old-fashioned iron pot in producing smoke of sufficient volume to destroy the common aphid or green fly. The houses being roomy and very high, the smoking of them was a slow and tedious process, and something more effectual was needed; so I ordered another pot to be made, similar to a cylinder stove, of sheet iron, about two and a half feet high and ten inches in diameter, with a small sliding door at the base for a draft. To use it, put a handful of shavings at the bottom, then fill it nearly full of tobacco (we use stems), rather loose at first, and set fire to the shavings through the door. Should the tobacco burn too rapidly, the door may be partially closed, and the tobacco pressed down with a stick of wood. A few minutes will suffice to fill up the largest greenhouse with a dense smoke, when the furnace may be taken out to smoke other houses if needed. That little apparatus is now generally used by gardeners around Boston; all agree in calling it superior to any other in use, being so very prompt, simple, and effectual.—*Denys Zirngiebel, Cambridge, Mass.*

Food by Railway.

The degree to which large cities are dependent upon rail roads for the supply of food is exhibited by some startling statistics; and Mr. Smiles observes that London may be said to be fed by the railways from day to day, having never more than a few days' food in stock. He adds that in these days of strikes the stoppage of supplies is quite within the limits of possibility; and that, were it possible to land an enemy of overpowering force on the Essex coast, it would be sufficient for them to occupy or cut the railways leading from the north to starve London into submission in less than a fortnight.

SCIENTIFIC AND PRACTICAL INFORMATION.

FACTS ABOUT FIRE ARMS.

An expert will load and fire a muzzle-loading arm once every six seconds, and a good breech-loader once every four seconds. Henry C. Bull, of New Orleans, who is one of the best marksmen in the world, has invented a new breech-loader, which is charged and fired with three motions, and which he claims can be discharged once every two seconds. During the late rebellion, a large proportion of the wounds, on both sides, were in the right arms of the combatants. This was due to the fact that, in the act of loading the gun, the right arm is lifted to work the ramrod. Those carrying breech-loaders were saved from such wounds, as the loading was done without lifting the right arm. In action, the value of a breech-loader or any kind of gun depends upon the rapidity with which the second shot can be fired after the first volley is delivered.

ADULTERATED SILK.

Ladies who admire the rich, heavy, stiff black silks which are sold at some shops, at apparently low prices, may be interested to know that a large portion of this richness is composed of salts of iron and astringents, with salts of tin and cyanides. The silk is merely a thin skeleton which supports the adulteration until the goods are sold.

FAILURE OF COPPER SULPHATE.

Railway sleepers injected with sulphate of copper will be preserved indefinitely, provided the copper remains in its original combination with the ligneous tissue. But M. Max Paulet shows that, on railways where carbonate of lime exists in the stone ballasting of the track or in the soil, the carbonate gradually penetrates the wood and substitutes the copper. Decay then follows, for carbonate of lime is not a septic agent.

COTTON SAMPLING BY HAND.

During the late civil war, when the supply of American cotton was cut off, a great stimulus was given to the cultivation of the fiber in India, and the price of Indian cotton, although rated of poor quality, rose to a high figure. But as soon as the war terminated, the American staple at once assumed its wonted preference, and the Indian article shrank to zero. The British authorities have always desired to encourage the Indian product, and it has been claimed that, if proper gins could be produced, the staple might be cleaned and separated from the seeds without the injury heretofore experienced. Dr. Forbes Watson, of Manchester, has for some time past been engaged in this work, and a trial of a number of different gins upon various samples of Indian cotton has recently been made. The cleaned specimens were then sampled by the fingers of experienced brokers, with the queer result that different samplers placed different values upon similar specimens, while, in some cases, a broker in sampling different packages of the same cotton would assign different values to each package. So unreliable were the general results thus obtained that it became necessary to cause the various specimens, in lots of 20 lbs. each, to be made up into yarn. The yarn is to be subjected to definite trials of quality and strength. This will effectively settle the question of commercial value, which the brokers are unable to do.

THE ECLIPSES OF 1875.

There are but two eclipses to appear during the present year, both of the sun. That of the 15th of April, however, will be quite remarkable, in point of length, as it is predicted that the duration of totality will be greater than during any of the succeeding eclipses due in 1878, 1886, 1892, 1893, etc. Mr. Hind, by new calculations, finds that on Bentinck Island the period of total obscurity will last over 257 seconds. The central line will pass to the north of Kaikal on Camorta Island, in the Nicobar Archipelago, at which point the duration of totality will be ten seconds longer.

The phenomenon will be visible at Bangkok, and hither the King of Siam has already invited observers. M. Janssen will, it is stated, proceed to that city, and the Royal Society has already organized an expedition, to be superintended by Mr. Lockyer.

THE DEBTS OF THE WORLD.

The *Pall Mall Gazette* carefully summarizes the debts of the nations of the world, and calculates the aggregate sum to be \$23,750,000,000. France owes the most, then Great Britain, and then the United States. Canada is the least in debt of any civilized country. Egypt pays the highest rate of interest, or ten per cent, and Holland the least, two and three quarters per cent. England can borrow at the least rate, three and one quarter per cent, and Mexico is charged the most, or eighteen per cent.

Geographical Progress in 1874.

Chief Justice Daly, President of the American Geographical Society, recently delivered his annual address before that association, and in so doing gave a most interesting account of the world's progress in geographical knowledge during the year lately closed. He began by remarking upon the physical occurrences, in the shape of great rainfalls, floods, earthquakes, extreme cold, etc., all of which he stated were remarkable for their violence and destructive effect; and after a brief reference to the transit of Venus, and Howarth's theory that the earth is gradually shrinking at the equator, he reviewed the general theories of oceanic circulation. Dr. Carpenter still advocates the view that there is a constant flow of cold water from the polar regions to the equator, which, reducing the ocean level at the poles, causes an indraft of the warm surface water of the Atlantic to flow toward the poles from the equator, thus producing a horizontal circula-

tion which completes itself, and accounts for the Gulf Stream and other phenomena connected with the currents and the course of the trade winds. Mr. Croll, on the other hand, maintains that all the movements of the water of the ocean, the deep as well as the surface waters, are produced by the action of the winds upon the surface, in connection with the motion of the earth.

Commander G. E. Belknap, charged with ascertaining a practicable route for a telegraph cable between Japan and Puget Sound, carried on a series of deep sea soundings in that part of the Pacific Ocean, which are of the highest interest, as they confirm the great depth of the Pacific and the powerful action of submarine currents. The soundings of the Tuscarora have been continued by Commander Erben, to ascertain the suitability of the ocean bottom for a telegraph cable from San Francisco to Honolulu, in the Hawaiian Islands, and the result is that it is suitable over the whole distance, from its almost unvarying soft oozy bottom.

In Europe the governmental surveys heretofore commenced have been continued. That the remains of the ancient city ungarthed by Dr. Schliemann are those of Troy is still contested. Those who dispute it, however, are scholars who have never examined the locality.

The recent excavations in Pompeii show that what has been revealed after the course of so many years is, after all, only a small part of the city, and every extension adds new objects, and some are of the deepest interest.

The excavations that are now going on in Rome are bringing to light numerous quantities of objects, especially on the Esquiline, relating to nearly everything connected with both the public and private life of the Romans.

An ancient Egyptian medical treatise has been discovered by Professor Ebers, of Leipzig, which was written 1,600 years before Christ. It is a handbook of Egyptian medical science at that time, and the description of the drugs mentioned in it shows that, at that period, Egypt had extensive commercial relations with Western Asia, and that there existed then an interchange of thought and knowledge.

Lieutenant Cameron has made a most important geographical discovery, which fixes the furthest source of the Nile within known limits, and which there is every reason to think will connect the network of lakes and rivers, of the water system that Livingstone was investigating, with the great rivers that flow to the western coast of Africa and probably with the Congo. Lieutenant Cameron surveyed Lake Tanganyika, and ascertained the elevation of the lake to be 2,710 feet.

The expedition of Rolfe for the exploration of the Libyan desert has returned. It was found to be the most sterile part of the Sahara. It is the dried-up basin of a shallow sea, below the level of the Mediterranean.

Colonel P. F. Warburton has made a remarkable journey across Australia, from Adelaide to the west coast, which was achieved under the most extraordinary difficulties. After the first 200 miles, the whole region traversed was a dreary and scarcely habitable waste, the country, with but few exceptional places, consisting of ridges of sand, with intervening flats which are without water and uninhabitable. The natives found are on the very lowest scale of humanity. They had no huts nor places of shelter, except the shady side of a bush.

The English and American Transit Campaigns Compared.

"It seems to me," says Professor Richard A. Proctor, "that a useful lesson may be learned by comparing the methods in which the two great English-speaking nations dealt with the late transit of Venus. We English, unless stirred by emulation, are slow to move; and though we do things in a thorough way, we seldom select the most effective methods for achieving our ends. Our American cousin is less ponderous in his movements, and, though to the orthodox British mind his methods may sometimes seem 'rough and ready,' yet he generally manages to accomplish his object, which after all is the important point. Not unfrequently the ingenuity and fertility of resource of Americans enables them to go easily ahead of us—not indeed that Englishmen are wanting in these qualities, but that either we are slow to exercise them or else find their exercise not appreciated. I was repeatedly struck by this during my stay in America, not only or even chiefly in scientific matters, but in contrivances relating to the conveniences and luxuries of life. To take a few out of many examples: With an enormous country, relatively thinly peopled, their system of railway traveling is altogether superior to ours: railways on our system would not pay their expenses in America; and yet notwithstanding a far higher cost per mile, our railway traveling would be simply unendurable there. With winter weather so bitter, in the greater part of the States, that by comparison the cold we thought so much of last December seems trifling, they have warm rooms and warm houses at a tenth part of the expenditure of fuel by which we manage to roast half the body while the other is chilled by cold drafts. They have only recently (by comparison) established meteorological observatories, yet already they have morning and afternoon weather announcements, nine times out of ten correct, for the whole area of the States west of the Mississippi; while we are laboriously, and at great expense, publishing each day announcements of the weather of the day before, as if that could be of any real use. In scientific matters they have a quiet way of taking up and settling matters which we in Europe have most ingeniously and elaborately failed to solve. I incline to think that this circumstance appeals rather strongly to their sense of humor; for we publish our failures rather too ostentatiously. We got the start of them, indeed, in the matter of the solar prominences, though only by de-

parting from old usage and giving our younger men a chance. But they showed us how to settle the question of the corona, which we had been pottering over ineffectually; and it must never be forgotten that our eclipse successes in 1870 and 1871 were due to their example. Professor Young in America has gone far ahead of us in the analysis of solar surroundings. Professor Langley's investigation of the details of the sun's surface is far better than any yet made by European astronomers. They first photographed the moon, though some of our writers conveniently forget the Drapers, as well as later successes of Rutherford. Every European attempt to measure the duration of the lightning flash, or of the electric spark, failed; but Professor Rood (of Columbia College, New York) has not only measured the duration of the electric spark, but has actually succeeded in determining the relative duration of different portions of the flash. And this is only one instance, out of several, in which Professor Rood has accomplished a feat of this sort—I mean the mastery of an experimental problem of exceeding delicacy. Professor Mayer (of the Stevens Institute, Hoboken) has successfully dealt with acoustical problems, which had been practically abandoned as too difficult by European experimenters. But these are only typical instances, selected almost at random. In passing from them let me remark that I am far from thinking that our American cousins really surpass us in scientific acumen or ingenuity, though I think they are much more fortunate in their methods and in their opportunities for exercising these qualities.

Their action in the matter of the recent transit affords an excellent illustration of their method of dealing with scientific subjects—a method characterized by the combination of scientific exactness with readiness of resource and practical common sense.

Having selected eight stations, three in the northern and five in the southern hemisphere, where the whole transit would be visible, the Americans started with a chance of success far greater than we possessed. For we had but one station in the northern hemisphere (in North India) where the whole transit could be observed.

In the more important question of the method for applying photography, the American and English astronomers took different courses. I set on one side, as peculiar to our plans the use of the Janssen turning arrangement for securing internal contacts, and speak only of the methods for photographing the progress of the transit. The English and European astronomers set themselves the task of securing neat and well defined sun pictures, trusting to these pictures to indicate the true position of Venus on the sun. The Americans (and the astronomers of Lord Lindsay's party, be it noticed) set themselves the task of securing pictures which would indicate the true distance between the centers of the sun and Venus, independently of any special exactness in the definition of the limbs of the two orbs. It seems to me, viewing the matter in its mathematical aspect, that the American astronomers prove to demonstration (using the estimates of photographic work given by De la Rue and other advocates of the European arrangement) that the result of the best possible photographic successes by the European method cannot give the parallax with even as small a probable error as that affecting the determinations already obtained.

Whether we consider their general plan, or their arrangements as to details, Americans showed themselves well advised and skillful. Instead of trusting (in the main) to a single method, they had at every one of their stations four methods available. Having ascertained the untrustworthy nature of contact observations, they took measures for determining the chord of transit by photography; and having decided on this course, they adopted a mode of photographing the sun which insured measurable pictures."—*English Mechanic*.

The St. Gothard Tunnel.

The works of the St. Gothard Tunnel continued to progress satisfactorily during the past year. The length of this immense work will be 14,920 meters, or nearly nine and a-half miles. The altitude of the northern entrance at Goeschenen will be 3,608 feet above the level of the sea, and that of the southern entrance 3,756 feet. The highest point in the interior of the tunnel will be 3,780 feet above the sea level, and it will be reached from the Goeschenen end by a rising gradient of 7 per 1,000. From the summit there will be a falling gradient of 1 per 1,000 to Airolo. The rock to be traversed is for the most part mica gneiss and mica schist. The most recent reports received in England respecting the progress of this important undertaking state that at the date of the report—October 21, 1874—the work done, and that remaining to be done, was as follows: Total length of tunnel, 48,651 feet; total length driven up to October 31, 8,661 feet; of tunnel remaining to be driven, 39,990 feet.

Boracic Acid.

At a recent meeting of the Chemical Society, Mr. Howard said boracic acid destroyed vegetable growth—grass, for instance—with a vigor and permanence which, if it were a fertilizer, would render it invaluable.

Mr. A. Smee, Jr., had found that, if 1 part of a 10 per cent solution of boracic acid were added to 8 of milk, it would keep it sweet for a week.

Dr. J. Edmunds, in a complicated case of amputation of the thigh, had employed dressing of lint, steeped in a hot saturated solution of boracic acid, with most satisfactory results in preventing putrefactive discharge. The bandage could remain for thirty-six or forty-eight hours without the slightest putrefactive odor.

Pipe clay rubbed on the hands will remove the unpleasant odor of chloride of lime.

IMPROVED CENTER DRAFT TONGUE FOR REAPERS AND MOWERS.

The invention represented in the annexed engraving is a device for equalizing the side draft of side-draft reaping or mowing machines. It consists in a tongue, constructed in sections and so arranged that the point of draft is transferred from the whiffletree to the pivot of the sections, enabling the horses to be kept clear of the standing grain, and, at the same time, preserving the proper position of the apparatus. The construction is also such as to allow of turning the machine with much greater facility.

Fig. 1 shows the tongue with its draft section in position, to equalize the draft. Fig. 2 shows the same in position for turning the machine. A is the fixed tongue, to prevent which from exercising a side draft on the carrying wheels, the section, B, is pivoted thereto at C. The inner end of the draft pole, B, is confined in an open cross strap, D, and the former carries the whiffletree, which has a swiveling movement thereon. A spring, E, is secured to the side of the draft pole, B, and extends into and bears against the guide strap, D, thus serving to hold the end of the draft pole outward, and out of line with the fixed tongue.

It will be seen that, as the horses pull in an oblique direction away from the standing grain, and by reason of the pivot heretofore described, the side draft is necessarily equalized because the direct draft is not at the whiffletree but at the pivot, C. This counteracts the side-dragging effect of the cutting apparatus, the off horse is relieved from the strain on his shoulder, and the machine moves forward in a straight line.

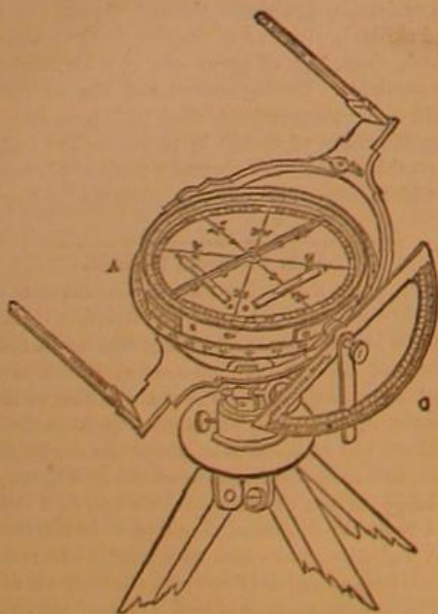
The action of the spring, E, is to keep the rear end of the pivoted pole about four or five inches out of a right line with the tongue and toward the machine. The strap, D, also acts as a purchase and lock to the inner end of the draft pole, in turning corners, thus avoiding the necessity of stopping the apparatus in so doing.

Patented October 15, 1872, and now owned by Mr. Jacob Kready, of New Pittsburgh, Wayne county, Ohio, who may be addressed for further particulars regarding sale of shop rights, etc.

IMPROVED MINING DIAL.

We publish an illustration of an instrument which is claimed to possess many advantages over the ordinary dial. In this latter the vernier cannot be used in conjunction with the needle, without first clamping the body of the dial, which involves a loss of time, while the repeated operations of clamping and unclamping induce wear, and throw the instrument out of adjustment.

The improvement in this dial consists in the addition of a plate under the body of the instrument, which projects beyond the body, and the circumference of which is divided



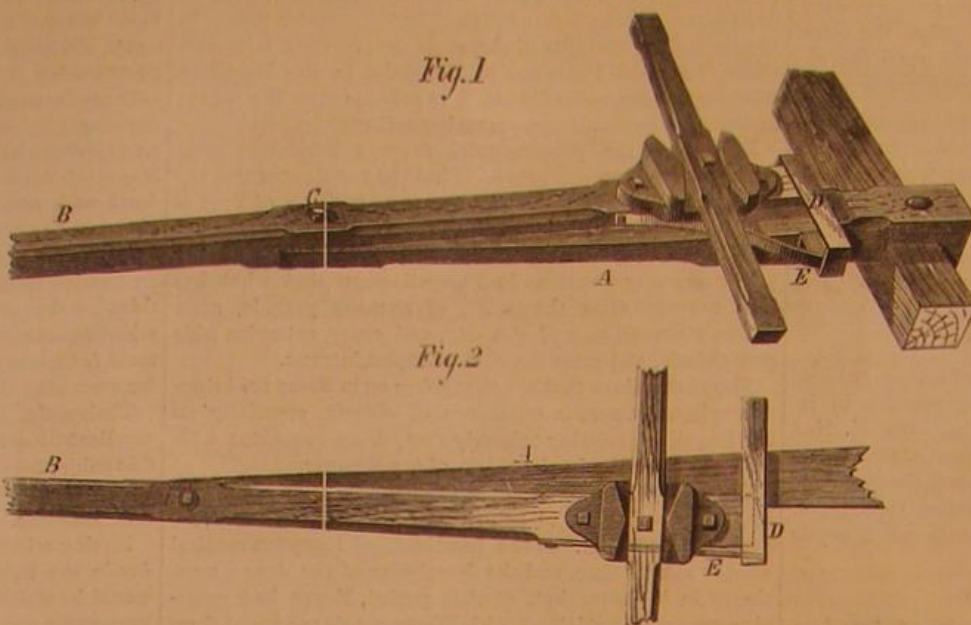
into 360°. This plate is clamped to the ball and socket joint, and remains rigid. The swing sights move on axes fixed to the body, on the outside ring of which is attached a vernier, which reads upon the plate, A, to three minutes. By this arrangement, on taking a sight the angle can either be read from the vernier or the needle. The figuring of the needle ring is reversed, that is, the east and west points change places, so that the angles are read off correctly, and the figures on the vernier ring are so arranged that the reading of the needle and the vernier ring coincide. An effective mutual check is thus established, and any error arising from incorrect reading, or from any local attraction, is readily detected. Accurate surveying with this instrument can thus be relied upon, so far as the magnetic bearings are concerned.

The arc shown at C works as in the ordinary dial, being fixed at the side of the instrument, so that it can be easily read at any time, and is not in the way. One great advantage possessed by this arrangement is that, if the instrument be out of adjustment, the error is at once detected by comparing the needle and the vernier readings. Messrs. Davis & Son, of Derby, England, are the inventors of the improvement.

Influence of Temperature on Magnetization.

M. Gauguier states that, in investigating the above subject, he first magnetized several small bars of steel varying from 0.12 to 0.24 inch in diameter by placing one of the extremities of each for a few moments in contact with one of the poles of a permanent magnet. He then noted their magnetic condition by determining some points of their curves of demagnetization.

Placing the bars a second time in contact with the magnet, he heated them with an alcohol lamp, and when they had cooled detached them, and once more determined their



CENTER DRAFT TONGUE FOR REAPERS AND MOWERS.

condition. In the second case the magnetization was found to be greatly the stronger, and in certain experiments the heat doubled the value of the currents of demagnetization.

This increase, however, it was found, was produced only when the bars were permitted to cool while attached to the permanent magnet. If separated before that time, instead of their magnetic properties being augmented, the same were decreased.

REID'S AUTOMATIC HATCHWAY.

We illustrate herewith a new and simple arrangement for hatchways, which is so constructed that the ascending or descending carriage automatically opens the hatch covers and subsequently gently closes the same. The device is one which might be readily applied to any building, as it requires the addition of but a few inexpensive pieces and a slight alteration of the top of the ordinary carriage



The hatch covers are separated diagonally and are lifted as the car ascends by the curved upper portion, A, of the latter. As the car continues its upward course, the covers are kept raised by means of the bell crank levers, B, connected thereto by rods, C, which levers press against the sides of the car and ease the fall of the doors. In descend-

ing the bottom of the car strikes the ends of the levers, and thus, as indicated in the engraving, opens the hatch below.

Patented July 22, 1873. For further particulars address William Reid, 126 Eleventh street, Brooklyn, N. Y.

New Process of Manufacture of Fatty Acids.

M. Bock has demonstrated that the greater part of the neutral fatty bodies are composed of small fat globules contained in albuminous envelopes of from 1 to 50 per cent of the weight of the bodies. The excesses of alkali, of pressure, or of heat necessary to decompose these bodies are in

reality applied in order to destroy or eliminate the albuminous envelopes.

The coloring matter of the fatty bodies, or that which forms during their decomposition, is attributed to the envelopes, and for this reason M. Bock proposes to break or partially destroy the latter by the action of a small quantity of sulphuric acid at a determinate temperature and during a limited time. The fatty matter is then boiled with water, for several hours, in open vessels. The water charged with glycerin is then decanted, and the glycerin separated and pumped.

It remains then to remove the albuminous envelopes and the coloring matter, which is done by submitting the material in the vessels to the action of weak solutions of oxidizing agents. When the reaction has continued for a sufficient period, the substance is left quiet, and subsequently decanted, washed, and pressed.

One of the advantages of this process, according to the inventor, is that all the operations are performed in open vessels, the contents of which

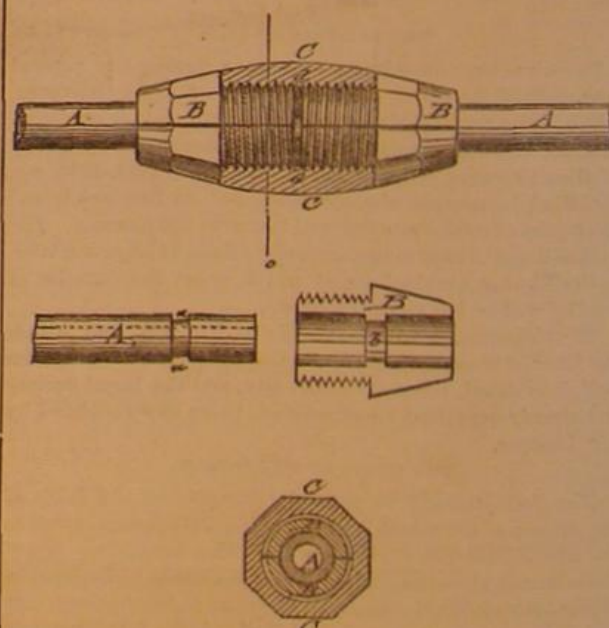
are raised to ebullition by steam, not exceeding in pressure 37 lbs. per square inch.

Models by Mail.

By provisions of the new postal law, now in vogue, models and merchandise of various descriptions, in packages not exceeding four pounds in weight, can be sent by mail at the rate of 8 cents per pound, or half a cent an ounce. This is a wonderful convenience for the public, especially for residents in distant places inaccessible by rail. But in sending models by mail, our correspondents should remember that the box or package must have openings in it, so that the contents may be observed by the postmaster; otherwise, or if the package is sealed, letter postage, or six cents an ounce, is chargeable on delivery. A little care will, therefore, save the sender considerable money.

IMPROVED PIPE JOINT.

Mr. W. P. Valentine, of New York city, whose invention we herewith illustrate, informs us that, by the use of this device, water, steam, and other pipes may be joined at any



angle by simple mechanical means, without the use of fire and solder. He employs sockets made of two half shells, B, fitted by means of a projecting shoulder to the recessed ends of the adjoining pipes, A. The sockets are cut with an outer screw thread, and firmly connected, when placed on the pipes, by a sleeve, C, with right and left hand thread, which is arranged to be screwed over it without altering the position of the pipes. A leather or rubber washer, D, in the sleeve, C, secures the tightness of the communication.

Patented through the Scientific American Patent Agency, January 20, 1875. For further particulars address the inventor, at 4 Amity street, New York city.

Comfortable Fishing.

A Western paper thus speaks of an improved method of fishing at the lakes in its district: It consists of a small house, built on runners like those of a sled, in which is placed a small stove, while in the floor a small aperture is left through which to drop the lines. Holes are cut in the ice, the houses are moved over them, and the fishermen sit by a warm stove while drawing in the fish.

THE CRANE.

The crane, of which our engraving represents a fine sample, is a large wading bird of the order *grallatores*, and different genera of the species are found in Europe and America. The American crane (*grus Americanus*) furnishes a good typical example of the whole class. Its long bill is dusky, turning yellow towards its base; the top and sides of the head are of a brilliant red; the feet are black, and the plumage is white, except the primary and adjacent feathers, which are brownish black. The length of the full grown bird, from the bill to the tip of the tail, is often thirty-four inches, and to the end of the claws sixty-five inches; the wings extend to ninety-two inches. The young birds are of a bluish gray color, with the feathers tipped with yellowish brown.

Cranes are common in our Southern and Western States, from October till April, when they retire to the north. Their hearing and vision are very acute, hence they are difficult to approach. They roost either on the ground or on high trees. Their nests are usually built of coarse materials, and are placed in high grass; the eggs are two in number, and are hatched by the alternate attentions of both birds. They are easily tamed when captured, and may be kept on vegetable food.

A New Enameling Process.

Mr. J. H. Robinson, of Liverpool, England, has recently invented a process which, he claims, is not only cheaper, but in which the resulting product is free from those specks of dirt which seem inseparable from the present methods of manufacture. The new process yields enamels of sufficient purity for dials and similar work, and is not so expensive as to virtually prohibit its use for ordinary purposes, such as name plates, notice boards, and wall advertisements. Thin sheet iron is first cut and stamped to the desired shape, the edges of the plate being turned up slightly in the usual way, so as to form a shallow tray, the edge serving to hold the enamel in position during the preliminary stages of the process. The plate is then to be made chemically clean by any of the ordinary processes of pickling and scouring. The ingredients of the enamel should be taken in the following proportions, but, in some cases or for certain purposes, they might be slightly varied: White lead 12 ozs., arsenic 2½ ozs., flint glass 8 ozs., saltpeter 3 ozs., borax 6½ ozs., and ground flint 2 ozs. These are to be powdered and mixed thoroughly, placed in the crucible, and fused; but before they are cooled they must be plunged into cold water, which has the effect of rendering the mass very brittle. The cakes of fused enamel are then pounded to about the fineness of coarse sand, washed, and dried. The powder is then ready for use. The plates of sheet iron, having been well cleansed and thoroughly dried, are sprinkled over with sufficient enamel powder to make the coating of the desired thickness, and are then placed in a muffle, the turned-up edges retaining the swelling enamel in position. Lettering or designs can be produced on the surface by the ordinary means; but if it is desired to put them on when the enameled plate is cold, they are first received on paper, an impression being taken in soft black enamel from the engraved plate, and subsequently transferred, the article being again placed in the muffle to fuse the enamel of the design or letters. The inventor claims that the iron back is more durable than copper, and it certainly is cheaper. Variations in the color of the enamel can of course be obtained by the addition of various salts and earths, such as those of cobalt, peroxide of manganese, protoxide of iron, etc., and similar diversity of color can be introduced into the design or the letters.

Cotton Gunpowder.

This explosive is of the gun cotton class, although it differs greatly from gun cotton proper, both in appearance and character, inasmuch as it is a fine powder of pale yellow color, and, it is stated, can be exploded with a cap direct after having been saturated with 20 per cent of water. This powder is now manufactured on a commercial scale at Oare, near Faversham, Eng., where a large number of military and naval officers, and scientific and mining gentlemen lately assembled to inspect the process of manufacture, and to witness some experiments to test its power and safety.

The initial process, as shown to the visitors, consisted in mixing together nitric and sulphuric acid, in which the cotton is steeped, 1 lb. at a time, after having been hand picked and further cleaned by being passed through a scutching machine, and afterwards washed and dried. After remaining in the acid for about four minutes, the cotton is withdrawn, and the surplus acid squeezed from it under hydraulic pressure. It is said to bring with it 20 lbs. of acid from the tank, 12 lbs. of which are pressed out, the remaining 8 lbs. being abstracted from it in a centrifugal machine, in which 6 lbs. form a charge. From the centrifugal machine the cotton is sent alternately to two steeping tanks and centrifugal machines, and after the second washing and drying it

is passed through a pair of coarsely set rolls, and subsequently through a pair set more finely. The fibers have now become finely divided into particles of gun cotton, and in this condition are subjected to a lengthened washing in a tank of aerated water, the air being forced through the mass of liquid pulp by a fan blast. From the aerating washer the gun cotton—for such it now is—is run into settling tanks and afterwards partially dried, when it is taken to an incorporating mill, consisting of a pan and pair of edge runners, in which it is triturated in company with one or two other chemical substances, which complete the combination termed cotton gunpowder. It now only has to be dried, and this is effected in wire-gauze-bottomed trays placed over a channel through which a current of warm air is driven. From the drying house the powder is taken to the cartridge-

stockade post—with 12 lbs. of the powder placed against its side. The application of the compound to land mines was shown by placing two boxes each containing 30 lbs. of the powder in holes in the foreshore of the Swale—which flows by the company's works—covering them with 6 inches of sods, and exploding them. The result in each case was the formation of a crater 22 feet in diameter and 8 feet deep, besides the demolition of some of the factory windows, a result, we need hardly say, which was more unexpected than the other. To illustrate the statement that the powder could be exploded even when saturated with 20 per cent of moisture, a box of the powder stated to be so saturated was placed on the beach and successfully exploded. The concluding experiment was the explosion of 50 lbs. of cotton gunpowder suspended in the Swale in a case 10 feet below water level.

The explosion threw up a fine column of water some 200 feet into the air, much to the satisfaction of the visitors, a satisfaction, however, not inferior to that afforded by the previous experiments, which demonstrated that a safe, handy and powerful explosive was ready to be placed on the market.—*Engineering.*

The Momentum of Heat.

Heat is one of the modes of motion. The sun is its source. Vegetation springs up, matures, and decays as the continued round of change goes on. Old forms are buried beneath the new which rise upon their ruins. Thus have immense beds of fuel been hidden for centuries beneath the earth's surface. Born of motion from the sun acting upon matter, these deposits represent stored-up inertia, to be changed into momentum.

All matter is ponderable, or has weight, whether it be gaseous, or fluid, or solid, and of course possesses momentum when under motion.

In speaking of the motion of particles, their weights are to be considered; those which have the highest motion have the least weight.

The carbonaceous deposits, called coal, are simply combined elementary particles of different natures, and, when set free, give out their force to whatever they may come in contact with. Phosphorus and sulphur have their particles easily disturbed; for this reason they are put upon matches. The motion of the hand easily sets their momentum free; the wood of the match is next acted upon, then light kindling matter, then the coal. On and on this process goes, increasing in force as fresh fuel is added.

It is momentum from first to last, originally stored in the coal, and set free to be used for the benefit of man. To apply it in a manner that will utilize it best is his province. When water receives this transferred momentum, or heat force, among its own particles, it becomes steam. Steam is simply water in molecular motion. When the water has received its molecular motion, or when the steam is formed, by its momentum applied to the piston of the engine, the wheels are turned, the train is set in motion, and continues until the momentum is restrained by outside resistance or the supply of fuel is stopped. Thus did momentum begin and end its work, merely set free by human power, man acting only as the agent.—*J. M. Hicks.*

Sound.

Professor Tyndall lectured recently on this subject at the Royal Institution. He began by saying that in the philosophy of Locke an idea was defined as a mental picture; and in all his (Professor Tyndall's) teaching of Science, he always attempted to give clear ideas—resting upon a physical basis—of the phenomena presented, avoiding all vagueness of phraseology, and in pursuance of this plan he would show a few experimental facts as a basis from which to start. He then took a large glass vessel filled with perfectly invisible carbonic acid gas, and held it between the electric lamp and the brilliantly illuminated screen, so that the large shadow of the glass vessel was seen upon the screen. Upon tilting the vessel the heavy carbonic acid gas began to pour out of it; and as it refracted light more than air, it became visible upon the screen as a falling stream full of waves. His assistant next began to blow through some invisible vapor of sulphuric ether placed between the screen and the lamp; and as the invisible mixed breath and vapor issued from the tube, the stream was rendered visible by its unequal refraction of the rays of light. The same effect was produced by means of the hot gases from a burning candle placed between the electric lamp and the screen. These acts, he said, would serve to give a physical basis for their ideas, by showing that, in a perfectly transparent atmosphere, there might be invisible layers, having an influence of their own.

If a wave of sound entered an invisible cloud of carbonic acid gas then the velocity of the wave would be reduced from 1,120 feet to 900 feet per second; but on leaving the gas and re-entering the common air, it would move with its original speed. At every change of velocity a certain portion of the sound would be sent back as an echo; thus on first reaching a layer of carbonic acid, a part of the sound would be reflected, and, after passing through the layer and reach-



THE AMERICAN CRANE.

filling sheds, and is made into cartridges, which are packed in cases and conveyed to the magazine. The magazine is situated some distance from the works, and is zinc-roofed and surrounded by a broad moat; zinc was preferred for the roof under the belief that, if an explosion were to occur, the zinc would volatilize instead of being blown about in fragments.

The first series of experiments were intended to illustrate the safety in transport and storage of the cotton gunpowder, and included the lighting of cartridges by ordinary means, when they simply burned quietly away, and the ignition of others by a capped fuse, when they exploded violently. In order to show that explosion would not follow upon conflagration, two barrels of the new powder were placed each in a roaring bonfire, and after a time the barrels were burned through and the contents blazed harmlessly away. An iron pile driver weighing half a ton was then allowed to fall 15 feet on to a box containing 10 lbs. of the powder, in order to illustrate immunity from danger in such cases as railway collisions, which, so far, it did, as the box was smashed and the powder scattered around.

The second series of experiments illustrated the strength of the powder, and consisted first in placing a charge of 2 ounces of the substance in a bore hole made in a block of Kentish rag stone measuring 5 feet by 3 feet by 18 inches, the explosion of the charge cracking the stone in all directions. Four steel ingots weighing 8 cwt. each were next laid in a pile, with 2 lbs. of the powder placed centrally between them. The explosion of the charge broke the ingots up and hurled the pieces to long distances. Other four ingots weighing 11 cwt. each were similarly treated with 2½ lbs. of the powder with similar results. A cylinder of cast iron, 2 feet in diameter and 18 inches deep, was charged in a central bore hole with 6 ounces of cotton gunpowder and fired, but the explosion only blew the hole through, driving a conical shaped piece out of the bottom. A 6 feet length of 70 lbs. steel rail was then laid on its side on bearings 4 feet 6 inches apart, and in its groove ½ lb. of the powder was placed and tamped with clay. The explosion broke the rail into four pieces, throwing the two ends far apart. In military work, the first illustration given was the cutting off a post of 12 inches by 12 inches timber—assumed to be a

ing the other side, a further portion would be sent back as another echo; if there were many alternate layers of air and carbonic acid gas, this action might take place so often as to quench an entire wave of sound and to dissipate it in echoes. Professor Tyndall here called attention to a small square wooden tube, into the air of which, he said, he could introduce at will seven vertical sheets of carbonic gas through pipes. One of the sensitive flames, which contracted at a shrill sound, was placed at one end of the tube, and a whistle continuously blown by a bellows was placed at the other. When the tube contained air only, the sound passed freely and contracted the flame; when he let seven sheets of carbonic acid gas enter the tube, they broke up the sound into echoes so that its action upon the flame was cut off, being intercepted by layers of invisible gas. He then showed that heated air would have the same effect, by doing away with the carbonic acid, and placing four gas flames below the tube, so as to heat it in four places, and produce four layers of heated air inside. Layers of unequally heated air prevented the sound from passing through the tube, and broke it up into echoes. The lecturer here remarked: "How could it be proved these layers produced echoes?" If they did so, of course he ought to be able to prove it experimentally, so some time since he asked his assistant to solve the problem practically, and Mr. Cotterill had done so. His plan was to take a large hot flame from a batwing burner, which had the power of reflecting sound, for the hotter the flame the greater was the reflection; and he placed this flame in a position to throw back the sound, which it actually did, as proved by the contraction of the sensitive flame.

Strange to say, the flame could reflect sound much better than calico, muslin, and other woven fabrics. Professor Tyndall here borrowed a little boy's handkerchief, and showed that it would not cut off the sound even when folded four times; neither would green baize, nor felt $\frac{1}{4}$ inch thick—so thick that it would entirely cut off the light of the noonday sun. Two hundred layers of muslin in a square pad had but a feeble power in cutting off sound. The lecturer remarked that this was because the air was continuous inside the fabrics. On wetting the handkerchief with water so as to prevent continuity of the air, a single layer of the wet handkerchief cut off the sound. He remarked that, after seeing these facts, the listeners would be quite prepared to understand that a heavy snow storm would have little power in intercepting sound, whereas loud noises might be quickly quenched on a clear day, supposing the air to be heated unequally in different places.

Professor Tyndall narrated how in one of his laboratory experiments he had placed fifteen layers of calico, each an inch or two behind the other and in front of one of his sensitive flames. He discovered that the sound from the whistle would pass through the whole of the fifteen layers, and that each layer would reflect a portion of it so as to act upon the sensitive flame; thus in passing and returning through the fifteen layers, the sound passed through thirty layers in all.

Professor Tyndall here took a large glass cabinet, about the size of a watchman's box, and he caused the sound from the whistle to enter it on one side, and to depress the sensitive flames when it escaped on the other. In the lower part of the cabinet inside he lit two large gas flames, and the hot air from these, rising in the cabinet, intercepted the sound, so that the flame ceased to be shortened. He thus proved that invisible columns of heated air would cut off sound. He then put out the burners and lit a piece of phosphorus placed in a saucer at the bottom of the cabinet; the latter of course was soon filled with a thick smoke of phosphoric acid—so thick was it, that it cut off from view a lighted candle which was placed at the back of the cabinet; yet this cloud, which was so powerful in cutting off the rays of light, did not interrupt the waves of sound at all. Having thus proved that invisible warm air may act as an acoustic cloud, he said that, when such clouds are close to the source of sound, the echoes are immediate, and mix with the original sound; but if the acoustic clouds are further off, then there are prolonged echoes. Further, the length of an echo is a measure almost of the depth of the acoustic cloud whence it comes. In the experiments at the South Foreland, he discovered that, when a sound penetrated to a great distance, then the echoes were longest.

At the close of his lecture he argued that the phenomenon which Arago could not explain was due to warm air from the chimneys of Paris, forming acoustic clouds which surrounded the station at Villejuif, while the other station at Monthlery was free from this heterogeneous atmosphere.

The Micro-Lantern.

Discarding the usual microscopic low powers, we have now adopted, with increased advantages, an objective constructed on the same principle as the well known portrait combination, very short in focus, and with a large aperture in comparison with its focal power. The tube in which the lenses are mounted is very short, so as to permit of the passage of a ray at a great degree of obliquity to the axis. This enables the objective power to cover a large field, or, speaking inversely, to project an image of large dimensions compared with its focal power. But no one who has bestowed attention upon the transmission of large oblique pencils will fail to see that, if the object to be enlarged were mounted upon a flat glass, the astigmatism would be so great that, while there would be plenty of light, there would be no marginal definition worthy of the term in the enlarged image. This is quite true; hence we will afford some explanation of the manner by which we so managed that, whereas by one of the usual microscopic objectives only one extended wing of a grasshopper was shown on the screen, we showed

not only the one wing, but also the body and the second wing, and not only the whole of one insect or fly, but the whole of three of them which were mounted on one slide, and this with such good marginal definition as to permit the spectators to advance to the screen and examine the details through hand magnifying glasses.

There is sold, in the watch glass makers' shops in Clerkenwell, a foreign made watch glass of a peculiar kind, and known in the trade as "concave crystal." The price we paid was at the rate of five shillings a dozen, or more than six times that at which ordinary lunette glasses can be obtained when purchased in quantities. They are stout and strong, the edges finely polished, and they are curved, spherically, to a very slight degree. The diameter of those we obtained were an inch and a half, and, instead of mounting the objects which were intended to be subsequently magnified between two circular but flat glasses as usual, we mounted them between two of these "concave crystals." Here was the whole secret. The two glasses must be placed "spoon fashion," and the object, being between them, is bent in a gentle curve. With objects mounted in this way, and employing an objective of the kind we have just described—what is known by photographers as a "loket portrait combination" will answer well if of short focus—the lime light need no longer be regarded as an indispensable requisite in the showing of microscopic objects; for with a good lamp, burning paraffin oil, a disk of six feet may very easily be obtained.

Hitherto we have spoken of natural objects. But in practice we have also used this arrangement in connection with photography, both in obtaining pictures, with large aperture, which should be microscopically sharp all over the area of delineation, and, conversely, of producing enlargements from pictures thus obtained. As respects the exposure required to produce an absolutely sharp picture, it is, compared with that which is necessary on a flat plate, less than half, because in the latter case a stop must be used to secure intense definition at the margin; hence if proper mechanical contrivances be adopted for effecting a rapid exposure, there will be no difficulty in taking a fully exposed negative of any scene in which instantaneity is a pre-requisite, the picture afterwards bearing a great degree of enlargement. After several trials we can assert with confidence that the manipulation of a circular and slightly concave surface is quite as easy as that of a flat glass.—*British Journal of Photography.*

THE VOLUME AND WEIGHT OF DISTILLED WATER AT DIFFERENT TEMPERATURES.

BY RICHARD H. BUEL.

In general, water expands when heated, and contracts on being cooled—with the exception that the greatest contraction occurs when the water has a temperature of about 39° Fah., so that expansion takes place whether the temperature is decreased or raised above this point. The precise temperature at which water attains its maximum density has not been accurately determined. The differences between the results obtained by independent investigations are, however, very slight, and the point of maximum density is commonly taken at 39.2° Fah., or 4° on the centigrade scale. At this temperature, the weight of a cubic foot of distilled water, as determined by the best authorities, is 62.425 lbs.; the weight of a United States gallon is 8.379927 lbs., of an imperial gallon, 10.05312 lbs., and of a cubic inch, 252.8787 grains. In French measures, it is usually assumed that a cubic decimeter of distilled water weighs 1 kilogramme. This is not strictly accurate, owing to a slight error, in regard to the weight of water of maximum density, which was made at the time of fixing the measure; and the absolute standard is the liter, which is a volume of a kilogramme of pure water at the temperature of maximum density. In practice, however, the volume of a liter is commonly assumed to be one cubic decimeter, and the error arising from this assumption is unimportant, being less than 0.00002 of a kilogramme. The expansion of water by heat is not regular for equal increments of temperature, but the law of the expansion has been determined by numerous experimenters, the most prominent of whom are Kopp, Matthiessen, Sorby, and Rosetti. The formulas constructed from their experiments are given below, being taken from Watt's "Dictionary of Chemistry."

Let V = ratio of a given volume of distilled water, at the temperature, T , on Fahrenheit's scale, to the volume of an equal weight, at the temperature of maximum density.

W = weight of a cubic foot of distilled water, in pounds, at any temperature, Fahrenheit.

For temperatures from 32° to 70° Fah.: $V = 1.00012 - 0.000033914 \times (T - 32) + 0.000023822 \times (T - 32)^2 - 0.00000006403 \times (T - 32)^3$.

For temperatures above 70° Fah.: $V = 0.99781 + 0.0000617 \times (T - 32) + 0.000001059 \times (T - 32)^2$.

$$W = \frac{62.425}{V}$$

The table given below has been computed by the aid of these formulas. The experiments on the expansion of water have not been carried beyond a temperature of 412° Fah., so that the results given in the table for higher temperatures have not been verified. It is not probable, however, that they are greatly in error. The highest temperature in the table corresponds to a pressure of saturated steam of more than 1,000 lbs. per square inch. The successive increments of 10° Fah. give such slight changes in the successive differences in relative weights and volumes as to render interpolations by proportion sufficiently accurate for most purposes. The weights given in the

tables are for pure water, so that, when water contains foreign matter, it will be necessary to multiply the tabular weight by the specific gravity of the water. For ordinary rain, spring, or river water, the correction is generally so slight that it may be neglected. Below are given the specific gravities of waters from different localities, the most of which have been taken from Professor Chandler's lecture on "Water," published in the thirty-first annual report of the American Institute:

Atlantic Ocean.....	1.0275
Dead Sea.....	1.17205
Great Salt Lake.....	1.17
Mississippi River.....	1.00068
Croton (New York Water Supply).....	1.00068
Ridgewood (Brooklyn Water Supply).....	1.00067
Cochituate (Boston Water Supply).....	1.00053
Schuylkill (Philadelphia Water Supply).....	1.00066
Delaware River.....	1.00059
Lake Erie.....	1.00107
Lake Michigan.....	1.00113
Genesee River.....	1.00026
Passaic River.....	1.00012
Thames, at London.....	1.00027
Seine, above Paris.....	1.00015

It will be seen from these figures that, for most cases, it will be sufficiently accurate to use the weights given in the table. If the weight of a gallon of water at any temperature is desired, it may be obtained by dividing the weight of a gallon of water at the temperature of maximum density, previously given, by the relative volume at the required temperature. It may also be obtained by multiplying the weight of a cubic foot of water, at the given temperature, by 0.13368 to find the weight of a United States gallon, and by 0.160372 to find the weight of an imperial gallon. When water contains foreign matter in solution, its rate of expansion by heat is not exactly the same as in the case of distilled water. There has not been a sufficiency of experiments, however, to determine the law of the variation, and no great error will arise from the assumption that the expansion is in accordance with the formulas given above.

With these explanations, the use of the following table will be rendered plain to the reader.

VOLUME AND WEIGHT OF DISTILLED WATER AT DIFFERENT TEMPERATURES ON THE FAHRENHEIT SCALE.

Temperature, Fahrenheit.	Ratio of volume to volume of equal weight at the temperature of maximum density.	Difference.	Weight of a cubic foot in pounds.	Difference.
32°	1.000129		62.417	
39.2°	1.000000	0.000129	62.425	0.008
40°	1.000004	0.000004	62.423	0.002
50°	1.000253	0.000249	62.409	0.014
60°	1.000929	0.000676	62.367	0.042
70°	1.001981	0.001052	62.302	0.065
80°	1.00332	0.001339	62.218	0.084
90°	1.00492	0.00160	62.119	0.099
100°	1.00686	0.00194	62.000	0.119
110°	1.00902	0.00216	61.867	0.133
120°	1.01143	0.00241	61.720	0.147
130°	1.01411	0.00268	61.556	0.164
140°	1.01690	0.00279	61.388	0.168
150°	1.01995	0.00305	61.204	0.184
160°	1.02324	0.00329	61.007	0.197
170°	1.02671	0.00347	60.801	0.206
180°	1.03033	0.00362	60.587	0.214
190°	1.03411	0.00378	60.366	0.221
200°	1.03807	0.00396	60.136	0.230
210°	1.04226	0.00419	59.894	0.242
220°	1.04668	0.00436	59.707	0.187
230°	1.05142	0.00456	59.641	0.066
240°	1.05633	0.00474	59.372	0.269
250°	1.06144	0.00491	59.096	0.276
260°	1.06679	0.00511	58.812	0.284
270°	1.07233	0.00535	58.517	0.295
280°	1.07809	0.00554	58.214	0.303
290°	1.08405	0.00576	57.903	0.311
300°	1.09023	0.00596	57.585	0.318
310°	1.09661	0.00618	57.259	0.326
320°	1.10323	0.00638	56.925	0.334
330°	1.11005	0.00662	56.584	0.341
340°	1.11706	0.00682	56.236	0.348
350°	1.12431	0.00701	55.883	0.353
360°	1.13175	0.00725	55.523	0.360
370°	1.13942	0.00744	55.158	0.365
380°	1.14729	0.00767	54.787	0.371
390°	1.15538	0.00787	54.411	0.376
400°	1.16366	0.00809	54.030	0.381
410°	1.17218	0.00828	53.645	0.385
420°	1.18090	0.00852	53.255	0.390
430°	1.18982	0.00872	52.862	0.393
440°	1.19898	0.00893	52.466	0.396
450°	1.20833	0.00916	52.065	0.401
460°	1.21790	0.00935	51.662	0.403
470°	1.22767	0.00957	51.256	0.406
480°	1.23766	0.00977	50.848	0.408
490°	1.24785	0.00999	50.438	0.410
500°	1.25828	0.01019	50.026	0.412
510°	1.26892	0.01043	49.611	0.415
520°	1.27975	0.01064	49.195	0.416
530°	1.29080	0.01083	48.778	0.417
540°	1.30204	0.01105	48.360	0.418
550°	1.31354	0.01124	47.941	0.419
		0.01150	47.521	0.420

Preparation of Wool before Carding.

Messrs. Whittaker and Ashworth state that this operation effects an economy in oil in the usual process of oiling the wool. The first treatment is in an alkaline bath. The wool is then worked for one or two minutes in an acid bath, at a temperature of about 99° Fah. This bath is composed of 200 gallons water and 3 pounds of commercial sulphuric acid; it serves for the treatment of about 200 pounds of wool. The wool is now carefully washed and dried. Thus prepared, the amount of oil requisite for the oiling process is reduced 50 per cent. The above is the subject of an English patent.

DECISIONS OF THE COURTS.

United States Circuit Court--District of Massachusetts.

ESTON PAPER COLLAR COMPANY vs. EMERSON LELAND.—PATENT EMBOSSED COLLARS.

[In equity.—Before CLIFFORD and LOWELL, Judges.—October, 1874.]

LOWELL, J.

This suit is brought to restrain the infringement of the second reissue of W. E. Lockwood's patent of 1859, the reissue being granted in 1873.

The specification declares the invention to consist of a collar or cuff having a paper surface imitative of the textile surface of a collar or cuff of textile fabric; that in carrying out his invention Lockwood uses a fabric composed of paper and muslin, or equivalent fabric, having a smooth, white, polished, or enameled paper surface to represent that of starched linen. It then describes one mode of making the imitation of a linen or muslin surface, by dies, but does not claim nor limit the invention to any particular appliances or machinery for embossing the fabric. The claim is for a collar having a paper surface imitative of the textile face and fiber of a starched linen collar, as set forth.

The case turns on the question of novelty. * There is the English patent of De La Rue, taken out in 1834, for embossing paper in parallel lines; and one granted to John Evans, in 1854, for ornamenting paper with an imitation of the patterns of textile fabrics. * Samples are produced from papers actually made before 1859, which are of this character. *

Collars and similar articles made of paper were patented to Walter Hunt in 1834 as a new manufacture; and Lockwood was the owner of this patent when he made the improvement now in controversy. In this state of the art, collars and cuffs made of paper being known, and paper embossed in various modes, some of which were imitations of the surface of textile fabrics, being known, we are of opinion that there was in 1859 no patentable novelty in the application of paper embossed in imitation of linen to the making of collars and cuffs.

The evidence in the record goes even beyond what we have already mentioned, and renders it probable that paper embossed in imitation of a linen surface was used for collars and cuffs long before the date of the alleged invention, and that such articles were offered for sale in New York and known to several persons. It is true that they were not found to be acceptable to the trade, and they had very probably been forgotten; but they were imitations of linen, and the reasons which operated to prevent their general use were of a commercial and economical character.

Bill dismissed with costs.

[W. G. Russell, for complainant.

A. J. Robinson, for defendant.]

United States Circuit Court--District of Connecticut.

SAMUEL G. MONCE and ROLLIN J. IVES vs. BENJAMIN F. ADAMS.—PATENT GLASS CUTTER.

[In equity.—Before SHUFMAN, Judge.—April, 1874.]

The invention covered by letters patent to Samuel G. Monce, June 8, 1869, for an "Improved tool for cutting glass," consists, so far as the revolving steel cutter is concerned, in the fact that the sides, which are parallel at the axis, are beveled toward each other, at the periphery, at an angle of about forty-five degrees to the axis, thus meeting about midway and forming a cutting edge, which is approximately a right angle.

Such an instrument embodies the conditions that give efficiency to the glazier's diamond, viz.: the cutting edge is *curvilinear*; it is formed by two surfaces meeting at *right angles*; these surfaces are *equally inclined* to the axis of the cutter; and when the cutter is properly mounted in its frame, the inclination of the cut will naturally be at *right angles* to the surface of the glass.

It is a fact worthy of mention that this small and inexpensive tool has proved to be of great utility and has achieved success, having confessedly superseded all other inventions as a substitute for the glazier's diamond.

Monce's invention is not anticipated by revolving cutters designed and used for other purposes (as for dressing the surface of grindstones, the cutting of gas pipes, or the cutting of paper or of pasteboard, or of leather), in which the distinctive feature of the invention—the double bevel forming the right-angled edge—is present, if at all, by accident, and which, although capable in exceptional cases of being used to cut glass, will not practically perform the office of a successful glass cutter for glaziers' purposes.

The cutter of the patent, which makes a cut at right angles to the surface of the glass, is not anticipated by the Pike cutter, which bears upon the glass in a slanting direction.

The patentee having disclaimed a revolving cutter, his claim to "The cutter A," constructed substantially as shown and described, and for the purposes set forth, is a claim to a particular form, shape, and angles of the cutter, which adapted it to the purposes of a glass cutter, and is as exact and accurate as the nature of the subject will permit.

The patent is not void for ambiguity, because the specification merely says that the cutter is to be "hardened," without specifying what degree of hardness is to be given to it.

[Charles E. Mitchell, for complainants.

W. Edgar Simonds, for defendant.]

Recent American and Foreign Patents.

Improved Corn Planter.

Jens Elverud, Red Wing, Minn.—By suitable construction, as each hole of a wheel comes beneath a hole in the reservoir and receives the seed, a corresponding arm comes above said hole and serves as a cut-off to prevent any more seed passing out than the amount contained in said hole. The wheels are revolved by tubes, which strike the ground and serve as fulcrum points around which the wheels move, the axle moving up and down in loops. The sleeve of each tube is pushed up to discharge the seed into the soil as the weight of the wheels and axle are thrown upon said tube.

Improved Invalid Bedstead.

Oscar G. Cosby and George W. McGovern, Richmond, Va.—The object is to enhance the ease and quiet of the patient when changing his position. The device consists in the combination of an endless cord, with mechanism for raising the hinged head section, consisting of a lever bracket, a slide, and a band and pulley, for the purpose of giving a positive and easy downward adjustment of the head section.

Improved Double Reversible Hinge.

Edward Halsey, San Jose, Cal.—The invention is an improvement in the class of reversible hinges which are formed of two plates, one having eyes or sockets, and the other pintles, on each side, and the eyes being slotted to receive the pintles, so that the door may swing in either direction without becoming detached. The improvement relates to a construction and arrangement whereby the hinge is strengthened and its operation made as nearly noiseless as practicable.

Improved Tank for Preserving.

John Peter Schmitz, San Francisco, Cal.—This invention relates to certain improvements in preserving apparatus, and it consists in an airtight tank in which the substance to be treated is placed, the said tank having a fire protector and a burner inside, which latter connects through a flexible tube with a lamp upon the outside. The flame of the lamp abstracts oxygen from the air in the tank, and substitutes therefor the preservative products of combustion, the flexible tube being tied, severed, and its tied end enclosed by a screw cap when the process of preserving is complete, and the tank and its contents are to be stored away.

Improved Stair Builder's Rule.

John J. Robinson, Orange C. H., Va.—The object of this invention is to provide an improved rule for stair-building, and it consists in a square rule, inside of which is contained a graduated extensible portion, and at the opposite end an adjustable prick, the said rule being provided with two spirit levels, one for plumbing and the other for ordinary leveling purposes. The inventor claims to be enabled, by means of this improved rule, to rapidly construct and fit the balusters to the hand rails, uniformly and in proper position.

Improved Sewing Machine.

Daniel Williamson, Sunbury, Pa.—This invention consists of an arrangement of cams on the driving shaft and a spring for working an upper feed; also a cam on the shaft and a spring for working the presser, whereby the same shaft shall operate the needle bar, presser bar, and feed bar.

Improved Gymnastic Apparatus.

Horace S. Carley, New York city.—This consists of a grooved wheel with a handle pivoted to each side, mounted on a rope stretched horizontally. The handles hang down each side for the performer to suspend himself by to perform his feats, and at the same time propel himself along the rope. The performer may mount above the wheel, either on the rope or on the ground, turning the handles upward and the stirrups downward, and thus ride on the wheel.

Improved Runner Attachment for Vehicles.

John A. Hyde, Englewood, N. J.—This invention consists of runners which are secured to the lower portions of the wheels by hinged jaws and clamps, the object being to convert the wagon temporarily into a sleigh.

Improved Miter Box.

Peter Suydam and William G. Suydam, New Brunswick, N. J.—For the saw guiding and regulating posts there are two rigid rods side by side, with tubes to rise and fall on them. Said tubes carry guides, for the sides of the saw, which are adjustable for saws of any thickness, and for taking up the slack caused by wear. One of said tubes carries a spring presser to hold the guides above the working position when required for adjusting the saw on the work. One of the posts has an adjustable stop collar to regulate the descent of the saw. The adjustable holders for spring miters consist of horizontal bars with a vertical piece at one end arranged to slide forward and backward, across the bottom of the box, and toward and from the back of the box, to hold one edge of the work while the other rests on the top of the back, said bars being provided with set screws for holding them.

Improved Scaffold Bracket.

Samuel Nelson Fisher, Milford, Mass.—This apparatus for supporting scaffolds in the erection of buildings consists of a folding bracket having an adjustable hook for fastening it to the building.

Improved Thill Coupling.

Axel Olsson, Williamsburgh, N. Y., assignor to himself, J. W. Cox, and D. Merritt, of same place.—This thill coupling locks itself when forced into place upon the coupling bolt, and at the same time may be easily unlocked when removed.

Improved Rolling Shutter.

Hector J. Defrenne, Green Bay, Wis.—This is a blind made of slats hooked together, to be raised and lowered by rollers suspended by cords. The latter pass over an upper roller in a chamber above the window, and down to another roller at the bottom of the chamber, on which they wind. The rollers are worked by an endless cord, which is so arranged on pulleys that one part of its course is along-side of one of the sides of the window frame, where it can be worked inside of the house for raising or lowering the blind whether the window is open or not. The invention also consists of a novel mode of connecting the slats together by wire links.

Improved Stays for the Bottoms of Pantaloon.

Stephen D. Mills, Kingston, N. Y.—This is an India rubber stay designed to take the place of the canvas stay now used in the manufacture of pantaloon to keep the bottoms of the legs in shape.

Improved Bridge.

Peter M. Fulton, Rhinebeck, N. Y.—Towers are erected at suitable required distance from each other, and bear arch-supporting cables. The height of the towers may be reduced to a considerable extent, and thereby the great cost of the same, as compared to suspension bridges, lessened. The towers serve also as abutments for the arch-sections, which are stretched and supported across the span between the towers, their symmetrical semi-sections being firmly joined by central key pieces. The arch sections are constructed from both towers toward the center without a supporting scaffolding, by the use of a derrick above and a traveling truck underneath, which forms the platform for the workmen. One arch section after the other is joined to the other and hung to the cables, until the grooved and pointed approaching ends of the arch sections may be connected by the correspondingly perforated key pieces. The roadway is then hung by vertical suspension rods to the lowermost arc.

Improved Plow.

Thomas S. Macomber, Hamilton, N. Y.—The invention consists in devices whereby the mold boards and their attached shares are connected to the beam of the plow, so that, by turning the right hand mold board down against the landside, the other mold board will be raised into a horizontal position, forming a right hand plow, and by turning the left hand mold board down against the landside, the right hand mold board will be raised into a horizontal position, forming a left hand plow.

Improved Oscillating Engine.

George W. Heald, Baldwinville, N. Y., assignor to himself and William F. Morris, of same place.—This improvement in oscillating engines consists of a novel contrivance of tightening bearings and adjusting screws therefor with the crosshead of the piston rod, which is arranged in guides projecting from the cylinder head, to take the strain of oscillating the cylinder from the rod.

Improved Steam Engine Governor.

Frederick M. Brown, Warren, R. I.—This governor is contrived similarly to some governors now in use, the peculiar feature of it being the upward movement of the balls on the arms when the speed diminishes, and the downward movement when the speed increases, and in the levers and rods by means of which these movements are produced.

Improved Map Exhibitor.

John Lichtenberger, Fort Wayne, Ind.—A hanging bracket supports the map rollers, which may be mounted directly in the bracket, one in front of another; or they may be arranged in a hollow cylinder mounted on pivots, so as to revolve upon its axis to bring the maps into position for pulling them down. A slot is formed for each map to drop through, and an endless cord with an idle pulley may be employed for turning the cylinder.

Improved Plow.

Albert Hampe, Staunton, Ill.—The greater or lesser depth of the share is regulated by swinging the standard backward or forward on its pivot bolt, and setting a fastening bolt to the position of the same. The lateral position of the plowshare sideways from the beam is adjusted by means of an end clevis and screw bolt, so that the plow can be set as required, increasing thereby the strength of the parts and the efficacy and usefulness of the plow.

Improved Harvester Rules.

David S. Fulton, Paris, Pa.—This invention is a machine for harvesting grain, and consists of a reel, the arms of which act independently of each other. Cam devices throw the arms into the proper position for sweeping the apron.

Improved Wrought Iron Column.

John B. Cornell, New York city.—The invention relates to the employment of a T-shaped bar for forming the joint between the vertical ribbed plates composing the chord, the edges of said plates being riveted to the lateral wings or flanges of the bar. The joint is therefore an element of strength, and a strut or cord of minimum size and weight and maximum strength is provided.

Improved Machine for Coiling Metal Rods.

Philander H. Standish, Jefferson City, Mo.—The mandrel consists of a flat bar of steel, wide and thick as the largest coil to be bent, with an oval tapered point, graduated from the size of the largest to that of the smallest coil. The bar is fitted in the hollow shaft of the driving wheel, so as to be shifted along it, to cause the tapered point to project under the bending wheel more or less, and is provided with a collar. There is a set screw at each end of the hollow shaft, for holding it wherever it may be set, to utilize the same machine for coils of all sizes, the bending wheel only being changed. The said wheel for that purpose is fitted detachably in a slotted lever, and the guide is fitted adjustably in the slot of the lever, to adjust to the wheels of different sizes.

Improved Bale Tie.

John B. Arrants, Society Hill, S. C.—This tie consists of a block to which one end of the hoop is riveted at the middle of the side which is outward when applied to the bale, and across the outside of the upper end. The inside of the lower end is a transverse groove, in which a loop is secured of wire, around one bar of which the other end of the hoop is bent. The loop is so adjusted on the aforesaid block that the strain of the hoop keeps it in place, and the loop so binds the part of the hoop bent around it in one of the said grooves in the block as to hold it securely.

Improved Water Closet.

Edwin O. Brinckerhoff, New York city.—By suitable construction, when water is admitted into a ring pipe, it will be discharged on all sides of the basin, so that the entire inner surface of said basin will be thoroughly washed, cleaning it much better and with less water than when the water is admitted at one side of the basin in the usual way.

Improved Rein Holder.

Benjamin R. Hamilton, South Deerfield, Mass.—This invention relates to the construction of rein holders, and consists in a wedge-shaped tube and a cross-grooved wedge confined therein, the reins being passed through the tube and the wedge made to act between them.

Improved Machine for Tapering Leather.

John Settle and George W. Settle, Lebanon, Oregon.—In using the machine, a semicylindrical block is adjusted as required, a knife-carrying frame is turned back, the strap or other leather to be operated upon is inserted between the block and the knife and roller of the frame, and the frame is swung forward, paring off the leather to exactly the desired taper.

Improved Station Indicator.

John W. Bryan, Watertown, Tenn.—This consists of a casing with an upper and lower chamber, provided with sliding frames and spring followers for holding the station-indicating plates, in connection with a sliding key or frame having shoulders for carrying the station plates to the upper front opening and retaining them, by springs at the sides of the opening, exposed to view. A false spring bottom carries the lower spring follower upward for receiving the station plates in regular order after each trip.

Improved Waterproof Liquid Blacking.

Edward Clark, New York city.—This waterproof blacking is made of gum shellac, methyl alcohol, gum camphor, lampblack, sweet oil, mutton tallow, turpentine, and oil of mirbane. It is applied with a soft camel hair brush, and requires no rubbing beyond what is necessary to spread it evenly over the surface to be blacked.

Improved Paper Bag Machine.

Charles H. Kellogg, Leverett, Mass.—The paper is moved along over a table, cut off, and then folded over a former; then the horizontal bottom folders move forward and fold in the sides of a portion of the tube which projects beyond the table, to form the upper part of the bottom; then the upper vertical bottom folder comes down, and the lower vertical folder moves up to fold the remaining portions and stick them to the other portions, paste having been suitably applied for the purpose beforehand.

Improved Water and Steam Indicator for Boilers.

William L. Carman, Belvidere, Neb.—To the upper end of a cylinder is bolted a cover, upon the inner side of which are two projections. Through one projection is formed a steam port, which passes out through the top in such a direction that the steam may strike a whistle. The inner end of the port is covered with a valve attached to a float, which floats upon water in the cylinder, and is kept in place by two guide pins. The cylinder is connected with the boiler by a water pipe and by a steam pipe, so that the pressure of steam may be the same in both boiler and cylinder. By this construction, as the water in the boiler becomes either too high or too low, the port will be uncovered, and the escaping steam will sound the whistle. By other construction, if the steam pressure reaches a point above that which a lever is weighted to resist, another valve will be raised, allowing the steam to escape and sound the whistle. There are also arrangements whereby the escaping steam from the ports may give a different sound, and thus show by the sound whether the alarm has reference to the water or the steam.

Improved Brush.

Charles A. Hussey, New York city.—This invention consists in a brush having a flexible handle for containing the mucilage, with a discharging tube through the neck of the handle, and a metallic shield or cover over the brush, which screws tightly to the neck.

Improved Washing Machine.

John F. Bassett, Limestone, N. Y.—In this machine the rollers between which the clothes are passed, are reciprocated longitudinally, so that the clothes are subjected to both a rubbing and rolling pressure. The improvement relates particularly to the means for adjusting the spring pressure on the lower roller.

Improved Pump.

George W. Hooper, Greene, Me.—This invention consists of packing for the piston rod, composed of a metal thimble fitted snugly to the rod, and held so as to accommodate it to the piston by a leather diaphragm, in which the thimble is fixed so as to be movable. The invention further consists in the construction of the end pieces of the cylinder which forms the cylinder heads, ways, or conduits for the water, and seats for the valves, and in the means for fastening the valves to the said seats, by passing the flexible end of the elastic face of the valve through a slot in the top of the said end pieces. The pump handle is arranged in a pivot block to shift forward and backward, to regulate the stroke to the depth of the well.

Improved Boot Leg Turning Machine.

David Bissell, Detroit, Mich.—In this machine a pulling bar is operated inside of a tube on which the leg is drawn, and a pushing bar is operated on the outside, to turn the leg over the end of the tube. The said bars move simultaneously in opposite directions. The invention consists in devices whereby the mechanism may be worked in the way most natural to the operator, also to avoid the shock and strain on the machine caused by the sudden stopping of the crank. The machine may be worked by hand or power, and be readily changed from one condition to the other, and smaller legs can be turned on the machine than it has been possible to turn as it has been heretofore made.

Improved Sheep Shears.

James L. Smith, Tuscola, Ill.—This invention consists in a guard placed on the inside near the point of one of the blades of shears, to shield the skin and guide the shears in the operation of shearing sheep or other animals.

Improved Watch Key.

John S. Birch, New York city.—This is a watch key adjustable to square pivots of different sizes, to enable the key to wind any watch. The key is made in two pieces, the upper ends of them being fastened in a solid handle; the lower ends are bored out to receive the square pivot; and the distance apart of the lower ends is adjusted to any size of pivot by a screw which passes through them and enters a nut on the other side. The head of the screw is concave underneath, and rests on one side in a slot in the jaw of the key. This appears to be an excellent invention in its line, being made of the finest hardened steel to ensure durability, and is the result of eight years' experiments on adjustable watch keys, of which Mr. Birch is the original inventor.

Chief Engineer's Office, U. S. Navy Yard,

WASHINGTON, November 18, 1874.
Commodore Thos. H. Patterson, U. S. N., Commandant:
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excellent and convenient force. It works easy and with
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tion of the fire.

I can recommend it as a very useful tool for work on
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Very respectfully, your obedient servant,
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for all descriptions of light Scroll Sawing. See advt.,
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For Sale—No. 6 McKenzie Blower; cost \$500; used
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Heavy Planer and Mather (second hand) wanted.
State lowest cash price, maker, and condition. P. P.
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Thomas's Fluid Tannate of Soda never fails to
remove Scale from any Steam boiler; it removes the
scale-producing material from all kinds of water; cannot
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cost both in Fuel and repairs of Boiler; increases steam-
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Boilers; has removed Bushels of Scales in single cases.
It is in Barrels 500 lb., ¼ Bbls. 250 lb., ½ Bbls. 125 lb.,
Price 10 cents per lb., less than ¼ price of other prepara-
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Address J. T., Birmingham, Conn. (P. O. Box 129.)

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Zero-Refrigerator with Water Cooler. Best in
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For small size Screw Cutting Engine Lathes and
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Price only \$250.—The Tom Thumb Electric
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Notes & Queries

J. P. S. can utilize old rubber as described on
p. 342, vol. 26. Galvanizing castings is described on p.
346, vol. 31.—A. L. and others will find a recipe for
a blackboard composition on p. 91, vol. 30.—S. A.
H. will find a formula for proportioning cone pul-
leys on p. 100, vol. 25.—F. P. can keep moths out of
clothing by the process given on p. 225, vol. 27.
Inkstains can be removed by the method given on
p. 139, vol. 29.—T. & L. will find directions for puri-
fying rancid butter on p. 119, vol. 30.—J. D. V. Jr.
will find a recipe for bronzing brass and copper on
p. 331, vol. 29.—S. M. can bleach cane juice for sugar
by the method given on p. 378, vol. 30.—O. K. will
find directions for making rubber stamps on p. 156,
vol. 31.—S. A. T. can fasten paper to brass by paint-
ing the brass with oil paint, letting it dry, and using
common glue. (This answers H. H. R.) Lead is
readily run into plaster molds. A recipe for a sol-
dering liquid is given on p. 43, vol. 31.—W. S. will find
directions for galvanizing iron on p. 12, vol. 316.
Rubber can be fastened to wood with glue.—T. R.
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11, vol. 31, which will do for making cloth airproof.
—S. M. E. will find a formula for the dimensions of
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and others are informed that no preventive for
boilerscale can be recommended unless the nature
of the mineral deposit is known.—W. M. ought not
to try and remove canceling ink from postage
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a recipe for Babbitt metal on p. 364, vol. 29.—E. T.
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250, vol. 31.—J. H. R. should consult a dictionary as
to the meaning of words in common use.—A. A.
will find a rule for calculating gears on p. 187, vol.
29.—L. K. Y. will find full descriptions of solder of
all kinds in our last three issues.—P. S. can join his
water spouts with waterproof glue; see p. 91,
vol. 31.

(1) S. A. T. asks: How can I cement a
porcelain mortar? A. Use a mixture of black
Japan varnish and white lead.

(2) W. B. B. asks: Having a good violin, to
improve it I removed all polish and paint with al-
cohol, which spoilt the tone. How can I restore
it? A. Take coarsely powdered copal and glass,
each 4 ozs., alcohol (64 over proof) 1 pint, camphor
¼ oz.; heat in a water bath, stirring frequently
until the solution is complete. When cold, decant
the clear portion. This is an excellent varnish for
any musical instrument of the violin species.

(3) J. J. D. asks: What is meant by slack
coal? A. Coal dust. The term is commonly ap-
plied to the dust formed in cutting out coal in the
mine, which is frequently piled in heaps at the
pit's mouth.

(4) F. O. asks: What metal is best for mak-
ing candy molds? I want to find one that cools
quickly. A. Tin molds are commonly used. Dust
them with powdered sugar to prevent the adher-
ence of the candy.

(5) C. F. E. asks: Which is the front side of
a mill dam? A. The side which the water runs to.

(6) D. G. K. asks: How can I prepare coach
varnish? A. Fuse 8 lbs. fine African gum copal,
add 3 gallons clarified oil, boil for 5 hours until
quite stringy. Mix with 3½ gallons turpentine, and
strain.

(7) P. H. K. asks: Can you give me a rule
to measure corn in a crib? A. Multiply the depth
of the corn in inches by the length and width of
the crib in inches, and divide by 2150.42. The quo-
tient will be the number of bushels.

(8) M. A. B. says: The best thing for tak-
ing dirt and grease off the hands without injury is
bicarbonate of soda, used in place of soap.

(9) I. R. M. asks: How can I calculate the
speed of a train of pulleys? A. Proceed as in vul-
gar fractions, placing the number of the revolu-
tions of the prime mover as the numerator of a
compound fraction, and the diameter of each of
the driving wheels in inches also as numerators,
and the diameters of each of the pulleys in inches
as denominators, and proceed by cancellation.

(10) A. E. S. asks: How can I paste news-
paper clippings into a scrap book without the
leaves curling up and warping? A. Use a gum
arabic mucilage with some refined sugar dissolved
in it.

(11) A. B. L. asks: How can I make a wash-
ing crystal? A. The soda ash and soda crystals of
commerce are used for this purpose, and you could
not make them on a small scale to advantage.

(12) C. asks: Is there an animal general-
ly known as the sea otter? A. Yes. It is found
in the Northern Pacific.

(13) S. says: I read an article on the bene-
ficial effects of glycerin in boilers. I tried the ex-
periment, and the result was the reverse of bene-
ficial. We got rid of most of the earthy matter
by using a surface blower, but the glycerin had
the effect of depositing the earthy matter in a hard
crust, and the surface blower showed clear water in
the boiler. A. The use of glycerin, as a solvent for
the salts in impure matters, has been recommended
for cleaning woolen fabrics, but your experiment
of its use in steam boilers is the first of which we
have heard. It is possible that, by blowing off
from the bottom, you might get rid of the deposit.
We shall be glad to hear further on this matter
from any of our readers who can communicate
any information.

(14) J. K. asks: What constitutes a yard of
plastering? A. Nine square feet of surface.

(15) J. B. S. asks: What is the best way of
polishing holly wood? A. Use a white shellac var-
nish.

(16) J. H. asks: Is the Pacific Ocean higher
than the Atlantic at the point where it is proposed
to connect them by a canal? A. No.

(17) W. R. B. says: In Dick's "Practical
Astronomer" is a description of Rogers' achroma-
tic telescope on a new plan. It consists of placing
a small compound lens of flint and crown glass in
a small part of the cone of rays of a large crown
glass objective, and thus correcting the rays, en-
abling a person to use a large crown glass objec-
tive and making it achromatic by the small com-
pound one. 1. I have a good crown glass double
convex lens, of 5 inches diameter and about 100
inches focus. What should be the size, shape, and
focus of each of the lenses forming the compound
one, to produce the proper correction for the above
mentioned lens? A. Plano concave of double
dense flint, of 2¼ inches diameter, ¾ inches radi-
us, and plano-convex of plate glass same dimen-
sions. 2. At what distance should the given com-
pound lens be placed from the object glass? A.
About 60 inches. 3. With the compound lens ad-
justed, what would be the entire focus of the in-
strument? A. Twelve feet six inches. 4. Are you
acquainted with any telescope on the above plan,
and is it satisfactory? A. An inch dialyte, by
Plossel, of Vienna, divided by *Coroner*, distance 0-6".

(18) S. G. S. asks: If the daily motion of
the earth were to cease, would all the loose bodies
on the surface fall into space? A. No.

(19) J. C. C. asks: Where is the best place
to hang a thermometer to ascertain the heat of the
atmosphere? A. If it is desired to know the tem-
perature of the surrounding atmosphere, the in-
strument should be placed in some shady spot,
protected alike from the direct rays of the sun and
cooling drafts of air. If exposed to the direct ra-
diation of the sun, the instrument itself will be-
come overheated (the materials of which it is com-
posed being better absorbers than the surrounding
air), and the consequence will be that the thermo-
meter will indicate the temperature of the materi-
als composing it and not that of the air. The indi-
cations of cheap thermometers are never abso-
lutely correct.

(20) P. E. R. asks: How can I cement glass
together, to withstand the action of electro-plating
solutions? A. Try a solution of shellac in alcohol,
evaporated to the consistence of a thick paste.

(21) G. A. N. says: I want a small engine,
to run a sewing machine or small lathe. Would a
¾x1½ inches cylinder, 20 or 30 lbs. pressure, and
300 or 400 revolutions per minute, be large enough
for the purpose? A. Yes.

(22) H. S. P. asks: 1. What would be the
horse power of an engine, with a cylinder of 5
inches bore by 6 inches stroke, running at 300
strokes per minute, with 70 lbs. of steam? A. It
would develop from 4 or 5 horsepower. 2. Would
it do to run a circular saw 15 inches in diameter
through two inch oak plank? A. Yes. 3. How large
a boiler would this engine require? A. Make a
boiler with 60 or 70 square feet of heating surface.
4. Will an upright boiler last as long as a horizon-
tal one? A. Upright boilers, when well made, are
quite serviceable.

(23) P. B. asks: 1. What is the average
weight of freight locomotives? A. There is a very
great variety, an average example being somewhat
as follows: Weight, 60,000 lbs. 2. What is the di-
ameter of the drive wheels? A. Five feet. 3. What
is the length of the stroke? A. Two feet. 4. What
is the diameter of the cylinder? A. Sixteen inches.
5. What is the weight of an average freight car?
A. Eight tons.

(24) W. P. asks: 1. What size of engine
would it take to run a boat 15 feet long at the rate
of 8 miles per hour? A. Make the cylinder 2½ x 1.
2. I have a boiler 36 inches high x 15 inches diam-
eter, carrying from 40 lbs. to 50 lbs. pressure per
square inch. Would it be large enough? A. The
boiler is too small for the speed.

(25) H. J. asks: 1. Will an engine having a
cylinder 3x6 inches, steam pressure of 60 lbs., run-
ning at 300 revolutions per minute, with a cut-off
at ¼ stroke, do to run a circular saw 6 inches in di-
ameter with? The fly wheel of the engine is 24
inches, and the mandrel pulley 6 inches, in diam-
eter. A. The engine is quite large enough. 2. My
boiler is 13 inches in diameter by 5 feet in length, a
plain cylinder in form. Is it big enough? A. No.
What will take the stains of varnish or paint off
marble? A. Try a paste composed of soda, pum-
ice-stone, and chalk.

Where is the best place to put exhaust steam in
a smoke stack, at top or bottom? A. The top.

(26) S. E. P. asks: How can I remove rust
from joiner's tools? A. Use emery and oil, with a
piece of wood. This also answers S. A. T.

(27) W. W. says: I have a small upright
engine, cylinder 4 inches diameter by 6 inches
stroke. Would it do to run an ordinary row boat?
How fast would she go, and what would be the best
kind of propeller wheel to use? What kind of
boiler would be best? Would it be necessary to
have a counterbalance on the crank? A. Your
engine is large enough for a boat 25 feet long, with
a propeller 30 inches in diameter and a boiler from
30 to 35 inches in diameter. Some slight counter-
balance may be put on, but it is not a matter of any
great importance.

(28) G. asks: What amount of sulphuric
acid will it require to entirely dissolve 1 lb. zinc?
A. For its complete conversion into sulphate of
zinc, 1 lb. of pure zinc requires 1½ lbs. of sul-
phuric acid of specific gravity 1.84=66° Baumé at 66°
Fahr. 2. What volume of hydrogen gas will the
mixture give off? A. One pound of pure zinc, by
its reaction with hydrated sulphuric acid, will lib-
erate about 40 gallons of hydrogen.

(29) C. S. R. asks: What is the cause of the
bursting of water backs? Two such accidents oc-
curred lately. A. There was probably ice in the
circulating pipes, so that the steam which was
formed could not escape. Under such circum-
stances, fire should never be permitted in a range.

(30) K. K. asks: What would be the differ-
ence between the pressure necessary to explode a
steam boiler from the inside, and that necessary to
crush or flatten it from the outside? A. In the
case of a wrought iron boiler, perfectly cylindri-
cal, the internal pressure that would rupture it is
thickness in inches x tensile strength in lbs. per
square inch ÷ the diameter in inches. The external
crushing force is: 111,000 x (thickness in inches)² ÷
diameter in inches x length in feet.

(31) B. R. asks: Can ice be torn off a dam
by powder? The ice is 18 inches thick and the
water 12 or 13 feet deep. A. We advise you not
to attempt this kind of blasting, unless you have
had some previous experience.

(32) J. H. asks: 1. How are red mortar and
black mortar made, for laying face bricks in? A.
Mortar is made red by mixing therewith a certain
proportion of Spanish brown, and black by lamp
black, but neither is sufficiently permanent to be
satisfactory. 2. Is fresh water better than salt
for making mortar in winter? A. Pure water is bet-
ter than salt water in any weather.

(33) H. says: The atmosphere in a certain
building is raised from 6° to 75° by water at 212°,
passing through coils of iron pipe. Suppose this
operation should be reversed, and an attempt made
to cool the atmosphere at 90° by cold water at a
temperature of 35°, provided the circulation were
kept up, to what degree of temperature could the
atmosphere be reduced? A. This question can-
not be answered except by experiment.

(34) J. S. asks: How much water can be
boiled away in 10 hours in a vat, 5 by 12 feet, with
1½ inch pipes laid close together over the bottom
of the vat, with steam at 60 or 70 lbs. per inch? A.
It will depend upon the arrangement whether you
boil away 25 or 75 per cent as much water as you
have steam. With a good apparatus, you may cal-
culate to evaporate ½ of a gallon of water in the
vat for every gallon of water evaporated in the
boiler.

(35) S. G. says: Suppose a water tank, 8x10
x3 feet deep, is placed on top of a house, 1,000 feet
from an engine house, what kind of an indicator
would be best to show how much water there is in
the tank? A. Put up a stand pipe, say one inch in
diameter, in the engine house, and connect it at
bottom with the pipe running from the pump to
the tank. Enlarge the upper part, which must be
on a level with the tank, so as to introduce a float;
connect this float by a cord over a pulley, with an
indicator in the engine room below. As the water
in this pipe will stand higher, when pumping, than
in the tank, it will be necessary to stop the pump
to find the true height.

(36) F. S. says: 1. Please give me a rule for
finding the strength of a boiler when diameter of
shell and thickness of iron are given. A. For a
single riveted iron boiler, the safe working strain,
in pounds per square inch, may be found by multi-
plying the thickness in inches by 7,500, and divid-
ing the product by the diameter of the boiler in
inches. 2. Would it make any difference in the
working of an engine which end of the boiler I
took the steam from, or at which end I let in
the feed water? A. Ordinarily, no.

Are large mill saws tempered after they are
made? A. Yes.

(37) S. D. K. says: We have a large hall,
built of brick, 50 feet square and 20 feet high. The
reverberation is so great as to make it very dis-
agreeable to speak in, causing confusion of sound.
What is the best remedy? Will wires do, and how

are they applied? A. The use of wire to improve the acoustics of halls, etc., is of comparatively recent date, and is not sufficiently extended in the number of reported experiments to warrant a very great degree of certainty in assigning either the size of the wire, their distance apart, or their exact location. It is generally thought best to place them in front of the vertical wall opposite the speaker, about 5 inches from the wall and 6 inches apart, extending vertically from the floor to ceiling. The object being simply to break the wave of sound, as small a wire will answer as is consistent with strength.

(38) J. G. R. asks: 1. Would it be practicable to have the telegraph wire within $\frac{1}{2}$ inch of the wood at every pole? A. Yes. 2. What is the smallest distance that will work well? A. Any distance if they do not touch. Air is an insulator, and galvanic electricity will not pass through it unless some other substance is present. It is better to keep the wire at some distance from the pole on account of snow or ice forming a connection between the wire and pole.

(39) G. W. M. asks: Is cement pipe much used for aqueducts for water supply? When laid entirely below the action of the frost, and bedded in clay, would it be durable and not likely to become leaky from cracking or otherwise? What thickness should three-inch cement pipe be to conduct water under a head of 30 feet? Would such a pressure be likely to produce leakage by filtration through the pores? Which would be most economical in the beginning, and less liable to further expense for repairs, to make the pipe in short joints before laying it, or to lay the cement in its final bed in a plastic state, forming the hole as fast as the work progresses? What is the process of the latter mentioned mode of laying pipe? What are the ingredients required, and their proportions? A. Cement pipe is principally used for drainage and very seldom for supply, except when the current runs to a grade without filling the pipe, and so not under pressure. A notable instance of a cement concrete pipe is that of the Vane aqueduct, thirty-seven miles in length, for supplying water to the city of Paris. This aqueduct has two and a half to three miles of arches, some of them fifty feet in height, and eleven miles of tunnels, which, with the aqueduct pipe, are all constructed of beton Coignet. The pipe is circular, $\frac{6}{8}$ feet in interior diameter, with a thickness of 9 inches at the top, and 12 inches at the sides, at the water surface. It has proved to be impermeable to water. But cement pipe of small size, bedded in the earth is much too liable to be broken by unequal pressure, caused by the washing away of its support, to be safe under ordinary circumstances.

(40) J. D. M. asks: What is the capacity of a cylinder 6x8 inches, carrying a pressure of 50 lbs. to the inch, and making 200 revolutions? A. Area of piston in square inches 28.27
Multiply by steam pressure 50
1413.5
Multiply by twice the length of stroke in feet 1.33
1,881.5
Multiply by revolutions per minute 200
376,300
Divide by 33,000 11.4
Horse power 11+

(41) W. W. F. says: 1. In a church are two furnaces for heating, which can be made to draw only when the atmosphere is in strong motion. Two large coal stoves have been substituted, with 8 inch pipes running the whole length of the church. These also operate the same way. What is the reason? A. The draft is checked by the great length of horizontal pipe, and most probably by the small size of the vertical flues likewise. The best conditions for draft in such cases are the location of the former at the bottom of the vertical flue, with little or no horizontal pipe, and the size of the flue being sufficient for the work it has to do. One of the worst conditions is that of a horizontal pipe running in a direction contrary to that of the strongest and most prevalent winds; and the same difficulty occurs in carrying heated air in pipes from a furnace. The furnace therefore should be placed at the windward end or side of the church, and have large flues ascending directly from them. 2. In building chimneys, is there any prescribed rule for the size or shape of flue? A. No graduated scale for the size of flues has been indicated, but 12 by 16 inches or 12 by 12 inches ought to be sufficient in a case like this.

(42) A. B. A. asks: Is there any process by which freckles can be removed from the face without injury to the skin? A. A good lotion is made of: Bichloride of mercury 6 grains, pure hydrochloric acid (specific gravity) 1 fluid drachm, water (distilled) $\frac{1}{4}$ pint, mix, and add of rectified spirits and rose water, each 2 fluid ozs., and glycerin 1 oz.

(43) J. M. says: I have a boiler 1 foot in diameter and 21 inches long, with 14 flues. The firebox and flues get choked. What is the cause of it? A. The flues are probably too small for ordinary fuel. Try charcoal. The power of your steam engine depends upon the steam pressure and speed, which you do not mention.

(44) O. A. asks: Would a room, partitioned off in a cellar, do to store ice for summer use? If so, how must I arrange it? A. You can make an ice room in your cellar that will most likely preserve ice, if the space you can devote to that object be large enough. Ice will keep best when compacted in a solid mass, and a cube of 12 feet will be found to be best for family storage, even where perhaps not more than one half of this amount will be required for use in one season. Place 2x12 inch uprights, 2 feet apart, around the room, with the edge to the wall, and line them with stout inch boards. Then fill in the spaces between the uprights with dry sawdust, and construct a similar protection on the ceiling of the room. Cover the ground with shavings 6 inches deep, and lay sleepers and a tight floor thereupon, arranged

to drain to one side, and provide a drain to carry off the water. Also provide ventilation from the top of the ice room. Put in a double door at the entrance, and provide a sawdust mattress to fill the space between them, making the inside door in sections to take down from the top. A space partitioned off outside of the ice room can be used as a cold closet.

(45) Q. asks: Are there any ingredients that can be molded into artificial stone for building purposes, that will stand the action of the weather? A. Artificial stone, made in the manner you refer to, is manufactured by three or four companies in this city and elsewhere; but their combination of ingredients is in each case protected by a patent. The peculiarity of each consists in its use of some choice and noted cement as a basis for its composition, and upon this their success mainly depends. One of these companies uses the hydraulic lime of Teff, and another Portland cement, and great care is taken to wash the sand perfectly clean and to cause the combination of the sand and cement to take place under the best conditions. This is sometimes done under pressure. The operations of these companies are now very extensive, but their processes are mainly concealed from the public, especially the points wherein their peculiarities consist.

(46) P. M. J. M. and many others.—We do not know of any rule for determining the horse power of a boiler.

(47) O. D. B. says, in reply to G. M. B. (who asks: How can I construct a receptacle in a garret for water from the roof of a house? It must not let the water be frozen in winter, or spoiled in summer): My garret being sufficiently tight, frost does no harm. For my tank I used a poor grade of $\frac{1}{4}$ inch pine, sawn into strips $\frac{3}{4}$ inches wide, all pieces of equal length. I took one thickness of matched $\frac{1}{4}$ inch stuff for the bottom, and then laid on the strips around next the edge of the bottom, and nailed each layer, breaking joints at the ends, until the requisite height was reached, thus making a tank needing no tongues or grooves. If it is to be over five feet high, saw the strips $\frac{3}{4}$ or 3 inches wide. Having lined the tank with sheet lead, the water was taken from the roof, and (through an elbow and conductor pipe of galvanized iron) was discharged into the bottom of the tank (the conductor being in the tank and reaching to the bottom); thus each successive shower moved all the water in the tank, stirring it up and causing the surplus or overflow to pass on to the main house cistern. The more roof water that can be conveniently turned into the tank the better, for the supply is thus kept constant and the changes are more frequent. A. We understand our correspondent's plan of building a tank to be something like that of erecting a log house, with the strips he refers to overlapping each other at the corners, and the whole wall nailed down into each other as the walls rise. We do not see the necessity of multiplying the number of joints to so great an extent as this plan involves, and think there is less labor required to be expended on the ordinary style of tank. When the tank is high, a cradling of slight scantlings will be necessary to bind it together and sustain the pressure of the water, in either case.

(48) J. B. B. asks: Please explain the construction and mode of working the automatic telegraph instruments in use in many brokers' offices of New York and Philadelphia. A. There are many kinds. In one of them a type wheel containing letters is propelled, step by step, by electro-magnetism, and another wheel containing figures is propelled in a similar manner. The printing is done by a third magnet, which attracts an armature attached to a lever, the distant end of which brings the paper against the type wheel. The paper is moved along by the movement of the lever.

(49) W. & Co. ask: What are the *modus operandi* and ingredients used in making electric carbons? A. The fine dust of coke and cooking coal is put into a close iron mold of the shape required for the carbon, and exposed to the heat of a furnace. When taken out, the burned mass is porous and unfit for use; but by repeatedly soaking it in thick sirup or gas tar, and reheating it, it at length acquires the necessary solidity and conducting power. The carbon that forms on the roof of gas retorts is harder and better than the carbon thus made, but it is difficult to work, and the supply of it is limited.

(50) A. T. O. says: I am building an engine of 3 inches stroke by $\frac{1}{4}$ inches bore. What sized boiler ought it to have to run a foot lathe? A. Make the boiler of $\frac{1}{4}$ inch iron or copper, 15 inches in diameter, and 30 to 36 inches high.

(51) A. W. P. asks: Is there any spot in the depth of the ocean where the density of the water is such as to prevent a 50 lbs. weight from sinking any farther? A. Possibly.

(52) A. K. asks: What causes a conical shot fired from a smooth bored gun to fly end over end? A. It is on account of the resistance of the air, since the axis of the shot is not permanent, as it has not been made to rotate on its axis while being forced from the gun.

(53) J. M. W. asks: Is there any means of finding gold and silver that is buried in the ground? A. Digging till it is found is the only solution of the difficulty.

(54) G. B. asks: What is the best polish for handles, such as chisel handles, etc.? A. Ordinary polishing paper answers very well. What power have I on my foot lathe, the driving wheel being 26 inches in diameter and the driven wheel 3 $\frac{1}{2}$ inches? The belt is $\frac{3}{4}$ inches in width. A. You must measure with a spring balance, or otherwise, how much pressure you produce on the treadle, multiply it by the distance the pressure is exerted in feet for each revolution, multiply also by the number of revolutions per minute, and divide by 33,000.

Why is wood seasoned under water heavier than

that seasoned by boiling or steaming? A. Generally because as much of the sap has not been expelled in the former case as in the latter.

(55) R. U. asks: What is Chatterton's compound, for insulating electric cables, composed of? A. Stockholm tar 1 part, resin 1 part, gutta percha 3 parts, by weight.

(56) A. L. C. asks: Does the perihelion of the earth's orbit to the sun always lead the sun in its course among the stars, or does it occupy a fixed position? A. It retrogrades slowly, moving in a direction contrary to the order of the signs.

How do you account for the ocean waters being salt? A. Streams carry down minerals, especially soluble chlorides, the water returning by evaporation and rain.

Will iron weigh the most when hot or cold, and why? A. A cast iron ball at first sinks in melted cast iron, then floats, and finally melts.

How much will a ball drop in the first mile, when shot from a cannon? A. A falling body describes in 1 second 16 $\frac{1}{2}$ feet, in 2 seconds 64 $\frac{1}{2}$ feet, in 3 seconds 144 $\frac{1}{2}$ feet, in 4 seconds 256 $\frac{1}{2}$ feet, in 5 seconds 400 $\frac{1}{2}$ feet. The United States 0.45 caliber bullet (charge 7 grains), at 1,050 yards range, elevation 3° 34' 15", has a dangerous space of 75 feet, and rises 35 feet above the line of sight at 500 yards. Initial velocity 1,300 feet per second. Pressure 16,300 lbs. per square inch.

I always notice that men, horses, and other animals, when running in a circle, always prefer to run with their left side toward the pole. How do you account for this? A. Because the left half of the brain and the right side of the body (which it governs) are best developed.

(57) F. E. R. asks: How many cells of a Callaud or of a Daniell battery would be required to silver plate small articles, such as buttons, coins, etc.? A. Two cells of either will do.

(58) M. D. H. and others.—It is self-evident that the earth and moon must gyrate about their common center of gravity. The pseudo science of metaphysics consists of an insensible change in the meaning of words during a course of reasoning. We may thus prove mathematically that one equals two, that a straight line is always perpendicular to itself, that a straight line may cut a circle in 4 points, etc.

(59) W. J. asks: How can I make a cheap apparatus to govern electricity, so that it can be taken in light or heavy shocks? A. Take 50 feet of No. 16 copper wire covered with cotton, and make a helix, and then take 1,000 feet of No. 20 copper wire insulated with copper and make another helix around the first. Connect a battery to the two ends of the first helix; and by rapidly breaking and making connection with the battery, a current will be developed in the second coil which can be felt by taking hold of the two ends of the second wire. By inserting a bundle of iron wires in the center of the first helix, the shocks will be greatly increased, and the amount of the shocks can be varied by the distance to which the iron wires are inserted in the helix. 2. What is an electric circuit? A. A circuit is made by connecting the two poles of a battery together.

(60) J. T. M. asks: 1. How many men's work is equal to one horse power? A. From 6 to 7. 2. Is an engine with its cylinder 3 inches long by 1 inch diameter large enough to run a half medium Gordon printing press? A. It is rather too small.

(61) G. C. P. Jr. asks: How can I make an electric battery for a telegraph apparatus? A. Get some cheap glass tumblers and place in the bottom of each an ounce of blue vitriol. Place over the blue vitriol a small coil of copper wire. Attach to the copper wire coil an insulated copper wire extending out of the top of the tumbler (gutta percha covered wire is the best for this purpose). Get some thick sheet zinc and cut out disks of it which will fit into the top of the tumblers, and to the zinc attach a short piece of copper wire. Fill the glass with water. Connect the wire leading from the copper coil of one tumbler to the wire leading to the zinc in the next tumbler. The strength of one cell will be one volt. Use as many tumblers as are necessary to get what power is required.

(62) S. asks: Why does the sun appear larger at the horizon? A. It is an illusion, caused by comparing the size of the sun with terrestrial objects.

When an author gives the strength of wood as 100 lbs., in what direction does he mean that the strain shall be applied? A. It is impossible to tell, unless there is something immediately preceding the information to explain it.

Why does a heated razor cut better than a cold one? A. We are not sure that this is a fact.

(63) S. H. B. asks: Is it enough to test kerosene oils to heat in an open vessel to 110°, and then apply a lighted match? A. Yes, it is a very good test.

(64) J. says: I have made a small steam engine (of one inch bore and three inches stroke) entirely of lead, and so far it runs well. Will it be comparatively durable, and can there be sufficient power got from it to run a sewing machine? A. If it is run light, with low steam, it will probably continue in order for a considerable time. It is probably quite powerful enough to drive a sewing machine, but it is doubtful whether it would stand the work for any long period.

(65) S. P. H. asks: In tempering sickles for cutting grass, to what color should they be drawn? A. A light purple, or a temperature of about 530° Fah.

Claret wine poured into a tumbler of water will penetrate the water and mix; but if a piece of bread is put into the water and the wine poured in, the wine will float on top of the water, part being absorbed by the bread. Why is this? A. We think this experiment can be performed without the bread, if carefully managed.

(66) F. asks: How many barrels of water per foot in depth will cisterns 7 feet, 8 feet, 9 feet, and 10 feet in diameter contain respectively? A. Multiply the square of the diameter by the decimal 0.186. Thus the cistern 7 feet in diameter contains for each foot in depth 49 times 0.186 or 9.114 barrels.

(67) W. S. P. asks: 1. Is a 400 barrel water tank, 16 feet square by 10 feet high, made of 3 inch plank properly braced and bolted, as strong and useful as a round tank of 16 feet diameter by 12 feet high, made of staves $\frac{3}{4}$ inches thick and properly banded? A. Yes. 2. If the square tank were cased inside with the lightest make of sheet zinc, or galvanized iron, would it be better? A. Yes. 3. How long would it last as a watertight vessel with more or less chalybeate or iron water in it and exposed to the air? A. From a few months to several years, according to the condition of the wood. 4. Would an iron varnish (distilled coal tar) be a protection to the iron or zinc? A. Yes.

(68) J. H. M. says: A friend states that, if it were possible for a man standing in a car 100 feet high, moving at the rate of 60 miles per minute, to throw an iron ball straight up 100 feet, it would drop exactly in his hands. I contend that, while the ball would descend in a straight line, yet, in the time required for the ascent and descent of the ball, the car would have moved a mile for every second from the place where the ball started, so that by the time the ball reached its starting point the man would be too far away for it to drop into his hands. He also says that, if he was standing on the roof at the rear end of the car, and I should be standing on the platform of the same car exactly underneath him, the car going at the same rate of speed as before, and he should drop this iron ball, it would strike me. I contend that by the time it reaches my level I would be as many miles from it as it occupied seconds in falling. Which is right? A. Your friend is right, if the resistance of the air can be disregarded.

(69) W. L. D. asks: When it is noon on Friday, at Greenwich Observatory, London (longitude 0), is it Friday or Thursday midnight, at opposite (longitude 180°)? A. Looking at the south pole of a globe, the day of the month is one later at all places between meridian 180° and midnight, counting toward the left, than between 180° and midnight, counting toward the right; that is, it is always later at the first meridian than at any place in west longitude, and earlier than at any place in east longitude.

(70) M. says, in reply to M. B., who asks for a rule for cutting a tree so that its top shall fall at a certain distance from its root: Let A B represent the tree, and C the point on the ground. Draw B C and calculate its length. From D, the center of B C, draw D E perpendicular to B C, and E will be where the tree should break. B A C and B D E are similar triangles, hence B A : B C :: B D : B E.

(71) C. W. says: You mention, as good for steps for turbines, rock or swamp maple. I have known the knots of light wood or pitch pine to last for years in this service.

(72) R. E. B. says, in reply to a question how to remove clinkers from firebrick: Pour vinegar where the clinker collects, and the latter can be peeled off after being well saturated.

(73) C. T. S. says, as to corrosion of engine bolts by using tallow as a lubricant: I think that D. K. has given the real reason for the cutting out of screws and other parts of pistons. After a practical experience of nearly twenty-five years, I am convinced that the use of oil of any kind in the steam chests and cylinders of steam engines is a positive damage and an inexcusable waste, except in the case of locomotives, when running down grades without steam. Nearly all oils contain salts and acids which are destructive to iron under the conditions above described. Oil thrown into a steam chest (where the temperature is high) almost instantly vanishes, leaving a residuum between the wearing surfaces, which is anything but a lubricant, causing more friction and wear than the oil ever compensates for. Oil pumps are sometimes resorted to where it is thought necessary to waste a gallon or two of oil weekly through an engine. Having occasion to make some slight repairs upon an engine a few days ago, I took off the cylinder head, and examined a piston which I put in new five years ago. I found the follower screws, and the screws and nuts under the packing springs, as perfect as when put in; and the cylinder was as bright and smooth as a mirror, also the valves and valve seats. Yet this engine had run 5 years without oil inside the cylinder, and made a saving to the proprietor of not less than \$100 in the item of oil alone. Piston and valve rods can be oiled from the outside if necessary; but if the packing in the stuffing boxes is renewed before it becomes hard and charred, very little oil will be needed. A. You do not state what kind of oil you found to leave a residue creating friction.

(74) J. H. S. says: D. K., in his reply to D. S. T. (No. 17, issue of Jan. 30), says that he had trouble with bolts, etc., being eaten away by the acid in the tallow he used, and that he now used hard oil. After a great deal of trouble from the same source, I got a large earthen crock and set on top of my arch, keeping it filled with crude tallow obtained at a meat market. It tried out very nicely, and is of course pure. I have used it on an engine for 15 months and everything is all right, although I am using the same water as I did when the trouble was in the cylinder. I have always found that, where hard oil was used in steam, everything ran very dry. It is not heavy enough.

(75) J. & J. T. say, in reply to J. C. & Co., as to the inclination of a boiling reel: At the Millers' National Convention in St. Louis, Mo., June, 1874, we learned that a fall of 1 in 48 always gave the best results.

S. A. T. asks: How can I make a fugitive ink that will disappear in two days after being written?—T. C. H. asks: How can I make an easily flowing ink for drawing on zinc plates, so as afterwards to etch the drawings with muriatic acid?—E. P. M. asks: How can I tan and color beaver skins?—L. M. asks: I. Can you give me a good rule for getting the length of a carriage axle from shoulder to shoulder before welding, supposing the hub of the wheels to be 6½ inches long, and the track of the wheels 4 feet 7 inches? 2. Please give me a rule for setting axles.—J. F. E. asks: What is put in soap to keep it from shrinking in drying?

COMMUNICATIONS RECEIVED.

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

On the Generation of the Wicked. By T. W. C., and by A. S.
On the Sagacity of the Partridge. By J. K.
On Glue as a Healing Remedy. By J. J. B.
On Honey. By A. L. F.
On Amalgamating the Precious Metals. By J. T.
On a Mammoth Skeleton. By A. R.
On a Lunar Phenomenon. By H. M. S.
On the New Rule at the Patent Office. By J. McC.
On the Slide Valve. By J. T. H.
On Squaring Numbers. By E. T.
On Spiritualism. By F. H. R.
On Small Steam Engines. By W. C. D.
On a Mathematical Fact. By E. H. W.
On the Human Will. By W. L. S.

Also enquiries and answers from the following:

M. G. L.—E. W.—T. F. & Co.—J. K.—J. G. T.—T. R.—A. E. O.—J. T. H.—S. T. J.—J. E. B.—F. H. W.—A. A. F.—C. C. C.—D. B.—G. W. H.—C. E. M.—J. K.—J. C. R.—G. C.—C. F. R.—J. C.—R. W. J.—J. R.—T. K. 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: "Who publishes books on dressing and coloring furs, and on bleaching wool? Who sells magnesia and chloride of magnesium? Who makes machines for cutting thin stuff off round logs while the latter revolve? Who sells the best steamer for laundry purposes? Who makes steel castings? Who sells the best gauge cocks, etc.? Are there glass-lined iron pipes in the market? Who makes engines suitable for boats 4 feet long?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week ending

February 16, 1875,

AND EACH BEARING THAT DATE.

[Those marked (r) are renewed patents.]

Advertising apparatus, T. E. Allison	159,881
Alarm and stamp, conductor's, L. J. Masterson	159,765
Amalgamator, I. Hineley	159,759
Annunciator, electric, Carter and Hewitt	159,901
Bale tie, A. A. Goldsmith	159,815
Ballot box, F. W. Brooks	159,890
Bank check, C. V. Mead	159,833
Barrel roller, C. L. Topf	159,864
Bed bottom, spring, J. A. Jones	159,900
Bedstead, folding, P. B. Vile	159,780
Bedstead, wardrobe, H. W. Curtis	159,908
Bee hive, J. Bullock	159,893
Bill file, W. R. Clough	159,796
Bird house, E. A. La Bay	159,908
Bolter, wash, A. Becker	159,745
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Root stiffeners, shaping, J. B. Moffitt	159,835
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Clothes wringer, P. N. Wollston	159,906
Cock, gage, I. S. Hamilton	159,909
Cock or valve, Heale and Gowan	159,924
Cock, self-closing hopper, H. Carruthers	159,900
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Faucet, T. Tully	159,981
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Iron, roll for rolling angle, Swift & York	159,978
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Plow, A. Rigby	159,967
Plow adjuster, S. T. Ferguson	159,913
Plows, sulky attachment to, G. Van Winkle	159,779
Printing press, W. E. Gump	159,819
Printing press delivery, Mayall & Harnett	159,947
Puddler, revolving, W. & G. H. Sellers	159,849
Pulley block, differential, B. F. Warren	159,987
Quilting machine, A. Beck	159,884
Railway frog, W. L. Lamborn	159,763
Rake, garden, F. B. Hedge	159,878

DESIGNS PATENTED.

8,057.—BRACKET.—N. L. Bradley, West Meriden, Conn.
8,058 to 8,061.—AQUARIUMS.—J. W. Fiske, New York city.
8,062.—CARPET.—A. Redfern, Philadelphia, Pa.
8,063.—SPICE CAN.—Z. R. Traver, Detroit, Mich.
8,064.—BOTTLES.—F. S. Upton, Rochester, N. Y.
8,065.—GAS FIRE LOG.—T. N. Dixon, Philadelphia, Pa.
8,066.—ALTO RELIEVO.—W. R. Gleason, Boston, Mass.
8,067.—HANDLE SOCKET.—J. H. Mackay, W. Meriden, Ct.
8,068.—CIGAR BOX.—M. Moll, New York city.
8,069.—FORK HANDLE.—C. Osborne, N. Attleboro, Mass.

TRADE MARKS REGISTERED.

2,228.—CIGARS.—F. De Bary & Co., New York city.
2,229.—SALVES.—C. Heinrich, Plainfield, N. J.
2,230.—MUSTARDS.—Jewett & Co., Milwaukee, Wis.
2,231.—MEDICINE.—J. Kaiser, Pittsburgh, Pa.
2,232 to 2,236.—CLOCKS.—F. Kroeber, Hoboken, N. J.
2,237.—CIGARS.—Lichtenstein & Co., New York city.
2,238.—MEDICINE.—E. G. Lewis, Pittsford, N. Y.
2,239.—PACKING.—W. H. Miller, Philadelphia, Pa.
2,240.—CIGARS, ETC.—G. Solomon, New York city.
2,241.—CIGARS.—J. M. Selp, Allentown, Pa.
2,242.—FERTILIZERS.—Walton & Co., Wilmington, Del.
2,243.—RAY POISON, ETC.—E. S. Wells, Jersey City, N. J.
2,244.—SCARFS.—Woods & Co., Baltimore, Md.
2,245.—SEWING SILK.—Brainerd & Co., New York city.
2,246.—BATHING POWDERS.—F. Rauchfuss, New York city.

SCHEDULE OF PATENT FEES.

On each Caveat	\$10
On each Trade mark	\$25
On filing each application for a Patent (1½ years)	\$15
On issuing each original Patent	\$20
On appeal to Examiners-in-Chief	\$10
On appeal to Commissioner of Patents	\$20
On application for Reissue	\$30
On filing a Disclaimer	\$10
On an application for Design (3½ years)	\$10
On application for Design (7 years)	\$15
On application for Design (14 years)	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, FEBRUARY 12 to 24, 1875.

4,389.—A. Willson and E. M. Law, Bell Ewart, Ont. Car coupling. Feb. 12, 1875.
4,390.—Jas. Laing, Dundee, Scotland. Overhead sewing machine. Feb. 15, 1875.
4,391.—F. C. Porter, Buffalo, N. Y., U. S. Folding table. Feb. 15, 1875.

4,392.—C. W. Sellins et al., Montpelier, Vt. Door spring. Feb. 16, 1875.
4,393.—J. T. B. Bennett, Birmingham, England. Making coke and gas. Feb. 16, 1875.
4,394.—J. C. Tilton, Pittsburgh, Pa., U. S. Wash boiler. Feb. 16, 1875.
4,395.—J. Carpenter, Mariners' Harbor, Northfield, N. Y., U. S. Wagon spring. Feb. 16, 1875.
4,396.—T. Shaw, Philadelphia, Pa., U. S. Steam, air, and hydraulic seated valve. Feb. 16, 1875.
4,397.—H. Harris, Seaford, Ont. Stove pipe damper. Feb. 16, 1875.
4,398.—B. Arnold, East Greenwich, R. I., U. S. Netting machine. Feb. 16, 1875.
4,399.—Wm. Adamson et al., Philadelphia, Pa., U. S. Making starch and fermented liquors. Feb. 17, 1875.
4,400.—L. H. Young, St. John, N. B. Punching machine. Feb. 18, 1875.
4,401.—S. Dobbs et al., Rochester, N. Y., U. S. Picture frame hanger. Feb. 18, 1875.
4,402.—I. F. Williams, Bristol, R. I., U. S. Rubber boot. Feb. 20, 1875.
4,403.—F. Kent, Hamilton, Ont. Tyre tightener. Feb. 20, 1875.
4,404.—J. B. Larkin, Pittsburgh, Pa., U. S. Grate and grate bar. Feb. 20, 1875.
4,405.—E. R. Whitney, Magog, P. Q. Hay loader. Feb. 20, 1875.
4,406.—N. Duhur, Cincinnati, Ohio, U. S. Cigar mold. Feb. 20, 1875.
4,407.—T. DeCadejo, New York city, N. Y., U. S. Smoke and spark conveyer. Feb. 20, 1875.
4,408.—I. F. Williams, Bristol, R. I., U. S. Lasts for boots. Feb. 20, 1875.
4,409.—S. L. Wiegand, Philadelphia, Pa., U. S. Grate bar, etc. Feb. 20, 1875.
4,410.—T. Irwin, Hamilton, Ont. Hot air furnace. Feb. 20, 1875.
4,411.—Wm. Stephenson, Acton, Ont. Tempering oven. Feb. 20, 1875.
4,412.—E. Hambur, Detroit, Mich., U. S. Rocking chair and cradle. Feb. 22, 1875.
4,413.—J. Grist, Jr., Ottawa, Ont. Mirror plate and mirror. Feb. 22, 1875.
4,414.—J. M. Bruce, West Townsend, Mass., U. S., et al., Street lantern. Feb. 22, 1875.
4,415.—J. M. Brosius et al., Richmond, Va., U. S. Car axle box. Feb. 22, 1875.
4,416.—J. L. Frailek, Picton, Ont., et al. Tyre upsetting machine. Feb. 22, 1875.
4,417.—D. S. Cornell, Warwick, Ont., et al. Hand straw cutter. Feb. 23, 1875.
4,418.—A. Rodgers, Muskegon, Mich., U. S. Circular saw carriage. Feb. 23, 1875.
4,419.—T. Penton, Sarnia, Ont. Combined cooking stove heater, and engine. Feb. 23, 1875.
4,420.—L. M. Becker, Peckham, England. Sewing machine. Feb. 23, 1875.
4,421.—B. Waggoner, Reach, Ont. Gang plow. Feb. 23, 1875.
4,422.—B. Waggoner, Reach, Ont. Iron neck yoke. Feb. 23, 1875.
4,423.—J. F. Williams, Niagara, Ont. Boot latch loop. Feb. 23, 1875.
4,424.—J. H. Osgood, Boston, Mass., U. S. Inking roller composition. Feb. 24, 1875.
4,425.—F. L. Bates, Carrollton, Miss., U. S. Nut lock. Feb. 24, 1875.
4,426.—E. R. Powell, Winoski, Vt., U. S., et al. Wheel harrow and grain coverer. Feb. 24, 1875.
4,427.—Wm. J. Garton, Toronto, Ont. Wax thread heating machine. Feb. 24, 1875.
4,428.—M. Hutchinson, Norfolk, N. Y., U. S. Heating drum. Feb. 24, 1875.
4,429.—A. Rodgers, Muskegon, Mich., U. S. Gang saw mill. Feb. 24, 1875.

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