# SCIENTIFIC AMERICAN

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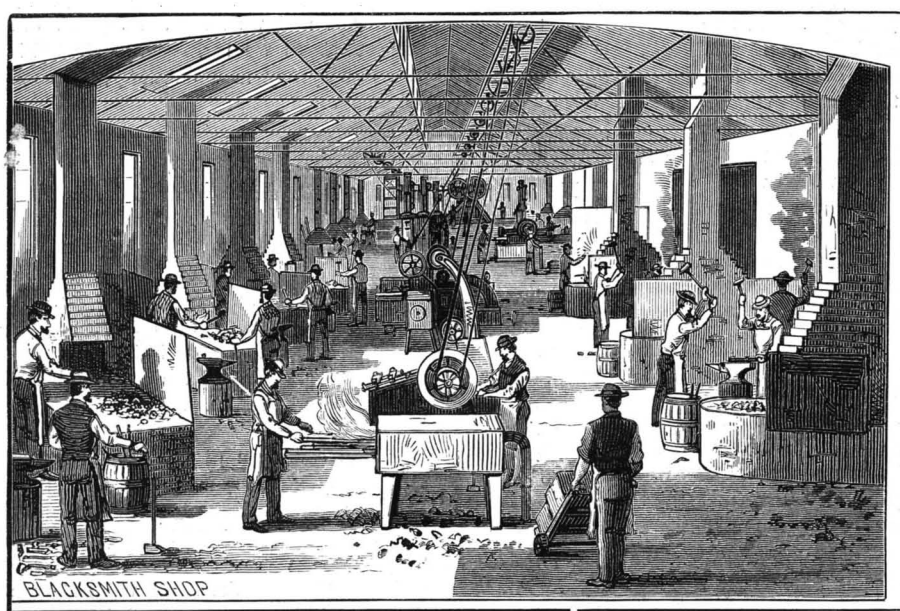
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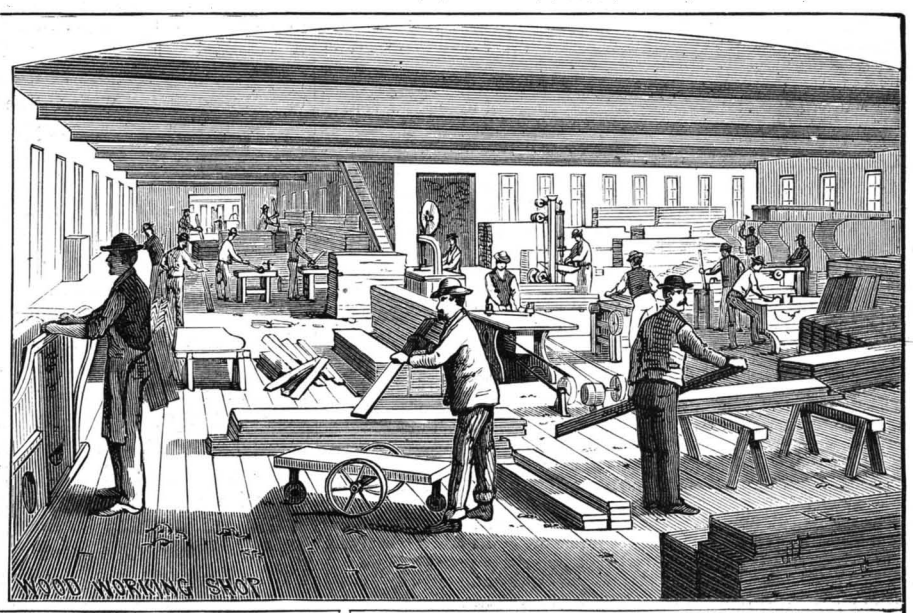
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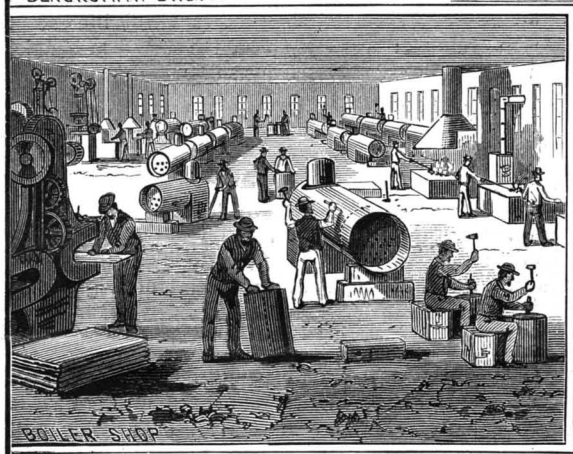
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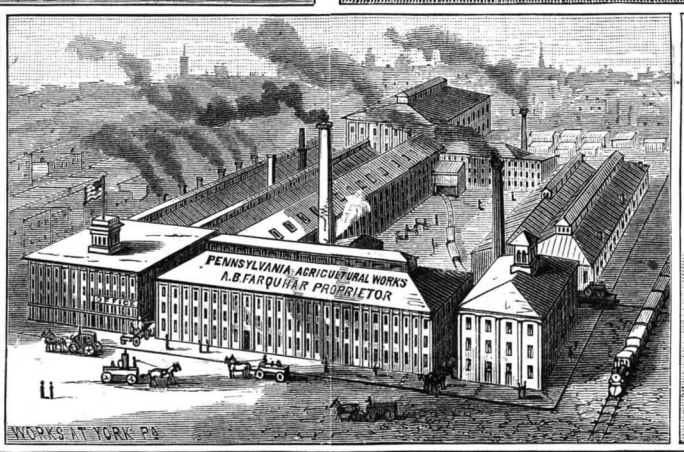

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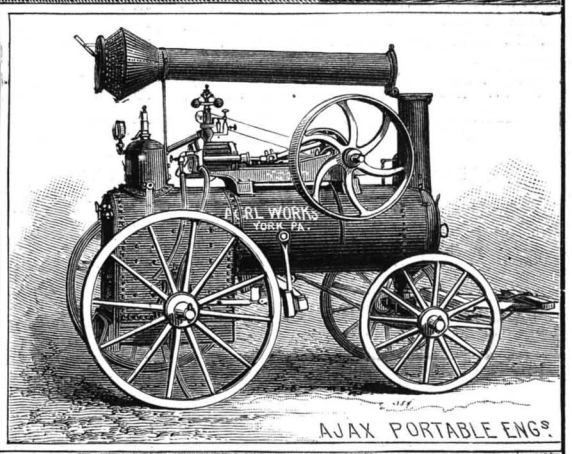

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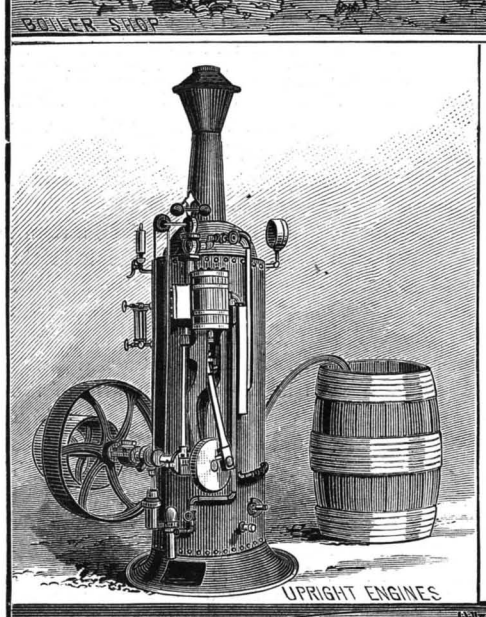
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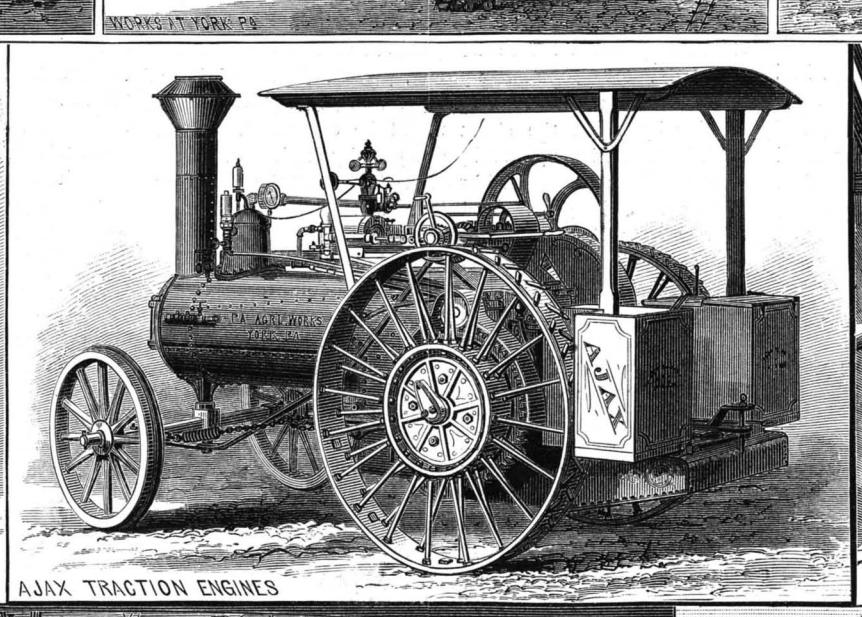

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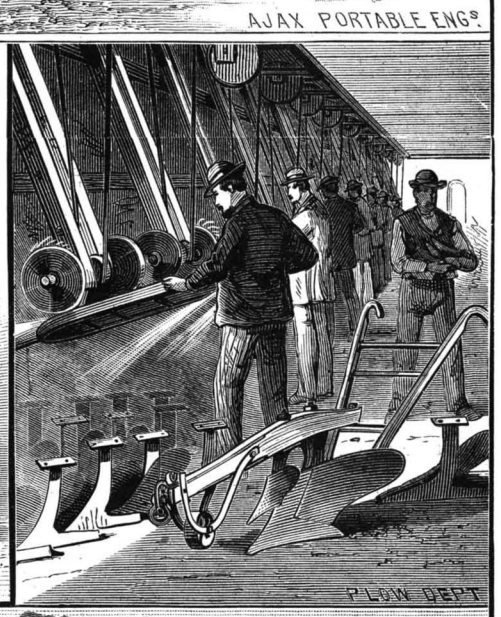
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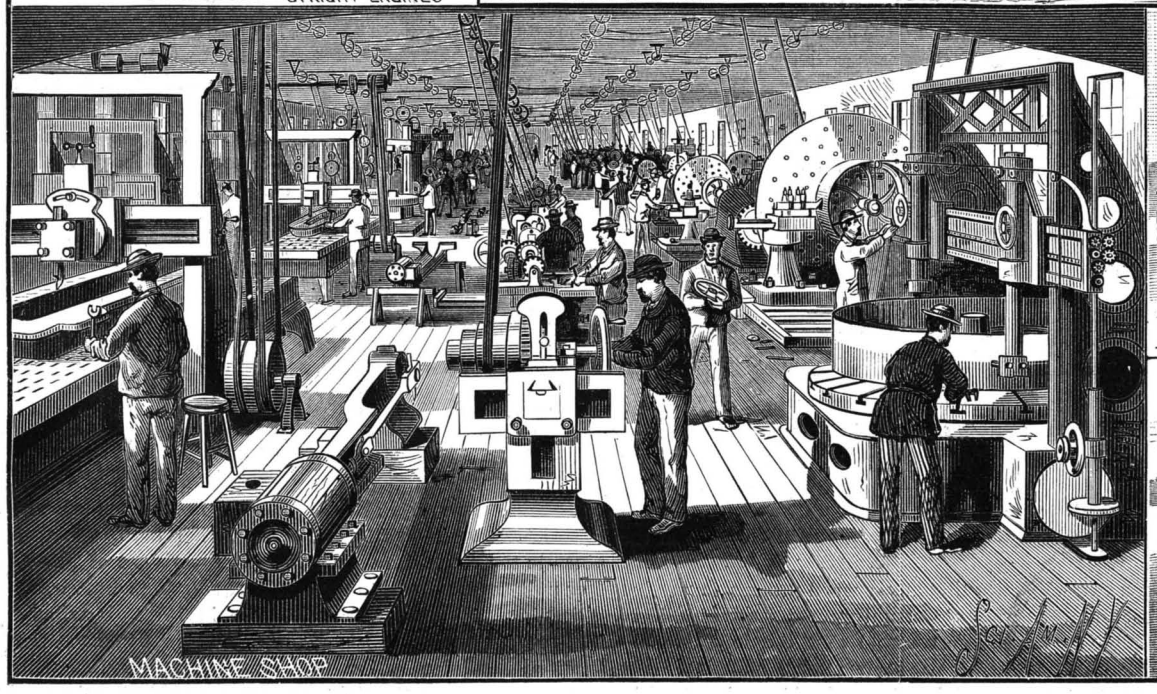
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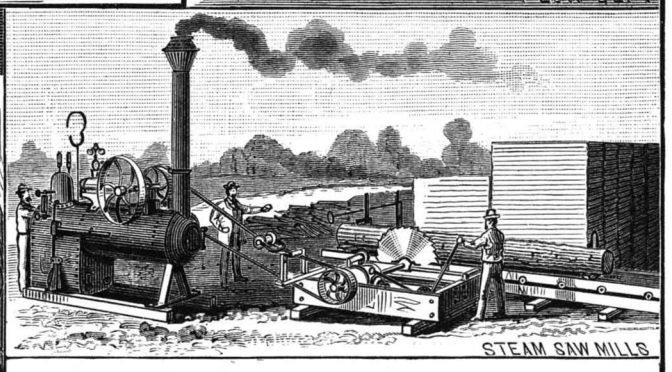
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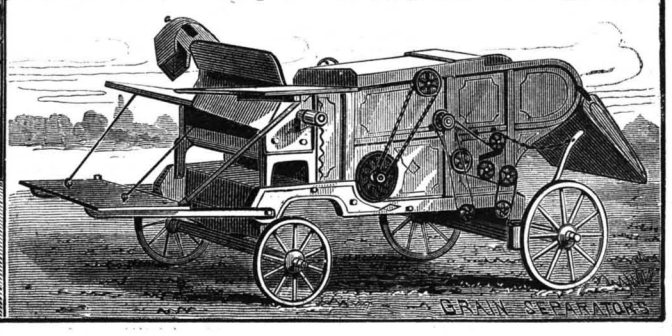
GRAIN SEPARATORS

**PENNSYLVANIA AGRICULTURAL WORKS, A. B. FARQUHAR, PROPRIETOR, YORK, PA.**—[See page 20.

# Scientific American.

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NEW YORK, SATURDAY, JANUARY 12, 1884.


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**THE SCIENTIFIC AMERICAN SUPPLEMENT**

**No. 419,**

**For the Week ending January 12, 1884.**

Price 10 cents. For sale by all newsdealers



## QUANTITY OF WATER PER HORSE POWER.

It is well known that the evaporation of water per pound of coal differs largely in different classes of boilers, and even in those of the same class, but of different proportions. This difference ranges from an evaporation of say 5 pounds of water per pound of coal in a poor or indifferent boiler to about 11 or 12 pounds of water per pound of coal in boilers of a better class well proportioned.

For the purposes of this article, we will assume that 8 pounds of water per pound of coal is a fair average for good boilers as now in use. We will further suppose 150 pounds of coal per hour consumed; then the evaporation would be $150 \times 8 = 1{,}200$ pounds water evaporated. This is the quantity or weight of steam that the boiler can supply, or the gross quantity applicable to the engine, and if the unit of 30 pounds steam per horse power per hour be assumed, it would be a 40 horse power boiler; but whether the power actually realized be 40 horses, or more or less, depends upon the economy with which the steam is consumed.

Now if this power be supposed to be the gross power of a fall of water, it would be readily understood that the available or useful power to be obtained would very largely depend upon the character and perfection of the water wheel to which the water was applied; whether such wheel should give out 50 per cent or 80 per cent of the gross power of the fall. So it is in the use of steam in the engine; the boiler supplies a gross quantity or weight of steam per unit of time, but what shall be the available or useful power given out by that weight of steam must depend in a great measure upon the character, condition, and perfection of the engine by which the steam is consumed. We have in use: 1st. The plain slide valve engine, working with little or no expansion; 2d. The adjustable cut-off engine, working with a fixed ratio of expansion determined by the amount of work to be done, or by the fancy of the engineer. And 3d. The automatic cut-off engine, in which the ratio of expansion is determined by the engine itself to exactly meet the requirements of load or work of the engine at any given instant of time. The economy in the use of steam in these different classes of engines is in the order named, the first being that of least economy and the third that of the greatest economy.

But there is still the matter of the *condition* of the engine to be taken account in considering the question of economy. If there are losses from leaks at any point between the boiler and the working side of the piston of the engine, either from joints, valves, or piston, all such leaks militate against economy.

Now there being such great variations in the conditions under which the steam is consumed, it is quite evident that no *one* unit of horse power per pound of steam consumed would be applicable to the different classes of engines.

At the Centennial Exhibition of 1876, the committee to whom was referred the testing of steam engines and boilers had this question before them, and after full consideration fixed the unit of one horse power, generated in *the boiler*, at 30 pounds of water evaporated per hour, irrespective of the engine by which the steam might be consumed, and this unit has since been generally accepted by engineers.

It has been ascertained by direct tests that the best class of engines, in good condition, will furnish one horse power from the steam resulting from the evaporation of less than 18 pounds of water per hour; and on the other hand, poorly constructed engines in bad condition have required as much as the steam generated from the evaporation of over 60 pounds of water. But the average experience for the production of one horse power is the unit of 30 pounds of water, or approximately one-half a cubic foot of water evaporated per hour by the boiler.

## ALCOHOL FROM BREAD.

In our paper of October 20, in discussing the modes of *raising* bread, and the chemical changes therein involved, we mentioned the fact that alcohol is one of the constant and necessary results of the process of yeast fermentation, and that it is safe to estimate that at least 1,000 gallons are wasted daily by evaporation in the baking of the bread for New York alone. Is there not here an opportunity for money-making by saving that which now goes to waste?

We alluded to the attempt made some years ago by a company formed in London to do this, which attempt was a failure. But the fact that one trial fails does not imply at all that another may not succeed. That company saved their alcohol easily, but they spoiled their bread, and we printed a note from a correspondent recently who remembered the attempt made in England, and the dryness and of course the tastelessness of their bread.

Now there can certainly be no occasion for this, that is, none excepting human greediness. Why is there need of looking for any more alcohol than that which regularly and normally goes off in the daily process of baking? If we will be content with that, we surely may save it, and we shall have just as good bread as that which we bake in our ordinary modes. But if we are bound to get all the alcohol possible, it is true we may do it, but we shall have bread which has lost its sweetness. We cannot have both at the same time.

We can scarcely deem that any special process is needed for doing the work; any opportunity for inventive skill. It is too simple for that. We are told that the London company expended $100,000 on their works, and it is not impossible that the very elaborateness itself was involved in the failure.

The plan which seems to us perfectly practical is this: A baker's oven is of course a closed chamber. A pipe conducted from the crown of its arch would be constantly carrying away, during the baking, whatever vapors passed off from the bread, which would be a mixture, aqueous and alcoholic. If this pipe were led through cold water, like the worm of a still, those vapors would be condensed. What opportunity here for expense? The cost of the pipe is the only thing. The oven remains precisely as it was, the baking goes on as before, and without the slightest reference to the distilling process. When the bread is baked, it is taken from the oven; the fact that a pipe was attached above has made no difference. We were baking bread, and we have done it, and as good bread as we knew how. If as a collateral product we have condensed any alcohol, very good; so much the better, and we have not injured our bread. But if in our greediness we try, because alcohol is worth money, to run our bakery as a distillery, we shall fail; and serve us right too.

## THE DEMAND FOR SKILL.

Notwithstanding the present slackness in business, there is a demand for skill in the mechanic arts now, as there usually is. The proprietor of a manufactory of machine tools recently supplemented a jeremiad on the dullness of the times by an inquiry for several first-class workmen. In explanation he said he had more than he needed of the qualities of "main strength and stupidity" in his establishment, but still had room for cultivated eyes and hands guided by judgment; in short, skilled workmen were in demand.

There is reason for this condition of affairs. The more nearly absolutely automatic machinery can be made, and the more exact hand tools and appliances can be made, the more exacting are the demands for personal skill and judgment. Machines are made, they do not grow, and they are made by the intelligent and skillful mechanic. They will not even keep in useful operation and continue in useful life except by constant care and the oversight of the skilled mechanic.

The time has passed when the idea of working materials was to hammer and bang them into shape somehow, with crude tools and cruder appliances. In the case of the metals especially, the workman uses good judgment with fine tools. No finer work is done and no more perfect results are obtained in any department of human production than in that of the working of metals, and to accomplish such results the most exact of tools must be wielded and guided by the most skillful hands and the most careful judgment.

## THE PONS-BROOKS COMET.

This interesting comet is approaching its brightest phase. As soon as the full moon of the 12th is out of the way, it will be in a most favorable condition for observation until it reaches perihelion on the 26th, and its course may be easily noted on every clear night. It was not plainly visible until the 21st of December, when it faintly beamed forth in the constellation Cygnus as a small nebulosity with a very small tail. Every clear night since, it has been distinctly seen, increasing in size and brightness, while its tail is lengthening into respectable dimensions. This is the naked-eye view. In the telescope, it is a beautiful object, a round nebulous mass larger than the full moon, with a bright nucleus in the center, and with a large tail extending east. Observers who watch it from night to night marvel at its rapid race over the sky. Making its way through Cygnus on the 21st, when first permanently visible, on the 23d it was between Gamma and Epsilon in the southern arm of the Cross. On Christmas night it was close to Epsilon, and on New Year's night it had passed the boundaries of Cygnus and entered those of Pegasus. Making its way through Pegasus, and passing near Zeta of that constellation, it will soon be found in the vicinity of Beta in the constellation Pisces. Traveling rapidly to the southeast, it will pass into Cetus, taking Phœnix next in its course, then Eridanus. On the last week in March it will be found in Horologium, when its luster will be about the same as at the time of discovery. After that time, it will soon be beyond the reach of the most powerful telescopes, and be seen no more until its return in the year 1955.

We give the following ephemeris taken from *Ciel et Terre*, by means of which observers in the possession of star maps or charts can easily follow the comet's course.

EPHEMERIS OF PONS-BROOKS' COMET.

| DATE. | R. A. | D | LUSTER. |
|---|---|---|---|
| 1884. | h. m. | | |
| Jan. 2. | 21 53 | +22° 1′ | 3, 5 |
| " 12. | 23 1 | + 2° 5′ | 4, 1 |
| " 22. | 28 53 | −15° 2′ | 3 |
| Feb. 2. | 0 34 | −28° 3′ | 2, 3 |
| " 11. | 1 2 | −37° 2′ | 1, 5 |
| " 21. | 1 23 | −43° 7′ | 1, 0 |
| Mar. 2. | 1 43 | −48° 5′ | 0, 6 |
| " 12. | 2 2 | −53° 0′ | 0. 4 |
| " 22. | 2 26 | −56° 2′ | 0, 4 |

It will be seen that, according to the Brussels ephemeris, the comet reaches perihelion at an earlier date than that given in the American ephemeris. In the matter of luster, 1 or unity corresponds to the brightness of the comet when it first became visible to the naked eye in 1812. It will be remembered that right ascension corresponds to terrestrial longitude, and declination to latitude. Any observer with a star-map, finding the right ascension and declination, as here given in the ephemeris, will find the approximate place

of the comet where the lines cross, and can thus follow its track.

The comet will rapidly diminish in luster after perihelion, when it will be about 71,000,000 miles from the sun. It will probably be visible in this latitude until the last of February. Its luster at perihelion will be four times greater than it was at its appearance in 1812.

An interesting incident conected with the comet was announced at a recent meeting of the Boston Scientific Society. The plane of the earth's orbit and that of the comet coincided on the 6th of December. Mr. Chandler, of the Harvard College Observatory, had suggested previously that when the earth reached that position in space, meteors would be seen moving in the comet's orbit. The prophecy was fulfilled. On the night of the 6th of December three members of the Society discovered twelve or more meteors radiating from this very point, in space.

It is confidently expected that the Pons-Brooks comet will grow much brighter, and project its tail farther into space before reaching perihelion. But there is always a fascinating uncertainty about comets. Our present visitor has had one or two sudden outbursts and has as suddenly grown dim. No one can tell what will come next; neither can any one understand why the comet that looks down upon us this year should be four times as bright as upon its former visit, seventy-one years ago! We must expect changes as the fleet footed visitor approaches the sun. A noteworthy change is now going on. A second tail is being developed while the original one is rapidly extending, and observers of the present generation may behold the long wished for sight of a comet with two tails, unless the second tail vanish as suddenly as it appeared.

## DRILLING AND BORING GUN BARRELS.

To the unmechanical eye, and to some mechanics, the true drilling of a gun barrel or a rifle barrel appears to be an almost impossible job, but in reality it is as simple as many other processes that awaken no surprise. Some gun barrels are made hollow at the beginning of their formation. Those which are rolled from "skelps," and have a welded seam along their entire length, are rolled on a rod that is the rudimentary bore. So, also, the damascened, or "stub and twist" barrels are hand-welded in a spiral of about three-quarters of an inch wide—technically, a pitch of three-quarters—on a rod that leaves the beginning of the bore. Neither of these sorts of barrels is drilled—they are only bored or rimmed. But the best rifle barrels and pistol barrels are drilled bars of solid steel, and the drilling is a more exact job than the boring. The bars, cut to proper lengths and annealed, are placed upright in a drilling machine, each bar resting on a revolving disk or chuck, and held in place by a guide at the top. The drills are fed down by an adjustable weight. Usually the drills are twist drills, but even when they are used they must be removed for every two or three inches of drilling and the barrels emptied of chips. Some manufacturers prefer a half-round drill with a single projecting cutting lip on its end. In either case the rotation of the barrel and its upright position are expected to insure a true hole from end to end.

All barrels, whether formed hollow or drilled from the solid, must be bored to size. This is effected by means of a bar of cast steel, round except for from twelve to fifteen inches from the end, which is forged square and ground perfectly true to gauge, which is slightly smaller than the intended diameter of the bore. On one of the faces of this squared portion is placed a segmental slip of soft pine wood, the cross section of which corresponds nearly to that of a "half-round" file. This piece of wood goes in with the rimmer, and secures a perfectly round hole, and prevents chattering. If the bore requires enlarging, one or more slips of paper are placed between the wood and steel. This boring is the final finish of the barrel before rifling.

## Improved Testing Machines.

At a recent meeting of the American Society of Civil Engineers in this city, a paper by Mr. A. V. Abbott, on "Some Improvements in Testing Machines," was read by the author, and illustrated by a stereopticon. A 200,000 pound testing machine was first described, its general construction providing for weighing the forces applied by means of platforms and levers somewhat similar to those used in ordinary scale work with special arrangements to reduce friction. To secure the direction of the pressure upon the test pieces in the axis of the machine, both ends of the piece are connected with segments of spheres moving freely in spherical sockets which take the proper position upon the first application of the stress.

Arrangements are also made by means of wedges to grip, and hold uniformly the ends of the test pieces. The machine is arranged to test in tension, compression, for transverse stress, for shearing, bulging, and torsion. In the machine exhibited the action of applying stress is automatic, and at the same time the same power gives an autographic record of the stress applied, and of any variations which may occur during the continuance of the stress, and with an instantaneous autographic record of the result at the conclusion of the test. The stresses are applied by means of weights which slide upon two parallel lever beams, the one registering up to 10,000 pounds, and the other up to 200,000. By means of a remarkably ingenious electrical attachment, connected with clock work, the movement of these weights is continuous and automatic, and the registering apparatus is also controlled by the same electric current.

It is impossible in this abstract, and without the aid of a diagram, to fully describe the details of these movements, but they seem to be very complete and accurate. Diagrams automatically made by the machine were exhibited and described.

A number of broken pieces of steel were exhibited, and also specimens of woods which had been tested in various ways. Machines of smaller powers were also described, and a number of briquettes of cement were broken upon a small automatic machine, which was exhibited.

## Boston's Sewerage Experiment.

The public will follow with interest Boston's experiment of leading its sewage into deep tide water. This morning the pumps will be set in motion at Old Harbor Point, the final discharge being at Moon Island. The entire cost has been $4,544,272, and the building of the sewerage is spoken of as "one of the greatest engineering feats of the age." It may seem a little hypercritical to express a regret on this inaugural day of great enterprise that Boston did not see fit to include in its plans all the possibilities in the case. London has taught the world that a nuisance can be turned into a profitable product available for agriculture. The market gardeners about the city eagerly take up all the sewage fertilizers turned out at the London works, and find them even better than what they buy in the market.

At Pullman, the infant city of Illinois, also, the revenue derived from the sale of the manipulated sewage is a good and fair interest upon the money invested in the works, to say nothing of the incalculable benefit to the community in the solution of a serious difficulty. A glance at the North Cambridge and Arlington meadows, and, in fact, the market gardening section of Middlesex County, ought to satisfy any one as to the extravagance of the policy which dumps the refuse of a great city into the sea. It is an open question, moreover, whether the "deep tide" will take and hold this sewage. Nantasket and the contiguous beaches may have occasion hereafter to thank Boston heartily for perfuming the surf and giving a new value to their bathing privileges. Of course the present works need not be abandoned, even if they prove to be a nuisance. The pumping station can be turned into a fertilizing factory, but the roundabout way of getting at it will certainly be very expensive.—*Springfield Republican, January* 1.

## The Planet Jupiter.

We never look upon Jupiter at opposition without rejoicing that, when the vast nebulous mass that once filled and extended far beyond the limits of the solar system quickened into life and threw off the concentric rings of which the planets were formed, the largest rings condensed into the planet Jupiter. Thus, the lesser members of the brotherhood may behold the magnificent spectacle of a planet second only to the great sun himself, a miniature solar system with a quartet of revolving satellites, a telescopic wonder on which the eye rests with ever new delight. The huge planet has not yet cooled down; his primeval fires still blaze, and he gives out light and heat to the moons that surround him, and as readily yield to his sovereign power as their mighty lord bows to the sun's resistless sway. Observers on the earth, nearly five hundred million miles away, may watch the process of world making on this distant sphere. In the belts that diversify his disk, in the huge spots that from time to time agitate his mass, in the immense cloud atmosphere that conceals his fiery nucleus, we behold, on a grand scale, the progress of the cooling process that millions of years ago stirred to the depths the earth's lesser bulk, before it developed to the perfection of its present condition as an abode for animate life. Just as surely will the prince of planets reach, latest of all the sun's family, the same perfection of development, when millions of years hence the earth, like the moon, has arrived at the period of inevitable decay, and, preceded on the list by Mercury, Mars, and perhaps Venus, will be floating through space as a dead world. Viewed in this light, every changing belt, every new spot, and every sudden rift are a revelation in Jovian language of the tremendous commotion that will eventually bring order out of chaos.—*Providence Journal.*

## The Importance of the Mechanic.

Each ensuing day makes more prominent the fact that we have come upon the time when the mechanic is master. We have crowded professions and ill-filled trades. A chance to fill the position of sub-assistant clerk in a wholesale house is eagerly grasped at by a hundred applicants, though the wages received be scarcely more than "a chance to learn the business." Let a master workman try to obtain an apprentice at three times the salary offered the clerk and his applicants will be poor alike in quantity and quality. A skilled workman in any trade need never want for hire; he is eagerly sought after by a hundred employers; he is independent of the condition of the market; the skill and cunning of his hand and eye are too valuable to lose, and must be paid whether the products are slowly or rapidly consumed. If business ceases, the master hand is eagerly seized by some rival house, which knows and values the product of his skill. He who would crush down the obstacles to success in our own days must have, as well as the wit to see the crevice, the strength to deal the blow. This is an age of the steam engine, and it is the engineer, not the conductor, who is master.—*Boston Commercial Bulletin.*

## Patent Office Affairs.

WASHINGTON, Dec. 31, 1883.

That Congress not only made no increase in the clerical force of the Patent Office last year, but actually reduced their number by twenty, is being prominently brought to the attention of Congressmen. It is undeniably a strong argument for ample force in the Patent Office that there is now a surplus of $2,500,000 in the National Treasury belonging to the Patent Department. A system of lessening the cost of patents by a graduated scale of fees has been proposed, but excessive cost is not so often complained of as the sometimes inevitable delays, many of which might be avoided by a more generous use of the money of patentees in paying for help in the Patent Office.

The Commissioner of Patents is required by law to make a report to Congress at the close of each calendar year, and I have made some inquiries as to the statistics it will embrace. There has been an increase in nearly every branch of the office over last year, and the receipts for moneys paid in during 1883 over 1882 is, in round numbers, $135,000. This, however, does not equal the increase of 1882 over 1881, which was $155,556.66. The increase in correspondence has been about ten per cent, and in applications of every kind nearly twenty per cent. The number of patents forfeited during the year is about 2,000. These figures are not exact, for in none of the divisions have any steps been taken toward furnishing the data for the Commissioner's report, which must be presented to Congress within the next month, but they are sufficiently close to show that the patent business throughout the country is not retrograding; it is rather constantly increasing in importance and demanding more rigid attention of the lawmakers and those who administer the laws.

The Civil Service Committee has completed its rules for the examination of applicants for positions in the Patent Office, and they will be published on Thursday of this week. For the position of assistant examiner the applicant will be required to show a knowledge of arithmetic, of algebra to equations of the second degree, of geometry and trigonometry, of chemistry and physics. For draughtsmen, drawing from mechanical models and explanations of certain rules for mechanical drawing will be required. For the position of assistant librarian, which is now vacant, a knowledge of French and German, and the ability to properly translate those languages into idiomatic English, is required, as well as explanations of methods of cataloguing, and the proper arrangement of books by classification of subjects. This knowledge of German is also made desirable in those seeking positions as assistant examiners.

The controversy respecting the electric railway is now fairly inaugurated in the Patent Office. The proceedings have been somewhat delayed by the taking of testimony abroad under a commission in support of the claims of the celebrated German scientist, Dr. Werner Siemens, of Berlin. Counsel were heard in argument upon the merits of the case last week, before the Examiner of Interferences. The point is to construct a commercially practicable railway, which can compete with the existing modes of transportation.

A small section of road was built and operated by Siemens, at the exposition at Berlin, in 1879, and there are now several short lines in operation in various parts of Europe, and notably one at the Giant's Causeway, in Ireland, familiar to travelers. Edison has a line two miles and a half long, at Menlo Park, N. J., fully equipped and in daily operation, for the benefit of visitors and pilgrims to the shrine. There is also an experimental road at Saratoga Springs, and another claimant is Stephen D. Field, of New York, a nephew of Cyrus W. Field.

The Commissioner, on Friday, gave a decision in a case which has been long pending, the application having been filed January 6, 1883, wherein it was claimed that John T. Berchers had discovered a method to effectually and fully preserve fish in cans. His method he described as cutting the fish longitudinally and in thin slices, instead of transversely and in thick lumps or chunks. Both the examiner who had the case in the first instance and the Board of Examiners-in-Chief decided that there was nothing patentable in the application, and the Commissioner, after fully setting forth the facts in the application, sustains the opinion of the examiners.

The new classification of subjects of invention, which is the official guide of the office in the distribution of applications for official action, when ready, will be published as a supplement to the *Gazette.*

The House Committee on Patents, as announced by Speaker Carlisle, is as follows: R. B. Vance, N. C.; O. R. Singleton, Miss.; C. S. Mitchell, Conn.; J. E. Haskell, Ky.; George W. Dargan, S. C.; J. Winans, Wis.; W. P. Hepburn, Iowa; H. L. Morey, Ohio; L. E. Alkin, Pa.; and W. W Rice, Mass. This is considered a good committee, some of the members having had experience in the committee heretofore.

The Senate Patent Committee is as follows: Orville H. Platt, Mass., chairman; George F. Hoar, Mass.; John I. Mitchell, Penn.; Elbridge G. Lapham, N. Y.; Richard Coke, Texas; Wilkinson Call, Florida; and J. N. Camden, W. Va.

Already a number of applications for extension of patents, which can only be done by Act of Congress, have been filed and they will all be carefully considered before action.

FRANKLIN.

### Nature of Electricity.

Prof. Thompson has shown how a series of floating magnet poles of like name, repelling one another, tend to produce equal distribution of the poles. Prof. Thompson, arguing from the second law of electrostatics (inverse squares), sought to explain the first law in a rational manner, on the hypothesis of self-repelling molecules, which tend to uniform distribution. When there is a surplus in one part and a deficit in another, the molecules are urged toward each other, *i. e.*, attract. This was shown by putting a surplus of floating magnets at one part of the basin. By the movements of these magnets, when confined in barriers and with surplus and deficit purposely made, the author imitated the effects of a Leyden jar, induction, a battery current, etc., the motions and arrangement of the poles illustrating the hypothetical behavior of electricity. The author was led by the hypothesis to infer that either the ether is electricity, or that the ether is electrified, and the former seemed the simpler conclusion.

### GRINDING MILLS.

High grinding, low grinding, and gradual reduction, or a system which will more or less completely embody the elements of any two systems, have engaged the attention of millers to a remarkable degree for some years past. With the efforts made for the advancement of this industry there have come remarkable improvements in all kinds of grinding mills. The dressing of burr millstones and the attention given to their running have also directed inventors to the making of improved forms of other grinding mills, where various designs of grinding and cutting disks of metal have been introduced for a greater variety of work, and for its performance in a much better way than was formerly possible.

We herewith illustrate some points of mills now being made, which are guaranteed to do a wide variety of work—to be fully equal to any pair of French burr millstones or any roller mill for the reduction of wheat to flour, either for the first breaks or regrinding the middlings and bran, also for fine corn to table meal, or corn and cobs to feed meal, as well as drugs, spices, and calcined bones to powder.

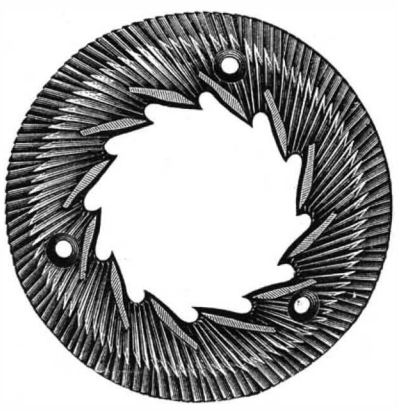


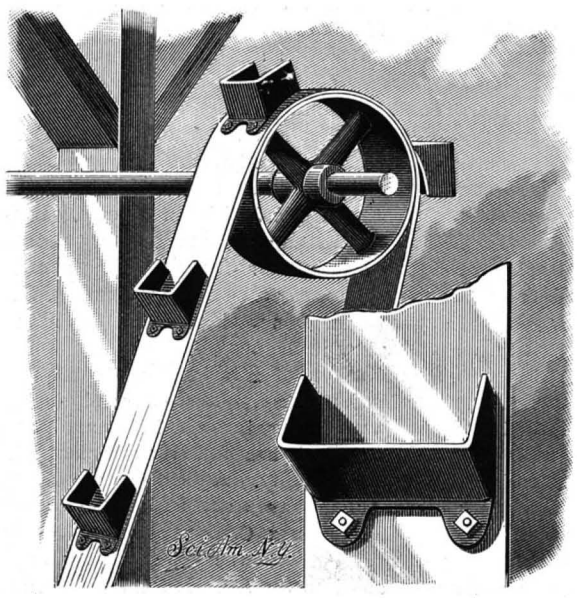
Fig. 1.

Fig. 1 represents the front side of the grinding disk, and Fig. 2 is an enlarged view of the same. The first reduction is produced in the bosomed part of the disk, where the furrows run sharp cutting edge front, to cut the grain fine with the least power possible. The second reduction is upon the flat outer circle of furrows running their inclined sides front, to mash and mellow the meal already cut fine. The saw toothed inner edge of the disks forms a natural crusher, to reduce pieces sheared from the cob, so they will pass through the mill by the aid of the conveyer flights arranged around the eye of the disks. These conveyer flights are arranged to act like a fan to draw cool air and grain into the mill at a low speed. The grain, first cut fine, is then rolled, mashed, and mellowed so perfectly that it enlarges in bulk. The grinding disks are cheaply renewed and easily interchangeable. A spring extending from the bridge tree down to the base gives sufficient elasticity to allow of nails and spikes passing through the mill without injury, while not crowding during the grinding.

These mills are made in several varieties, adapted for either animal power or steam or water power, the "Scientific grain mill" and "Quaker City grinding mill" especially having acquired an enviable degree of popularity. Their special construction is covered by several patents, and the makers, Messrs. A. W. Straub & Co., of 2,227 to 2,231 Wood Street, Philadelphia, endeavor to make them the best mills in the market.

### ELEVATOR BUCKET.

The buckets shown in the accompanying engraving may be constructed of either wrought, malleable, or cast iron, or other suitable material. Each bucket is made with a back and sides but without any bottom, the belt on the outside of which the bucket is arranged serving that purpose. The outer edges of the sides are so shaped as to conform, or nearly so, to the circular travel of the belt around the drums.



HOLMES' ELEVATOR BUCKET.

The buckets are secured to the exterior of the belt by short bolts passing through flanges on the back, whereby they may be readily attached to or removed from the belt. By making them without an attached bottom and arranging them on the outside of the belt they will readily and quickly empty themselves as they pass over the upper drum of the belt, as the flexing of the belt will work the contents away from the open bottoms of the buckets, relieving the mass within and giving it a quick and free discharge. The construction effectually prevents the clogging or sticking of the mass to the interior. As the buckets have but three sides, the belt answering for the fourth, they can be more easily made than those having four sides. The elevator can also be arranged vertically or nearly so, and its buckets will empty freely, thus saving a large amount of space in mills having several stories. This form of bucket is cheap, simple, and durable.

This invention has been patented by Mr. Joseph A. Holmes, of Greenland, N. H.

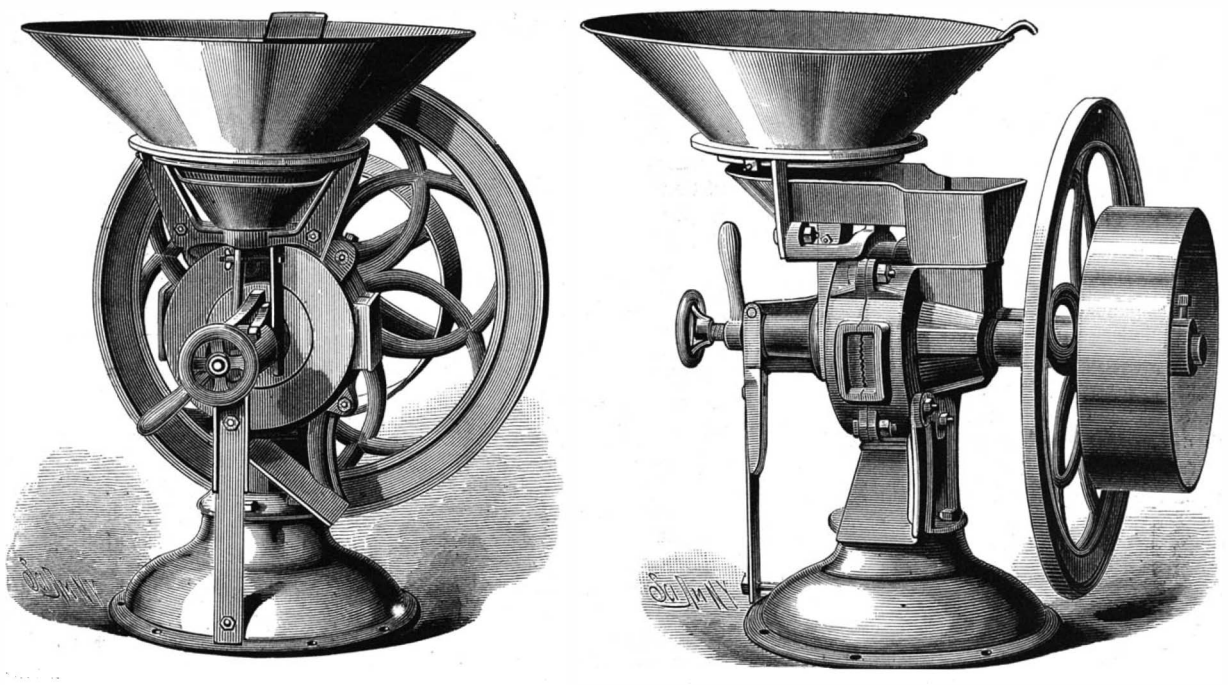
### Demagnetizing of Watches.

One of our contemporaries, in noticing the "queer freaks of watches" from having become magnetized by being brought too near dynamos or swift running belts, is led to refer to the Maxim machine for demagnetizing them as one whose "mechanism is a secret." Readers of the SCIENTIFIC AMERICAN will doubtless remember that we gave illustrations and description of this machine in August, 1881. The theory on which it works is that the different parts of the watch—the plates, arbors, mainspring, balance wheel, etc., all being magnetized, though with different degrees of strength, are brought within the influence of a powerful magnet, and then rapidly rotated, so that the watch is subjected to rapid reversals of polarity, while at the same time it is being steadily withdrawn from the field of influence of the magnet. The opposite poles, of course, destroy the magnetism of each other, and the recharging of each separate piece in the watch is prevented, or rather is successively weakened by the gradual withdrawal under the compound motion the machine gives the watch. An interesting paper explaining early experiments in this ine, with full illustrations, will be found in SUPPLEMENT Nos. 206 and 207. It was written by Prof. Alfred M. Mayer, of the Stevens Technological Institute.

### Another Possible Cause of Boiler Explosions.

M. Vignes, in the *Journal la France*, draws attention to experiments made as long ago as 1846, by Professor Donny, of Ghent, and intended to show the influence which air exercises on the boiling point of water and on the character of its ebullition, In this experiment, ordinary water is placed in a clean glass tube, open at one end, and boiled long enough to drive away not only the air above the surface of the water, but all the air dissolved in the water. Then when the upper part of the tube is full of pure steam, the mouth is hermetically sealed and the tube is left to cool. When cool, it is about half full of water, above which is vapor of water at a very low pressure. The tube being thus prepared, its lower end is plunged into a bath of glycerine or oil, which is gradually heated. No ebullition is visible in the tube when the temperature reaches 234 degrees Fah. At 240 degrees Fah., however, the column of water bursts, as it were, in two, with a sudden explosion, and part of it is flung against the sealed end with such force as often to break it open. Now in industrial works, it often happens that a boiler, having been filled with water, works for three or four hours without receiving a further supply. It may then be cooled down, and the next time it is wanted it may very probably be fired up again without starting the feed pump, the water level being judged sufficiently high; but the water in such a boiler will be in the same condition as that in the test tube; that is, it will be deprived of all air, and consist of water below and vapor above, the latter, however, being probably at a much higher pressure than that of the water in the tube. This water has no free surfaces in its interior due to the presence of bubbles of air, from which evaporation can take place. Consequently, as in the test tube, there will be delay in vaporizing—at least, until the expansion becomes great enough to overcome the pressure of the superincumbent vapor, and a sudden flashing into steam, which will be of the nature of an explosion, and may easily overcome the resistance of the boiler. The pressure thus attained may be very great. In the test tube, the pressure of the temperature of explosion—240 degrees Fah.—will be eighty-six times what may be taken as the pressure of the superincumbent vapor in the boiler, as already observed. That pressure will probably be much higher, and the pressure of the explosion will probably be much higher also. To avoid this source of danger, it will be sufficient, as M. Vignes points out, to make it a rule always to feed a boiler when it is fired up after standing. This will have the double effect of lowering the pressure and of facilitating evaporation, by distributing the mass of water in the boiler, and charging it to some extent with bubbles of air. Meanwhile, the facts he has adduced are certainly sufficient to warrant a belief that we have here a key to many cases of boiler explosions which have hitherto been wrapped in mystery, and it seems very desirable that careful and precise experiments should be undertaken to prove or disprove the production, on a large scale, of the phenomena thus shown to exist in laboratory experiments.

Fig. 2.



STRAUB & CO.'S GRINDING MILL.

### The Knibbs Valve Patent Suits.

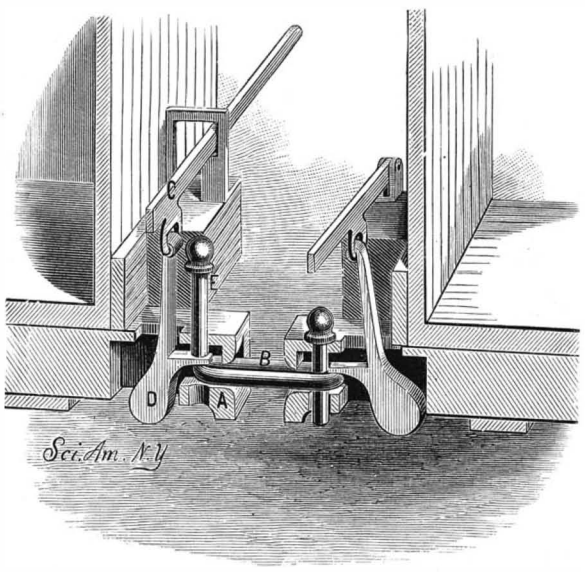
It is expected that the old Philadelphia, the first steam fire engine, which was recently taken to Boston as evidence in an important patent suit against that city, will be returned to its owners, the Insurance Patrol, to-day or to-morrow. The suit was by Marcus P. Norton and others, assignees of James Knibbs, of Troy, N. Y., who claimed to hold the original patent for a relief valve which was extensively used upon its steam fire engines by the city of Boston and elsewhere throughout the country. In the former city alone the royalties claimed by the plaintiffs amounted to $450,000. The part taken in the case by the old engine Philadelphia was interesting. It seems from the statement of those who accompanied her to Boston that she was wanted to prove that the valve for which the complainants claimed the patent right had been used on her two or more years before the patent was issued. During the trial the court and jury adjourned to the Boston Common to witness a practical comparison of the working of the valve of the old engine with that of one of the latest construction. The result, it is said, was amazing, as the old engine, which many feared could not stand the strain, threw a larger stream with two pieces of hose than the other did with one. The valves, it was stated, were shown to be the same, to the satisfaction of the jury, and a verdict for the city of Boston was rendered on Saturday last. Among those who testified with reference to the valve of the Philadelphia was Jacob Neaffie, builder of the engine and member of the firm of Neaffie and Levy; Joseph L. Parry, the designer; Richard Warren, an engineer of the present Fire Department; and George Kurtz, the original engineer of the Philadelphia, who conducted the practical test at the trial, and who managed the engine over 20 years ago, when her usefulness was exhibited in the city of Boston, near the same spot, and a prize of $600 won.—*Phil. Ledger.*

### Plate Glass Insurance.

A plate glass insurance company having to pay 1,456 losses in eight months to September, report 343 breakages from stone throwing, etc.; imperfect glazing caused 144; 86 door plates were broken by wind and 59 by wind and hail; burglars, 76; malicious persons, 43; runaway horses, 24; persons falling on sidewalk, 39; window cleaners, 103; moving shutters, 54; with other breakages from 59 down to 1, the last caused by a flying owl.

### CAR COUPLING.

The drawhead, A, which is of the usual form, is provided with a longitudinal slot in the bottom, in front of which are the usual pin holes. Two blocks project from the end of the car, and on one of them a standard is secured to which a lever, C, is pivoted, which passes through a slot in a standard on the other block. An offset or shoulder is formed in one edge of this slot on which the free end of the lever can be rested when it is to be held in a raised position. The lever extends nearly, or quite, to the side of the car, and if desired can be connected with a rod extending to the top of the car. To the middle of the lever is pivoted a pendulous ocking bar provided at its lower end with an inwardly and downwardly inclined weighted lug, D, and with a prong projecting toward the outer end of the draw head. The top of the draw head has an aperture through which the pendulous bar passes. When a car is uncoupled, the free end of its lever is raised and held in this position on the shoulder as shown in the left of the engraving. The coupling pin, E, will also be raised as it rests on the projection. The



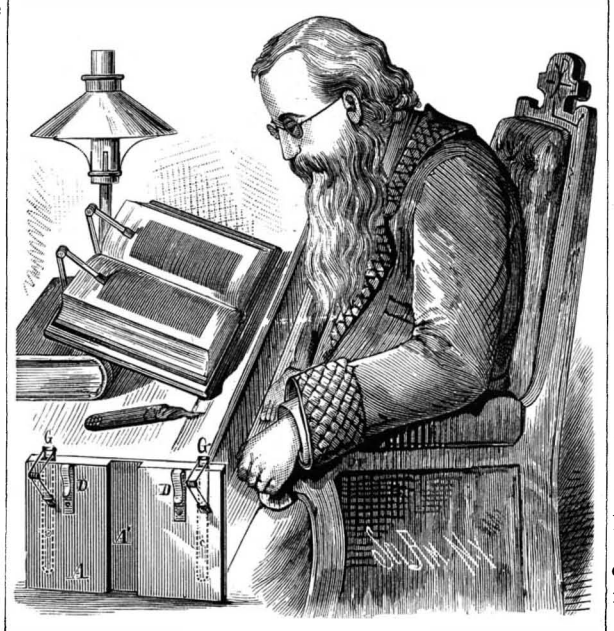

DOUGHERTY'S CAR COUPLING.

weighted lug tends to swing the bar toward the end of the draw head, thus keeping the projection in place. As the link enters it strikes the lug below the projection and swings the bar inward, thereby moving the projection from under the pin, which drops through the link, coupling the two cars together. When the free end of a link held in one draw head is to be raised so that it can pass into the opposite draw head, the weighted end of the pendulum bar is permitted to act by its own weight on the end of the link, as indicated in the right of the engraving.

This invention has been recently patented by Mr. M. J. Dougherty, whose address is Box 136, Carbondale, Pa.

### BOOK HOLDER.

The board upon which the book is to rest is provided with a wide central transverse groove, A′, for receiving the back of the book. The covers of the book rest on the raised parts of the board at each side of the groove, and are held in place by spring tongues, shown at D, secured to the upper surface of the raised portions. Parallel with and a short distance from each end is a recess formed in each raised part of the board, and which are open at the upper edge of the board. In the recesses are held sliding frames, which are bent upward at their outer ends, forming spring arms inclined toward the upper surface of the board and having pads on their free ends. The pads are pressed on the leaves of the book, holding them down. A pintle passing through each slot and slide prevents the slides from being




WOOD'S BOOK HOLDER.

entirely withdrawn. When a leaf is to be turned the spring arms are raised and the slides drawn from the recesses, so that the arms will be entirely out of the way of the leaves. The slides are held in this position by the friction caused by the pressure of the spring against the sides of the recess. The device can be placed on vessels, desks, music racks, etc.

This invention has been patented by Mr. Elbridge J. Wood, of Palmer, Mass.

### Manufacture of Tin Plate.

Stoll, of Stuttgart, delivered a lecture on this important industry, one of the few not known here, of which Dingler's *Polytechnic. Journal* publishes the following interesting abstract:

Tin plate can be classified, according to the iron used, as follows: Charcoal plate, puddled iron, coke plate, and steel plate. In a few works sheet iron is still made of iron refined with charcoal. Of course an excellent quality of pig iron must be used to make puddled iron of good and best quality. Steel plate is made of very tough steel made by different processes. The so-called charcoal tin is made by refining pig iron and scrap with charcoal, and is very dense and strong. For this reason tin plate made from it is rather harder to work, but will stand longer and is better than that made from softer iron. Only puddled iron is generally used for coke plate, since a better quality is rarely required for such tin.

The iron used in making tin plate is prepared as follows: The blooms, weighing from forty to fifty hundredweight as they come from the puddling or refining furnaces, are first placed under steam hammers, then rolled into thin bars, which are cut up and tied in bundles. These bundles are strongly heated in the reheating furnace, thoroughly wrought, heated again, rolled into bars in calibrated rolls, then cut in lengths corresponding to the different sizes of plate, and called platins or plate iron. These bars are then rolled out with hard rollers into sheets, which are trimmed with huge scissors to the exact sizes met with in commerce. The sheets must be pickled to remove the coating of oxide (rust), either hydrochloric or sulphuric acid being used according to circumstances.

The material is rendered so hard and brittle by this treatment that it has to be annealed before proceeding to the next step, namely, smoothing and polishing it. This is accomplished by heating it in tightly closed boxes or muffles, the plates being packed tightly together. These muffles are placed on wagons and run in a warming furnace, where they are left ten or fifteen hours. The polishing is performed by drawing the sheets of iron, after they have been pickled and tempered, between polished rolls of hard cast steel heavily weighted.

To get a clean metallic surface, such as is requisite to receive the tin, the iron must be dipped repeatedly into quite dilute sulphuric or hydrochloric acid, then polished and scoured, each one separately, with sharp sand over the entire surface. It is now ready to receive the tin, and passes to the tinning room.

In this room there are five kettles, all of the same height, placed in a row and heated with fires beneath them. They are called the grease kettle, the tinning kettle, the brush kettle, the fine tin or roller kettle, and the grease kettle. The different operations performed in these kettles take place in this order: The pickled and scoured plates are put in the first kettle and thoroughly coated with grease; usually pure tallow, but sometimes palm oil is used. Then it goes to the tin kettle, in which it is moved about until evenly tinned all over. From this it goes to the third kettle, also containing tin. Here each individual plate is taken out and brushed with an oakum brush or pad of hemp to remove the coarser particles. It is next put in the fine tin (*passirkessel*), then in the last kettle, that also contains hot grease, on a grating, or moved up and down in it by rollers. When the plates come from this kettle they are placed on racks to cool. The tinning is now completed, but they do not look very nice, owing to the adherent grease. To remove this they are drawn through three or four large boxes filled with slaked lime, sawdust, bran, or flour; flour is the best of all, for it cleans them better, and after it gets saturated with grease the flour can be used for cattle feed.

After the tin plates leave these boxes they go to the polishing bench to remove the dust. This bench consists of a table covered with woolen cloth, or a sheep pelt, and the sheets are rubbed singly with a rubber made of wool or sheepskin, which brings out the pure, fine luster of the tin.

The tin is next assorted by a careful inspection of both sides, and classified as first, second, or third quality. Sheets that are imperfectly tinned are sent back to the tinning room, while the rest are packed in wooden boxes and the brand burned on.

Attempts have been made to replace the fat with chloride of tin, but tin plate made in this way was found to be inferior to that made by the old process, because it is far more prone to rust. At present scarcely any tin plate is made with chloride of tin, but some manufacturers use this process for tinning cooking utensils.

Another improvement consists in passing the tin, as it comes dripping from the last bath of melted tin, between rollers that squeeze off the excess of tin and leave a uniform coating of any desired thickness according as they are set close or far apart.

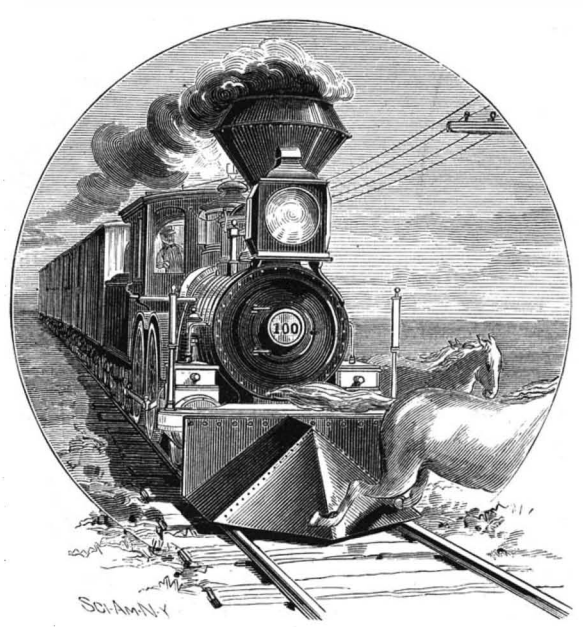
Elm is the wood generally used for boxing tin.

### Errors in Maps of New York State.

The survey of the State of New York, according to the official report of the Commissioners, bears out the conclusion that French's map of 1860 is the best map of the State in use, although it is found that the boundaries of counties in central New York are misplaced from one to two miles. The city of Owego is there placed a mile further west than it really is, and the western boundary of Tompkins County is two miles too far west. The boundaries as marked on the grounds are correct, and the State Survey maps, when completed, will represent the boundaries as they actually exist.

### LOCOMOTIVE COW CATCHER.

The accompanying illustration represents a device for removing or throwing from the track animals or heavy obstructions, such as rocks, without danger of derailing the engine. The cow catcher is made of plates of boiler iron firmly connected to form a ∧-shaped box, open at the under side and inclined to a point at its forward end. At the bottom is a frame of bars, serving to strengthen the plates. The catcher is bolted firmly to the bumper of the




PHILLIPS' LOCOMOTIVE COW CATCHER.

engine, and is made wide enough to cover the rails. On the lower edge of each side is connected a strong spring plate, having its end extending backward and downward so as to terminate just above the rail. The cow catcher is made strong enough to lift an animal so as to throw it back upon the rear part, from which it will roll off. The springs are strong enough to resist heavy pressure, and will remove small objects not removed by the catcher, and, in case the rails should be sprung, will act to force them down so that the wheels can pass safely over.

This invention has been patented by Mr. William Phillips, of Marshfield, Oregon.

## AMERICAN INDUSTRIES.—No. 88.

### THE MANUFACTURE OF STEAM ENGINES AND AGRICULTURAL IMPLEMENTS.

The celebrated manufacturing town of York lies in the famous agricultural region of the Codorus Valley, in Southern Pennsylvania, between Philadelphia and Baltimore, and is about five hours by rail from New York city. Its most important industry is the manufactory of steam engines and agricultural machinery known as the Pennsylvania Agricultural Woks, owned and managed by A. B. Farquhar. These works were founded by Mr. Farquhar a quarter of a century ago, and additions have been made from time to time until they now fairly rank as one of the most complete and extensive establishments, for the production of machinery and implements, not only in the United States but in the world. The works were designed especially for the manufacture of improved machinery and agricultural implements, with tools adapted to every part of the work; and having the benefit of abundant skilled labor at moderate cost (owing to low rents, good markets, and healthy location), and being contiguous to the vast lumber, iron, and coal regions of the country and in easy access of the great cities of New York, Philadelphia, and Baltimore, the proprietor is enabled to offer superior advantages to those needing first class agricultural tools and machinery.

The works cover a number of acres, and embrace machine, engine, and boiler shops, bolt and nut factory, planing and saw mills, foundries for brass and iron, forging, shearing, and polishing rooms, besides warehouses, lumber yards, etc., all complete in itself. Among the specialties are steam engines, saw mills, thrashing machines, plows, agricultural steels, cultivators, grain drills, corn planters, horse powers, etc., in almost endless variety. Some idea of the magnitude of the operations may be formed from the fact that the weekly consumption of iron now averages over 150,000 pounds, and of steel fully 10,000 pounds, and of lumber from 50,000 to 100,000 feet.

The business shows an annual average increase of from fifteen to twenty per cent, necessitating frequent additions to both buildings and machinery. This is a direct result of the principle governing the whole concern—only the best material and most skilled labor are employed, and everything sold is fully warranted; not a single detail is risked by bad work, and if a mistake or defect occur it is promptly made good. The utmost pains are taken at every point to turn out only work of the highest order. As a natural consequence the trade now extends over the habitable globe, and at the time of our visit orders were being filled for nearly every State in the Union, and shipments being made to remote corners of the world. Large additions to the works have been made within the past year, and machinery of the most improved pattern known to the trade has been introduced for the manufacture of each part of the work.

The best relations exist between proprietor and employes, and there has never been a strike in the works. The superintendents and workmen take almost as much interest in the success of the business and quality of the machinery turned out as the proprietor.

No traveling men are employed, the business relying on quality for its maintenance and increase. It is the aim of the proprietor to give full value to all purchasers and to make it a benefit to them to deal with him, and as proof that his efforts in this direction have been successful he points with just pride to his immense and rapidly increasing business. The works ran full handed during the entire period following the financial depression of 1873.

The most competent experts are employed in the several departments, and large sums are expended in order that they may post themselves concerning the wants of different sections and keep the manufactures up to the highest standard of excellence. Many medals from the world's fairs of Europe, our Centennial and State fairs, attest the high regard in which the machinery is held.

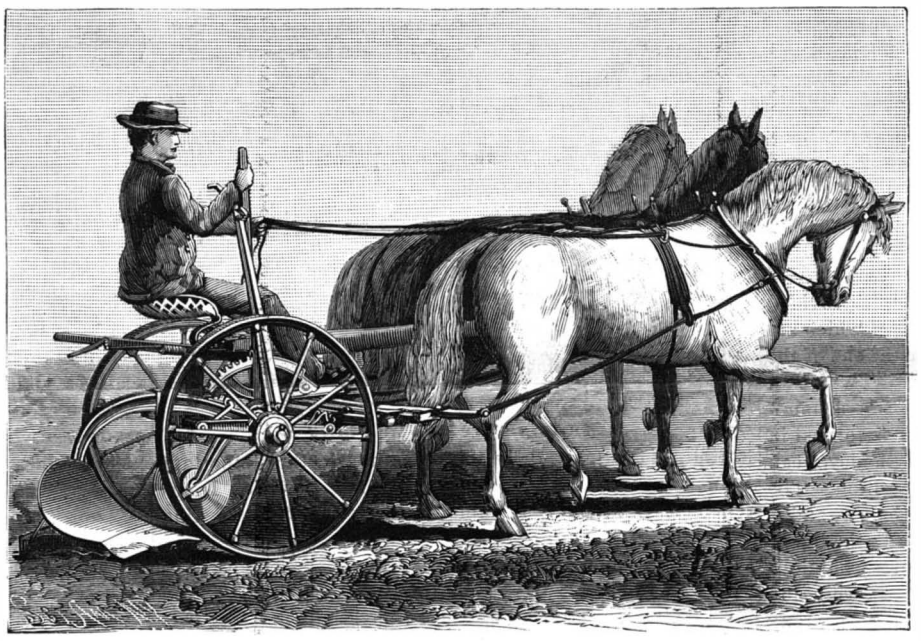
A bird's eye view of the principal factories is shown in our engraving, each department being arranged with special relation to the business pertaining to it. Although it is impossible to give a conception of the size and completeness of the works, some idea may be formed when we say that the total floor space approximates half a million square feet. The view on our title page gives an idea of the arrangement of the shops, some fifteen in number, and some of the leading machines and implements. The buildings are all constructed of brick and iron, with slate or metal roofs. A complete system of water mains, hydrants, and hose pipe protects the works from fire. The wood-working shops are supplied with a system of perforated pipes, so arranged that the entire structure may be deluged with water by turning one wheel. The factories are all lighted by electric lights. Tracks connect the different buildings with the five railroads centering at York. The very best work can be furnished at the lowest price, since all parts of the machinery and implements are made here—the nuts, washers, bolts, steam fittings, etc., belonging to the engines, and the handles, beams, castings, steels, bolts, etc., belonging to the plows and implements.

In addition to the works located at York, the large and rapidly increasing Southern trade necessitated the opening of the branch store and factory known as the Central City Iron Works, in Macon, Ga., now one of the most complete in the South. The large export trade is handled from the store in New York city.

Among the well-known specialties manufactured at these works are the Farquhar Ajax traction and portable engines (the fire-boxes are steel, and the boilers have a remarkable record, not one having ever exploded); the vertical boiler with submerged tubes, arranged with wheels when desired; the Farquhar separator with self-regulating blast, saving every grain; saw-mills with patent feed, set works and dogs of most improved kind. Among the leading implements manufactured here are the Penna. drill and corn planter, with perfect force feed and phosphate attachment, and Farquhar's celebrated wheel or sulky plow.

Farquhar's Ajax Traction Engine has several important patented advantages. The boiler is made of steel, and is so constructed that it is impossible for the crown-sheet to become exposed, even on the steepest grades. A steam guiding attachment enables the engineer to steer with ease, by the simple movement of the lever. The wheels are of a most improved pattern, strong, durable, and of a handsome design. Springs are placed in the hubs of the wheels, acting as a cushion between the engine and gearing, and supporting the weight and avoiding jarring when passing over an obstruction. A neat cab covers the platform, protecting the engine and engineer from storms or hot sun.

The Ajax Portable Engine is of the center crank type, and possesses strength combined with simplicity. The pedestals and cross-head guides are cast solid with the bedplate, thus making it impossible for the engine to work out of line or give. The cranks are made of the best steel. The fire-boxes of the boilers are made of steel, of the same brand as that used by the Pennsylvania Railroad in their locomotives. The rest of the boiler is made of the best charcoal iron.



FARQUHAR SULKY PLOW.

The Vertical Engine is very popular, being light, convenient, and cheap, and is as good as the horizontal where light power, from two to six horse, is required where used for thrashing grain or other portable purposes. The boilers are provided with two trunnions and wheels. The tubes are submerged. The engine and boiler are carefully made to insure durability and strength.

In the Farquhar Improved Saw Mill the patent feed, set works, and dogs and head blocks are all of improved form; the saw shaft is steel. It is stated that some of our large lumbermen have found it economical to throw out their old mills and substitute this.

The Farquhar Separator is so well known as to need but little description. It was awarded the first premium and medal at the Centennial and Paris expositions on account of its lightness of draught, rapidity and economy of work. Owing to its self-regulating blast, which cleans the grain ready for market, the chain elevator which cannot be choked, steel shafts and spikes, it possesses advantages of the highest order.

Farquhar's Wheel or Sulky Plow does work better, cheaper, quicker, and with infinitely more ease than the walking plow. Its special advantages are simplicity of construction, effective work, steel beam. It has a positive self-lifting attachment, adjustable hub box, light, strong, and handsome wheel, and may be easily and readily adjusted from two to three horses. It is constructed wholly of iron and steel. It has sliding axles, is light draught and is most durable, although weighing less than the others in use. In construction, adjustment, and ease of management it is superior.

Many other improved implements were being turned out in great quantities when we visited the works. We have only space to speak of a few which particularly attracted attention. The Geddes hinge harrow is one of the best in use. It draws from the center, is easy on the team, and being hinged it works as well on uneven land, and is easily lifted when in motion, to discharge weeds, etc. It is strong and durable, and can be doubled in a portable form. The teeth are prevented from getting loose by being fastened with nuts and washers. Harrows constructed upon other plans, but all showing the same degree of good workmanship, were noted.

The Farquhar improved cotton planter is very simple and perfect in its operation, dropping the unrolled seed with remarkable regularity and in any desired amount. The Keystone corn planter will plant from ten to twelve acres of corn per day, dropping kernels in drills or in hills, at any desired distance apart, and sowing at the same time, if needed, any kind of pulverized fertilizer. The Pennsylvania force-feed fertilizer grain drill will not only sow the grain evenly, but, what is an equally important feature, it will distribute the phosphate with the same precision, doing the work without any loss of either seed or fertilizer.

The Farquhar Hoffheins mower and reaper possesses many points of excellence. The frame being of solid iron and very compact holds the shafts securely in position and is supported by two ground wheels, either or both of which drive the machinery. The self-rake, moving automatically, will make the bundles at regular intervals, their size being regulated by means of a treadle convenient to the driver's foot. The height of cut can be regulated while the machine is in motion; the guards can be thrown down, so as to run under the fallen grain, or elevated to pass obstructions.

Farquhar's climax horse-power, for thrashing, ginning, and general farm use, is triple geared, the strain being divided so as to prevent breakage or wear. All the gearing is connected by one strong iron frame; the levers are so arranged that the strain of the team is thrown upon iron braces, and can be taken off or put on in a moment without loosening a bolt. All the boxes are self-oiling. This horse power is strictly portable and can be quickly and easily set up by ordinary farm laborers. Corn shellers adapted to hand or horse power, farm mills, standard grinding mills for corn, wheat, and other grains, fodder cutters, cider mills, farm and freight wagons, etc., are turned out in almost endless variety.

We have not the space to even enumerate them. All the various parts of the agricultural implements and the steam engines and boilers—including bolts, nuts, thrasher spikes, wrenches, plow irons, and forgings of all descriptions, and valves, cylinder lubricators, water gauges, air cocks, steam whistles, inspirators, etc.—are turned out at these works.

Further particulars of this manufactory and the work it produces may be obtained from the large illustrated catalogue, which will be furnished upon application by the proprietor, Mr. A. B. Farquhar, York, Pa.

### Lathe Pulley Faces.

Machinists have often noticed the edge wear of belts on pulley steps of lathe cones, caused by the riding or the rubbing of the belt on one step against the rise of the next higher step; and this creeping up notwithstanding the swell or crowning of the face of the pulley step. A recently noticed remedy is one that is applied by the Pratt & Whitney Company, Hartford, Conn., on all their lately built lathes—a remedy as simple as it is effectual. The crown of the pulley face is not in the center, but on the "off" side, or toward the next lower step, away from the adjoining rise. By practice it has been found that this diversion from the center is too slight to affect the eye, the off on a step of 2⅝ inches for a 2½ inch belt being only one-eighth of an inch; but it is an effectual remedy.

The crowning of the faces is effected by equally simple means. Machinists generally know the Slate taper attachment to lathes, which guides the tool carriage independent of the traverse screw, in turning or in boring tapers. The arrangement for producing the swell is on the same principle, the transverse screw being removed and the upper portion of the carriage with the tool post being held by a flat spring at the back of the lathe against a former, a slightly swelled strip to correspond with the intended crowning of the face of the pulley step. This is the last turning operation on the lathe cone, the former chips being in line or level.

### Railroad to Alaska and Ferry at Behring Strait.

A railroad around the world, or something nearly of that nature, is evidently in the mind of one of our correspondents, who suggests the employment of our surplus revenue in building the line from Oregon to Alaska, and that then the Russian government would be likely to extend the line through Siberia to Pekin. This having been done, it requires not much further stretch of the imagination to see, with the mind's eye, the long rails stretching out under the shadows of the Himalayas until they make connection with the proposed line in the Jordan Valley, and thence with the European system.

A CORRESPONDENT in the Government Engineering Laboratory, College Howrha, Bengal, writing in reference to the discoloration of brick walls, says that in three samples of white incrustation he found the substances to be mainly potassium nitrate with a trace of magnesium nitrate.

## Correspondence.

### Were the "Small Motors" Wrong?

*To the Editor of the Scientific American:*

Your correspondent "Alia," etc., takes me up about my fourteen foot boat that was going out fishing so nicely with its store of compressed air, laid in a pipe along her gunwale. I never intended to have her driven in any such way as "Alia's" experience in boating indicates. His engine has a 3 x 3 cylinder; this, with a 100 pound pressure, is surely good for a full horse power, and can easily be crowded to double that and more; and yet he can get but a mile in nine minutes.

Now, we will say nothing about increasing that rate, but we will only look for the power needed to attain it. My boat—perhaps his boat is different—but my boat I can pull, with a steady stroke—not the "Yale jerk"—at very nearly that rate, and not expend over one-tenth part of a horse power. Haud inexpertus loquor. What has become, then, of the remaining immense proportion of his engine's power? Plainly it has been wasted some way; mostly, perhaps, by indirect action. Taking the commonly received estimates of the bulk of steam required for a given power and time, one cubic foot of air compressed to the degree assumed by me is sufficient to drive my boat, on the basis of what I can do myself in rowing, not less than seven hours. The length of gunwale of a 14 foot boat is not 28 feet as stated by "Alia," at least I never saw any boats built that way; it takes about 35 feet to go around mine. That length of 2 inch pipe measures over three-quarters of a cubic foot.

By using direct pneumatic propulsion I think I am justified in asserting that the boat can be driven as I formerly stated.

A.

### Storage of Wind Power.

*To the Editor of the Scientific American:*

For quartz, saw, flouring, and other mills, so situated that they can be built on a hill side, so as to furnish a sufficiently strong foundation, there is no power so easily stored, used, and restored as perfectly dry fine sand. The mill can be easily and cheaply arranged with buckets to carry the sand back into the bins, from whence it is taken as wanted through spouts and conveyed to an overshot water wheel of sufficient size to run the machinery required. The sand costs little or nothing but the hauling, is to be had everywhere, sustains but very little waste by use or restoring, and works as well if not better than water. This applies to all the deserts and plains of the West and Mexico. I know of one mill now run by dry sand, and it does good work.

True, water can be used, where it can be had to pump, but the pumps and tanks cost much more than those necessary for sand. Air pumps and compressed air can also be used, but the first cost of the plant is too great. Any carpenter can make all the appliances required for using dry sand, and any farmer, ranchman, miner, or manufacturer who owns a side hill, so as to have a solid foundation for his sand tanks or bins, can use this power with but very small outlay to start with.

X. Y. Z.

### The Washington Monument and the Axial Motion of the Earth.

*To the Editor of the Scientific American:*

Nearly forty years ago the French physicist Foucault furnished a direct proof to enable us to see the earth go round. His famous demonstration caused a great sensation at the time, and will always be known as Foucault's experiment. It is based on the fact that a pendulum once set in motion will continue to swing in the same plane, if it is suspended in such a way that the pivot can turn around and still leave the pendulum free to swing in the same plane, instead of turning with the pivot. The pendulum must be a heavy one and the point of suspension as free as possible from friction. We will suppose such a pendulum placed at the North Pole. If the earth rotates, it would carry round the point of suspension once in twenty-four hours, and also the surface of the earth under the pendulum. If the pendulum did not partake of this motion, but kept steadily swinging in the plane in which it was started, we could see the surface moving round beneath it, though it would appear as if the direction of the pendulum were constantly changing. The pendulum would seem to swing round the circle once in twenty-four hours, while the building in which it hung and the earth on which the building stood would seem to be at rest; but we could have no doubt as to which was the real and which was the apparent motion. At any place between the pole and the equator the experiment would not be so simple, as the point of suspension would be carried round by the rotation, but the direction in which the pendulum swings would seem to be constantly shifting, though it can be calculated just what the change ought to be in any given latitude. If, then, the observed motion agrees exactly with the calculated one, the demonstration is as complete and satisfactory as it would be at the pole.

Foucault made his experiment in the church of St. Genevieve, in Paris. Here he suspended under the dome a pendulum some two hundred feet in length, performing its vibrations in eight seconds. A graduated circle was drawn on the floor beneath it, and hour after hour and day after day the measured swing of the heavy ball was found to be precisely in accordance with the theory that the earth turns on its axis once in twenty-four hours. The apparent changes in the direction of its motion were explicable in no other way, and the hypothesis was thus demonstrated beyond the possibility of doubt. The globe on which we dwell was seen to go round, and Foucault was the scientific hero of the day.

The idea recently occurred to the writer while viewing the Washington Monument that a grand opportunity was there presented for repeating Foucault's experiment, as a pendulum of any desired length could be employed, and with the aid of our most perfect appliances it could be carried out on a scale which would secure the most satisfactory results, and it would add another feature to the many attractions which already bring visitors thousands of miles to the capital of the nation.

S. L. DENNEY.

Strasburg, Lancaster Co., Pa., December 24, 1883.

### Blowing up Tornadoes.

*To the Editor of the Scientific American:*

In your issue of December 8, John F. Schultz has a scheme for changing the track of tornadoes—by blowing them out of existence. A cyclone is meant, I suppose, for a tornado is properly a "straight blow." There are several objections to his method of changing a cyclone's course. If one of these whirlwinds traveled in a straight line, and always on the ground, his plan would be feasible; but as a cyclone often jumps or bounds along, and seldom travels in anything like a direct course, one would scarcely know where to locate his keg of powder; and if he knew, he would not have time to do it. In fact, by the time the powder was in place the cyclone would probably be in the next county. How are we to do if the cyclone comes at night, when it cannot be seen? Even if some one had nerve enough, on seeing a cyclone, to put a keg of powder, as near as he could judge, in its path, the whirlwind would probably miss the powder and blow the man out of existence. About the best plan is to get into a "dug out" when there is danger of a cyclone, and in the western and central parts of this State almost every farmer has one.

BERT DAVIS.

Topeka, Kansas, December 17, 1883.

### "The Brandy Bread Company."

*To the Editor of the Scientific American:*

In your issue of the 22d is an article with the above heading. The object of the Brandy Bread Company is to obtain alcohol from bread in the process of baking.

In the course of fermentation the dough passes through four processes, if the fermentation is allowed to go on, viz.: saccharine, vinous, acetic, putrefactive. The dough should always be put into the oven before it passes through the first fermentation; the bread in that case will be good, having the sugar in it. If allowed to pass into the vinous fermentation, so as to obtain alcohol from it, the bread will be poor in flavor and in quality.

N. D.

Portland, Me., December 22.

### Cost of Producing Beef.

The report of the Committee on Cost of Production, at the late Chicago Fat Stock Show, goes extensively into the question of the proper basis on which awards at such exhibitions should be made. In order that the results might be determined solely upon the quantities of the various kinds of cattle food used, as well as the skill of the feeder, the price of each article of food named in the statements was determined upon an equitable and uniform basis to all the competitors, as follows:

| | |
|---|---|
| Value of calf at birth | $5.00 |
| " milk, per gallon | .04 |
| " shelled corn, per 100 lb | .71 |
| " corn in ear, per 100 lb | .53 |
| " soft corn, per 100 lb | .50 |
| " oats, per 100 lb | .75 |
| " corn meal, per 100 lb | .80 |
| " corn and oats, per 100 lb | .80 |
| " shorts, per 100 lb | .70 |
| " bran, per 100 lb | .60 |
| " oil meal, per 100 lb | 1.25 |
| " oil cake, per 100 lb | 1.25 |
| " hay, per 100 lb | .30 |
| " pasturage per month, up to 12 months | .75 |
| " " " 12 to 24 months | 1.00 |
| " " " 24 to 36 months | 1.25 |
| Expense for care, feeding, salting, and interest, up to 12 mos. | 4.00 |
| " " " " " 12 to 24 mos. | 6.00 |
| " " " " " 24 to 36 mos. | 9.00 |

The great diversity of articles consumed by the competing animals, as well as the methods of handling stock, made it somewhat difficult to determine upon the comparative value of some of the articles of food named for the most rapid production of beef, the quality of which could not be satisfactorily determined until the carcasses are displayed upon the block. The prices of grain, etc., named were not the present market price, but a fair average for a term of three years The value of calf at birth, pasturage consumed, and expense for care, etc., were rated the same with each exhibitor.

The committee recommended that for the future greater care be given by exhibitors in their statements as to quantity of each article of food consumed, exact time that animals were on pasture or stock fields, and details of expense for care, etc., to enable a more careful comparison to be made of the various methods of feeding and the effect of same upon the animals. Attention was also called to one of the lessons to be learned in the statistics presented, viz.:

If feeders desire to keep their cattle for feeding beyond two years, the most profitable results have been obtained where the animals have been liberally fed the first year on a coarse diet that will develop bone and muscle upon which to build the matured carcass. The most economical production of beef does not always result from strong feeding of grain or concentrated food during the first twelve months of age of the steer.

The committee strongly urged upon feeders the importance of liberal feeding from birth of calf, and giving more attention to the important matter of early maturity. The figures clearly demonstrate that the greatest profit results of the feeder in marketing cattle at an early age, not exceeding twenty-four months.

### Our Losses by Fire.

According to the *Fireman's Journal*, which quotes from the *Commercial Bulletin*, the losses by fire in this country during the first eleven months of the present year have been about ninety-two millions of dollars, and it is probable that the total of losses for the year will reach the round sum of one hundred millions. If we add to this the expense of maintaining insurance offices and agents, we shall find that the cost of combustible construction, carelessness, and incendiarism in the United States has this year been at least one hundred and fifty millions of dollars. We are often told that by the "blessings of insurance" this enormous burden is "distributed" so as to be "unfelt." In other words, the man who builds the cheapest and most combustible warehouse that he can, fills it with valuable goods, and then sets it on fire, either intentionally or by carelessness, gets back the value of his building and goods in cash from the underwriters, and they again collect what they pay out, together with as much more for their own salaries and expenses, by levying a tax upon all the buildings and goods, which is finally added to the price of the goods, and paid by the consumer. To take a single example, the cotton manufacturer pays, in the price, the cost of insurance on the raw cotton until it is delivered at his mill, and a further premium upon the same while in process of manufacture, and upon the buildings in which it is manufactured, with the machinery in them. All these form a part of the cost of manufacture, and are added to the price of the product. From the manufacturer the goods go to the commission merchant, who also pays a premium for insuring them and the building in which he stores them; and from him they go to the jobber and the retailer. Each one of these keeps them, as well as his own warehouse, covered by insurance, and adds the cost to the price of what he sells. Supposing a year to elapse between the gathering of the cotton and its delivery in the shape of cloth to the consumer, the enhancement in cost, to pay the expense of insurance alone, will be, as a rough average, about two per cent. Every other manufactured article bears a similar tax, in many cases, where the production and sale are slow, amounting to 10 or 15 per cent instead of two; and even raw produce is somewhat burdened. Since the impost bears upon all alike, each person endeavors to reimburse himself by asking a little higher price for his labor, so that in the end the insurance burden diffuses itself as a nearly uniform tax of about two per cent upon the total annual expenditure of every family in the country.

Viewed in this light, the insurance tax is not so "insensible" as some would have us believe. To state the case in a little different way, every man or woman in the community who is paid for his or her labor works one week in every year as a gratuitous contribution toward paying the salaries of insurance agents and the fire losses caused by carelessness or crime. Returning again to the original estimate, and setting the total cost of fires and insurance in the United States at one hundred and fifty million dollars a year, we will divide this sum by the number of families in the country, which would be, by the usual reckoning, about ten millions. Ten million families, to raise a hundred and fifty million dollars a year, must pay fifteen dollars apiece, on an average. Taking into account the climate and circumstances of all portions of our territory, it may be safely asserted, we imagine, that fifteen dollars for each family would pay the cost of all the wood and coal used for household cooking and heating throughout the United States; and a transformation in methods of construction, by which conflagrations would be rendered, if not impossible, at least as rare as in some countries, would be a direct pecuniary benefit, equaling in value a perpetual gift to every family in the republic of all the fuel needed for domestic use.—*American Architect.*

### Crushing Properties of Wet Snow.

Wet snow on roofs has been causing much inconvenience and many accidents of late. The extra weight to be supported in such contingencies seems not to be sufficiently calculated upon by builders. The snow is so light as it generally falls, taking eight to twelve cubic inches to equal the weight of a cubic inch of water, that people do not generally realize how this same snow, becoming saturated by gentle rains, and added to by successive snow falls, may finally pile up an aggregate weight. Old and leaky roofs, and especially those which are flat, or have only a slight pitch, should be promptly relieved of this extra burden on the occasion of every considerable fall of snow, for if not crushed they may, nevertheless, be deflected enough to crack or loosen the covering, and thus develop leaks. Flat roofs especially, should be promptly relieved of their weight of snow, and it should also be seen to that all gutters should be kept free from snow and ice. This precaution will keep the leaders open, and prevent their bursting.

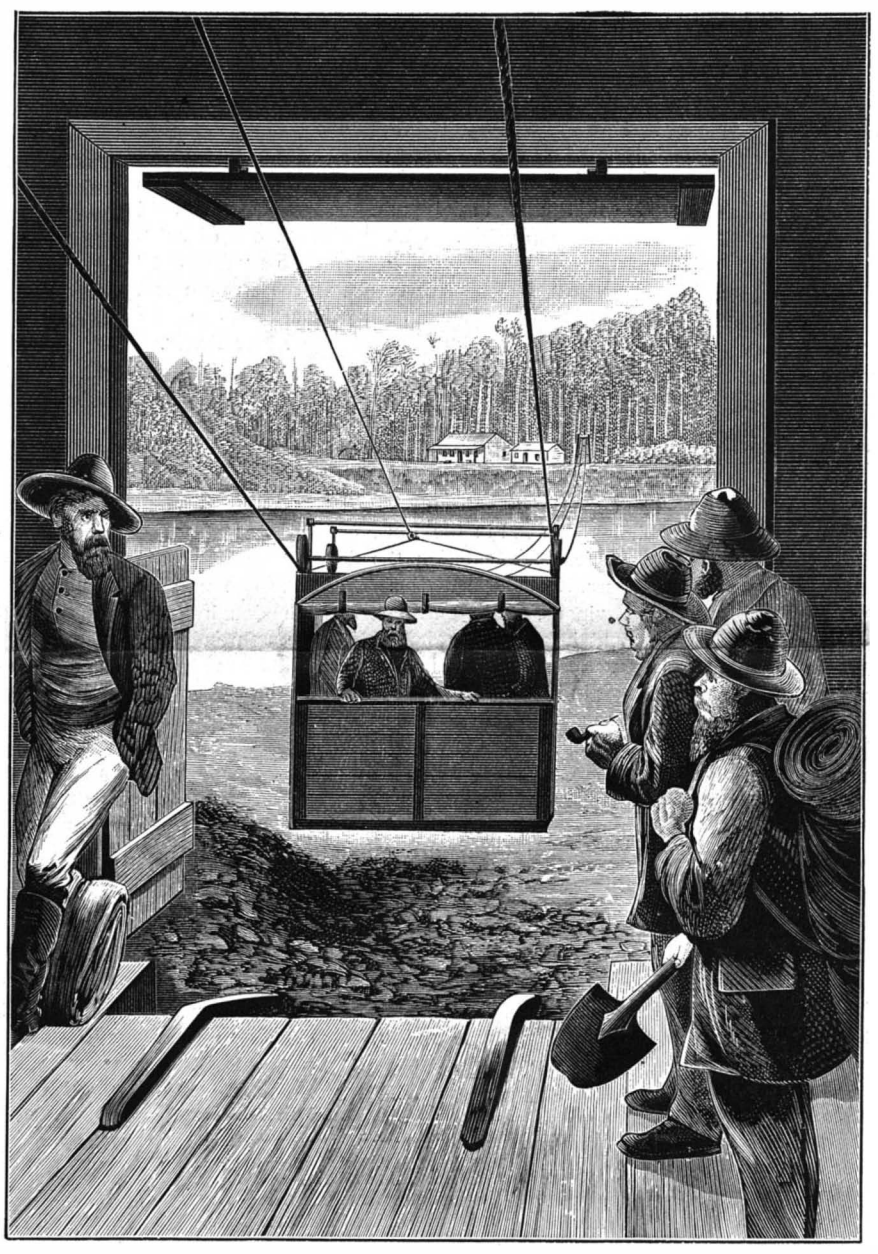
### Vulcanizing India Rubber.

Accidents have frequently occurred, especially in dental workshops, from the use of too high a temperature in melting and vulcanizing India rubber. Moreover, complicated apparatus is required for vulcanizing by dry heat. According to the *Moniteur Produits Chimiques*, this apparatus can be replaced by a bath of any liquid boiling at 140° or 150° C. (285° to 300° Fahr.), at which temperature the sulphur unites with the India rubber.

The cheapest salt for such a bath is chloride of calcium; but other solutions, such as acetate of soda and carbonate of potash, can be employed; also glycerine, oils, and paraffine. These liquids can be used in ordinary metallic vessels. Of course, the India rubber and sulphur solution must be in an air-tight vessel, as before.

### WIRE TRAM ACROSS THE TEREMAKAU, N. Z.

The Teremakau River is situated in the Middle Island of New Zealand, in the district of Hokitiki. The stream has no great pretensions to size during the summer months, but in winter it rises to a considerable height, and not unfrequently floods the adjacent country. A wire tramway has been constructed for the purpose of crossing the river. The contrivance is ingenious, and saves both time and inconvenience. As will be seen by our sketch, the passengers are seated in the car, which is being conveyed over the river by an arrangement of wire ropes, which works with precision and facility. It is also perfectly safe, a fact that could not be urged as regards a ferry boat at certain periods of the year. Contrivances of this kind are numerous in South America.—*Town and Country.*



WIRE TRAM ACROSS THE TEREMAKAU, N. Z.

### Physical Education of Girls.

We are pleased to find that increased attention is being paid to the question of the physical training of young and growing girls. The Swedish physical exercises have found general favor, while many games and athletic pursuits are now permitted which formerly were proscribed by prudish schoolmistresses and timid mammas. There can be no doubt that the present movement is in the right direction so long as it is kept within reasonable limits; for the extension of competitive athletic sports to our girl schools would be a great mistake. But, short of this, the daily employment of systematic exercise will prove of the greatest service in after life by developing the frame and obviating those ills which so frequently supervene in the passage from girlhood into womanhood. The disorders which occur at that period are generally to be referred to imperfect development and to defective nutrition. When the girl is naturally healthy, little is wanted but to encourage, or we might say insist on, ordinary systematic exercise being taken daily. This should consist of certain gymnastic exercises, which ought to be practiced each day as part of the school work, supplemented by such games as lawn tennis, rounders, golf, etc. Swimming is an exercise that every girl should indulge in, and it ought to be taught systematically at all our girl schools. Rowing, too, is an exercise which greatly strengthens the muscles of the trunk and abdomen, and is therefore serviceable, when employed with judgment, in giving grace and elegance to the figure. Schools at the seaside or near a river should avail themselves of the opportunity, and have rowing taught by same trustworthy boatman. Riding has always been an exercise in favor with the profession; the expense attending it, however, debars its pursuit in many cases. With delicate girls, or those rapidly growing, some of the above named exercises may prove unsuitable; in these cases it is best to rely at first entirely on gymnastics till the frame is strengthened. Until recently dress proved a great barrier in preventing the free exercise of the limbs and body, but the introduction of a more sensible costume for the playground will in future, it is to be hoped, remove the disadvantage. The costume in use consists of a short skirt of blue serge, draped with a crimson scarf, blue jersey, short trousers, and long stockings. Such a dress is quite suitable for girls under fifteen, and we fancy those who are educated on this system will not as they grow older readily submit to the bondage of high-heeled boots and tight lacing, though probably they would have to adopt a more lengthened skirt.—*Lancet.*

THE Clyde shipbuilding for 1883 represents a tonnage of 419,664 in 329 vessels. Twenty-five years ago the Clyde yards turned out only 35,709 tons in one year. For the past four years the business of shipbuilding there has steadily and largely increased. There are those who predict a falling off during 1884, on account of low freights and the many "ocean tramps" now in the business, but in answer to this it is claimed that the recently built ships are so economical of fuel, compared to carrying space provided, that they will continue to crowd out those of older build.

### New Mode of Constructing Small Ships.

Sheet metal boats form the subject of a patent recently issued to a firm of boiler makers at Barrow-in-Furness, England. Sheet metal sides are bent under pressure to the required shape, having flanges on their lower edges for riveting to the keel bar, and the stern ends may be joined either with or without a stern plate. The bent plates forming the boat's sides may be readily packed in small space for transportation, and easily put together on reaching their destination, the design being to so construct boats lighter than of wood, or of numerous plates of metal riveted together.

### Earthquake and Volcanic Eruption in Alaska.

On the morning of October 6 a settlement of fishermen on English Bay heard a heavy report, and looking in the direction from which the sound came saw immense volumes of smoke and flame burst forth from the summit of Mount Augustine. The sky became obscured, and a few hours later great quantities of pumice dust began to fall, some of it being fine and smooth and some gritty.

At 3½ P.M. on the same day an earthquake wave 30 feet high came rushing in over the hamlet, sweeping away all the boats and deluging the houses. The tide at the time was low, and this saved the settlement from utter destruction. The wave was followed by two other waves about 18 feet high, which were succeeded at irregular intervals by others. The pumice ashes fell to a depth of 5 inches, making the day so dark that lamps had to be lit. At night the surrounding country was illuminated by flames from the crater. Ordinarily Mount Augustine is covered with snow, but this year it is completely bare.

Upon examination after the disturbances had subsided, it was found that the mountain had been split in two from base to summit, and that the northern slope had fallen to the level of the surrounding cliffs. Simultaneously with the eruption a new island made its appearance in the passage between Chernaboura Island and the mainland. It was 75 feet high and a mile and a half long. So violent was the volcanic action that two extinct volcanoes on the peninsula of Alaska, lying to the westward of the active volcano Iliamna, 12,000 feet high, burst into activity and emitted immense volumes of smoke and dust. Flames were visible at night.

### Tin in California.

An article in the *Mining Review*, by E. N. Robinson, C.E., states that the mine of Cajalco, in the Temiscal range, California, has assayed 13·1 per cent from the ore, of a purity of 0·98. This mine is believed by Cornish miners who have examined it to be a true and permanent vein, probably increasgin in richness as it increases in depth.

### Great Ships of War.

According to the official report submitted to the French Chamber of Deputies concerning the condition of the French fleet, the iron clad squadron of France may be divided into three groups. The first comprises three heavily armored ships, the Duperre, Devastation, and Redoubtable. These are protected by armor 22 inches in thickness, and are armed with 13 3-8 inch breech loading rifled guns. The second group consists of seven iron clad vessels with 8 5-8 inch armor and carrying guns similar to those of the preceding group. This class of ships will be superseded in a few years by vessels of the same magnitude as the three first mentioned. The third group is composed of seven vessels having an armor of but six inches, but these will, with the exception of one of them, remain but a short time longer in service.

There are at present launched and in course of completion, and almost ready for service, two heavily armored iron clads, the Admiral Baudin and the Foudroyant, while seven more of a similar type are being constructed. Besides these, says the *Army and Navy Journal*, there are available two armored coast guards, constituting formidable engines of war, and five more have been launched and are in rapid process of completion. In addition to these there are two new coast guard iron clads, of an inferior type, in process of armament for immediate service, and these will be supplemented in a few months by an additional vessel of the same class.

The report includes, as a reserve, six coast guard iron clads of the old type, which will remain available but for a few more years; also six floating batteries belonging to the same class. In addition to the foregoing the French fleet is provided with five fast cruisers of the commerce destroying type.

The writer says: "If we compare the effective force of our navy with that of other maritime powers, we find that England has 33 iron clads, of which 16 only have an armor varying from 17⅞ to 24 inches in thickness. Five iron clads of the first class are in course of construction. Besides these, England has 11 station iron clads,* 10 iron clad coast guard ships, 2 station iron clads of inferior size, 44 cruisers, and 180 torpedo boats of all grades.

"Italy has afloat, at the present date, four iron clads of the first magnitude. These gigantic war vessels are armed with 100 ton guns. Three iron clads of lesser proportions are in course of construction in the Italian dockyards, and will be launched next spring. These will take the place of the 8 iron clads of a past type at present belonging to the Italian navy, and which are destined soon to disappear.

"Germany, especially, has constituted her navy with a view to coast defense and running warfare (*guerra de course*). She possesses 4 large iron clad coast guards; 13 iron clad gun boats, adapted also for torpedo warfare; 24 fast armed cruisers (rams), capable of steaming 14 knots.

"The principal Russian war vessels are: 1 turreted iron clad; 1 central redoubt iron clad; 5 station iron clads; 3 iron clad coast guards, with heavy batteries; 7 turreted iron clad coast guards; and 10 turreted monitors. Russia has in process of construction 5 turreted monitors and one station iron clad."

The appropriation asked for by the French Admiralty amounts to 197,835,017 francs, or $39,567,003.40. This amount has been approved of by the Commission, with but a slight reduction on points of minor importance and not exceeding 54,000 francs —$10,800.

List of French war vessels in course of construction in the French naval dock yards, and to be available in the early part of 1884: One gun boat, La Comete; one iron clad, Vauban, at Cherbourg; one iron clad, Terrible; one cruiser, Iphigene, at Brest; one tender, Alcian, at Lorient; one iron clad, Tonnant; one tender, Ibis; one tender, Vigilant, at Rochefort; one iron clad, Caiman; one iron clad, Foudroyant; one cruiser, Arethusa, at Toulon. Total, 11 vessels.

### A Dry Galvanic Battery.

Electro-piles without fluids were among the earliest forms invented, but they had but very little power, and although they last a long time have very little value. They are now beginning to attract attention again, and C. Schneler, of Dresden, has invented one consisting of a copper cylinder open at both ends, in which is placed another open cylinder of amalgamated zinc. For filling, he mixes up plaster of Paris with a saturated aqueous solution of chloride of zinc containing 7 per cent of common salt. A stiff paste is made in this way, and poured in the annular space between the two cylinders, where it soon hardens and sets. The electro-motive force is not stated.—*Poly. Notizbl.*, p. 381.

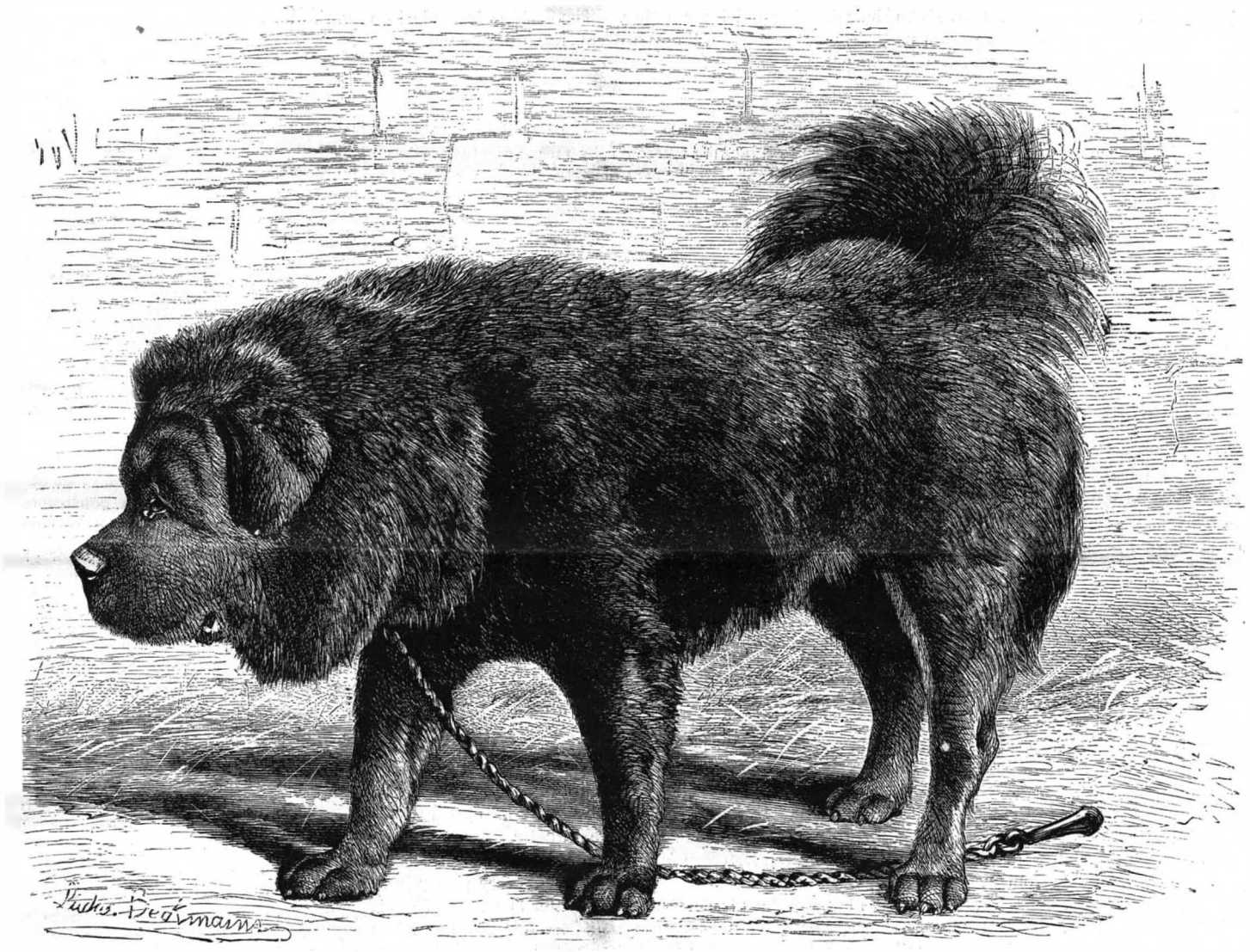
* Cuirasse de Station, a ship, in European navies, ranking second in the list of fighting ships.

### The "Dugong," or Vegetarian Whale.

A writer in the *Gentleman's Magazine* gives some interesting particulars relative to this species of whale, now taken to a considerable extent in Queensland, and valuable alike for its oil and as food. Its size varies from eight to twenty feet in length, it lives upon submarine meadows of seaweed, it has no gills, but breathes air by means of lungs, its head is round and somewhat human like, and has hair something like that of a man's beard. It is said many stories of merman and mermaid may be traced to these creatures. Their oil is said to have all the medicinal merits of cod liver oil without its unpleasant flavor; at ordinary temperatures it deposits crystals, as olive oil does in frosty weather, but on warming slightly becomes liquid and clear. The flesh is much prized in Australia, being cut off in flitches and slabs, and it is stated that "from the same animal is taken meat resembling beef, veal, and bacon."

### THE THIBET DOG.

The peculiar dogs of Thibet have frequently been described by travelers, and generally the size and strength of the same have been exaggerated. A very fine specimen of these animals was exhibited at the Vienna Dog Show, a picture of which is given herewith. The animal is about as high as a large pointer or setter, and has some resemblance to those Newfoundland dogs known as "Labrador dogs."



THE THIBET DOG.

His long, thick, and soft hair lies closely against his body and is not kinked; the color is a deep, brilliant, glossy black with yellow spots over the eyes and light colored spots on the paws. The wrinkled forehead, the small eyes, and hanging upper lip give the animal a threatening appearance, which corresponds with its ugly and vicious disposition.

These animals have generally been known as "Thibet hounds;" but this name is not correct, for although they resemble hounds somewhat in their appearance, they do not belong to this class of dogs.—*Illustrirte Zeitung.*

### The Mole and His Little Ways.

The Rev. J. G. Wood lately delivered at Cooper Institute, in this city, a lecture on the mole. He said in part: "If a man were placed in a damp, dark, subterranean prison, he would not like it a bit, but would make the best of his way, as quickly as he could, to the air, the light, and the warmth of the upper world. Moles do not agree at all with human beings, but prefer coldness, moisture, and darkness. The mole is a burrower, and in the natural pursuit of his vocation—devouring the pupa of caterpillars, and also ground worms—he is compelled to throw up those little mounds of fresh earth which are called mole hills. Farmers strongly object to them on this ground, because mole hills look untidy. Then they have a lurking prejudice that they also do damage to the crops, which is nonsense, because the mole is strictly insectivorous and carnivorous, and utterly disdains cereals or roots. He is really a benefactor, because he supplies the farmer with a top dressing of unexhausted earth.

"All burrowers must be cylindrical and pointed at the foremost end, and that is the shape of the mole. He is intermediate in size between a mouse and a rat, and his anatomy is highly interesting from the manner in which all the muscular power goes to the fore arm, which does the burrowing, and the spade-like hands with the long claws. Anatomists at one time were greatly puzzled by what appeared to be a sixth finger, which would have been a terrible anomaly. Fortunately it was discovered to be not a finger, but a radial sesamoid, of which the human anatomy contains numerous instances, as, for example, the knee cap. It was for the purpose of extending the forking power of the mole's hand. When an honest agriculturist comes to a bit of hard ground, he first loosens it with the fork and then shovels. The mole does precisely the same. When he opens his fingers as wide as he can, he does the forking business; when he closes them compactly, he shovels. I have seen at an agricultural fair a very smart digging machine, but upon examining it I found it to be only the mole's hands multiplied and set on wheels.

"The mole has eyes, but he does not use them very much. Shakespeare speaks repeatedly of the blind mole, but the sweet bard of Avon was incorrect. The mole is not blind, but his eyes are exceedingly small. If any person wants to find out this for himself he must first hold his mole, which is no joke, for they bite like fiends and scratch with their fore-paws like wild cats. Then by blowing away the fur, a small black speck appears, which is the eye. But the best way is to put the mole in water, when the eye immediately appears, showing that he has the power of projecting the eye beyond the fur. The same proverbial wisdom that made the mole blind gives it credit for a sense of hearing singularly delicate; yet the fact is that the ears are not specially acute. The delicacy of hearing is due to the singular manner in which the earth carries wave sounds, a circumstance well known to hunters and military men. The sense of smell is the pre-eminent quality in this creature, and upon which he depends chiefly to procure food. Moles are fiery to the last degree, and quarrelsome. Whenever two meet they fight, and the vanquished is devoured by the victor."

### The "After Glow."

The red sunsets noticed over a large part of the earth for many weeks form the subject of a careful essay by Mr. George W. Stewart, of Tulare, Cal. It is believed the phenomena cannot be attributed to density of atmosphere, effect of heavy sandstorms, or any local conditions, which would have no effect at such great distances above the earth's surface, the light appearing far above the uppermost stratum of clouds. The writer recounts some former phenomena in connection with eruptions at Honolulu and at Java, and concludes that the recent noticeable sunsets have been caused by finely divided volcanic dust or gaseous vapor from the great eruption in Java, which broke out August 26 last. It is pointed out that the volcanic dust of lesser eruptions has frequently been carried thousands of miles, and that Mr. S. E. Bishop, of the Hawaiian Survey Department, as early as September 22 concluded that "some very light element among the vapors of the Java eruption had continued at a very great height in the atmosphere," and thus been more widely distributed over the earth than ever before. The Sandwich Island observer thus describes the appearance there at that early date:

"I would note three peculiarities of this phenomenon, distinguishing it from ordinary sunset reflections, and unlike anything I remember to have observed before. First: It appears to be a reflection from no cloud or stratum of vapor whatever. An undefinable haze might, perhaps, be fancied to be the medium reflecting sunlight. Second: The peculiar glow, as of a distant conflagration, totally unlike our common sunsets. Third: The very late hour to which the light was observable, long past the usual hour of total cessation of twilight. To these may be added a fourth peculiarity—that the center of brilliancy was more or less to the south of west."

### Vaccination and Small-Pox.

Notwithstanding the almost universal consensus of public opinion among intelligent persons as to the importance of systematic and thorough, and, if necessary, compulsory vaccination, as a preventive of small-pox, we fear it is too true that the majority of people "take chances," or omit the precaution till they hear of the spread of the disease. Some of the Southern cities have been energetically agitating this subject, and the New Orleans Auxiliary Sanitary Association publish, for the information of the public, a pamphlet thereon, written by Prof. Stanford E. Chaille, M.D., which gives arguments and statistics it is impossible to gainsay. Among other matters suggested, is the fact that on some few persons vaccination can never be made "to take," which is not singular, since some persons will not take small-pox; the estimates of the proportion of persons insusceptible to small-pox vary from 4 to 22 in every 100. Other persons are insusceptible to vaccination at one time, yet susceptible at another; which is also true of small-pox. On some persons vaccination will take several times, which is also true as to small-pox, for there have been persons who have had veritable small-pox not only twice, but even six times. On some persons, not the majority, the protection given by vaccination wears out in time. Actual experiment by vaccination is the *sole* means of determining whether any person belongs to either of these classes. The most serious imperfection connected with vaccination is its frequently careless and, therefore, imperfect performance. The good results necessarily vary with the efficiency of the operation. Any sensible person can estimate this efficiency by the appearance of the resulting scar or cicatrix. This, if perfect, is indelible, circular, depressed, *dotted with minute pits*, and not less than a quarter of an inch in diameter. Several such scars indicate greater security. English official instructions require four to five separate punctures.

THE TELEPHONE IN ITALY.—In proportion to its population Italy makes more use of the telephone than any other country in the world. There are now 4,786 subscribers to the General Italian Telephone Company, being an increase of 100 per cent in the last year.

### Asphyxia from Illuminating Gas.

Scarcely a week passes that we do not read of several deaths from gas poisoning, some of them the result of carelessness in turning out the gas, others from ignorance in blowing out the gas, and a few intentional cases of presumed suicide. In addition to these accidents in sleeping rooms, which affect only the individual or individuals occupying the room, there are the dangers of poisoning from the gentle but continuous escape of gas from leaks and the larger escape from broken pipes.

Dr. Von Pettenkofer, who gives special attention to all questions of hygienic aspect, recently delivered a lecture in Berlin, in the course of which he treated the gas poisoning question as follows:

All kinds of illuminating gases injure the air in the same manner as it is contaminated by the respiration of persons; namely, by depriving it of its oxygen and loading it with carbonic acid, water, and heat. Gas does not contaminate the air any more than stearine candles do, if we remember their relative illuminating power and let one gas flame equal twelve such candles. Hence, a gas flame is to be considered in a hygienical aspect as a step in advance, and no particularly injurious properties are to be assigned to it, since it injures the air only the same way as men do when crowded together in close rooms.

With unburned gas it is quite another matter, since the latter is a violent poison both for man and beast. It claims hundreds of victims annually, and whole families have been destroyed by escaping gas in houses where there were no gas pipes at all. Where there are pipes the gas makes its presence known by its odor, and the gas meter is a very safe indicator whether any gas escapes in the day time, while the cocks are closed.

Far more dangerous and insidious are the escapes of gas from breaks in the street mains, whereby the gas is enabled to enter the cellars and lower floors of houses.

Why is illuminating gas so poisonous? he asks, and proceeds to answer it thus: because it contains carbonic oxide. The invaluable results of Grube's very thorough investigations are before us, and from these it appears that the injury done by this gas does not depend upon the continuance of its action, but upon its concentration, or the percentage of it in the air. Air containing five parts in ten thousand can be breathed by men and animals for hours and even days without any injury to the health From seven to eight parts in ten thousand cause indisposition; twenty parts produce difficult breathing, loss of power, and uncertainty of motion; with twenty to forty parts drowsiness begins, and when there is still more carbonic oxide in the air the poisoning is attended with violent symptoms. Brain and spinal column especially are affected; cramps seize the victim, yet he may recover if brought quickly into fresh air. Breathing air heavily charged with carbonic oxide for a long time may likewise cause death.

In the cases of poisoning above mentioned, observation showed that the quantity of carbonic acid in the air of the room varied at different times, though the source of the poison (the broken pipe) remained the same.

Medical statistics gave the following very surprising result—that accidents resulting from the escape of illuminating gas from broken pipes were almost exclusively confined to the colder seasons of the year. Out of twenty-two cases reported last year in Munich, five were in October, two in November, two in December, three in January, eight in February, and two in April. The months of May, June, July, August, and September were free from such occurrences. Hitherto this peculiar circumstance has been explained in a general way as follows: Since breaks are known to be more frequent in winter than in summer, it may be assumed that the frozen earth prevents the gas from escaping through the roadway; hence it is sucked into the neighboring houses and there does its mischief. The results of scientific investigation do not altogether substantiate this theory. It is true that frozen ground is harder than the unfrozen, but it is by no means air tight, and allows gas to pass through as well as when it is not frozen. What is far more important is this—that houses heated by the most improved methods and kept warm within act like cupping glasses on the ground air, by sucking it in and the gas with it.

The lecturer proved most conclusively, by presenting the results of experiments and observations of all sorts, that there is, in fact, more gas in the earth in summer than in winter, when the draught toward heated houses is very striking; thus the inflow of gas increases with the difference between the temperature of the heated room and the external air, while on the other hand there is a decrease as soon as the windows are kept partially open.

Since gas that has passed through the earth is odorless, so that the smell is not perceptible until the soil becomes saturated with the gas, its entry into inhabited houses is the more insidious and dangerous, because it does not appeal to the sense of smell. For this reason special precautions should be taken in regard to cellars and ground floors, and when those living there suffer notably from headaches, it is advisable to open the windows If the same occurs again after ventilating for hours, we may assume that there is an escape of gas somewhere in the neighborhood.

When a broken pipe is found, it is not sufficient to merely repair the break; but it was most urgently insisted on by the lecturer that the police should compel the inhabitants of all the neighboring houses to keep all their windows open for a long time. It is only in this way that serious accidents can certainly be prevented, for the gas that remains in the soil will continue to flow into the houses, after the break has been repaired, as soon as the aspirating process begins with the setting in of cold weather.

Turning to the importance of hygienic investigations, Pettenkofer pleaded most energetically for the establishment of hygienic institutes in all universities, such as have hitherto been confined to Munich and Leipsic, although Gottingen is now beginning the erection of such a one.

It is well known here that our streets are rarely ever torn up for any purpose whatever without the smell of gas being very apparent to the least experienced, and gas men know only too well that there is a continual waste through small leaks that cannot be easily found where pipes are buried beneath the ground. In some towns this leakage is so great that the gas is turned off during the day. Hence we see how gas may and probably does enter every heated house having an open cellar.

A subway for pipes and wires would be the only effectual remedy for gas poisoning on Pettenkofer's very plausible theory, and adds one more plea for the subway.

### Seeds of Camellia Oleifera.

BY H. M'CALLUM.

The *Camellia oleifera* grows abundantly in China, where the seeds are gathered and the oil pressed out and used for hair dressing and illuminating. The residue is made into cakes or powdered, the powder being used for washing purposes, especially for extracting grease spots; an infusion of it is also made for killing worms, grubs, etc., and even fish. The cakes are used with water as a hair wash. The seeds contain a glucoside, *saponin*, as well as the oil. 44 per cent of oil may be extracted by means of ether, using a Soxhlet tube, and 10 per cent of saponin from the residue by treatment with 84 per cent alcohol; even after this treatment it is soapy.

The oil is viscid, yellowish, scentless, with an unpleasant after taste, and is not soluble in 84 per cent alcohol. The saponin is not quite pure, as it leaves 0·9 per cent ash. It is a friable amorphous white powder, which irritates the nostrils; when dry it is almost odorless, but its aqueous solution has a disagreeable odor. Its taste is at first sweetish, then bitter and disagreeable, causing a biting sensation in the throat. It is hygroscopic, very soluble in water, freely in 84 per cent alcohol, sparingly in absolute alcohol, and insoluble in ether. An aqueous solution is precipitated by barium hydroxide, by Fehling's solution, by basic lead acetate in the cold, and by normal lead acetate and dilute hydrochloric acid when warmed; in the last case a glucose remains in solution. When the aqueous solution is boiled with Fehling's solution, a slight reduction takes place. It forms emulsions with oils and chloroform; and when it is shaken with mercury, the metal is reduced to a fine gray powder.—*Pharm. J. Trans.*

### Water Drinking.

So good authority as *The Lancet* (London) thinks it is somewhat surprising that in a country in which rain falls almost every day in large or small measure, the use of pure water as a drink is not better understood than it is. Even now that the sway of temperance is well established, and continues to extend, we should be surprised to learn that a majority of Englishmen do not habitually discard the use of the natural beverage for one or other in which it is compounded with foreign ingredients. Yet its very purity from all but a solitary trace of mineral matter is what renders it capable of exactly satisfying, and neither more nor less than satisfying, the needs of thirsty tissue, and of assisting by its mere diluent and solvent action, without stimulation or other affection of function, the digestion and excretion of food. No other qualifications are necessary. Given digestible, solid food, and fair, that is normal, digestive power, water alone is all sufficient as liquid. During the feebleness consequent on disease or overwork everything is changed. There is blood, though impoverished in quality, to receive and convey nutritive material, and there are tissues to be fed, but the *vis a tergo*, the driving power of the heart, resides in a languid muscle, and the alimentary canal, itself but poorly irrigated from that center of supply, receives what food is taken only to prove its incapacity to utilize it. Nature is flagging, and a stimulant alone will make ends meet in the circle of tissue-building processes. As a general rule, however, abstinence holds the first rank, both in theory and practice. We do not assert that the man who regularly, and in strict moderation, partakes of a light stimulant—claret, for instance—may not, especially if he is equally regular in regard to out-door exercise, live comfortably to the full term of human life; but what we say is that the more simply the man fares, the more he employs such adventitious measures for actual physical necessity, the more he will gain in health, in life, in working power, and in aptitude to benefit by stimulation when strength is failing from disease or from decay. But if water be the drink, how shall it be drunk? The means must have regard to the end required of them. To moisten food and prepare it for digestion it is hardly necessary to say that it should be taken with a meal; a couple of tumblerfuls at dinner is not an excessive quantity for most persons. For thirst-quenching properties nothing can surpass this simplest of drinks, and all which approach it in efficacy owe their power almost entirely to it. As to temperature, there is no real ground for supposing that one should not drink a sufficiency of cold water when the body is heated by exertion. The inhabitants of hot climates have no such objection. Some tropical wells are dug so deep that the water within them, even in hot seasons, is as cool as that of a European spring. In fevers, too, the use of ice in quantities sufficient to allay thirst is a part of rational and legitimate treatment. The shock which has to be avoided in all such states is not that which cools the mucous membrane, but that of sharp chill applied to the surface of the body. Some persons, however, find it convenient and beneficial to imbibe a certain amount of warm water daily, preferably at bedtime. They find that they thus obtain a bland diluent and laxative, without even the momentary reaction which follows the introduction of a colder fluid, and softened by abstraction of its calcareous matter in the previous process of boiling. This method, which is an accommodation to jaded stomachs, has its value for such, though it is not great even for them; but it affords no noticeable advantage for those of greater tone. The use of water as an aid to excretion deserves some remark. In certain cases of renal disease it has been found to assist elimination of waste by flushing, without in any way irritating the kidneys. Every one is probably aware of its similar action on the contents of the bowel when taken on the old-fashioned but common-sense plan of drinking a glass of water regularly morning and evening, without any solid food. Whatever may be true of harmless luxuries, enough has been said to show that health, happiness, and work find stimulus enough in the unsophisticated well of nature.

### Coffee and Tea.

Perhaps the most brilliant address which has yet been delivered at the Parkes Museum since the evening lectures have been inaugurated was that given by Dr. G. V. Poore on December 6. Sir Henry Thompson occupied the chair, and among the audience were to be seen Dr. Russell Reynolds, Mr. Berkeley Hill, Professor Corfield, and other distinguished medical men. The subject chosen by the lecturer was "Coffee and Tea." After stating his belief that stimulants, both alcoholic and alkalcidal, had their uses, and that we ought to be very sure of our ground before we attempt to override appetite by dogma—as the Mohammedans had done—Dr. Poore proceeded to contrast "coffee with tea." The cup of coffee, provided it were genuine, contained more alkaloidal stimulant than the cup of tea, and owing to the absence of tannin the action of coffee was more rapid than that of tea. The specific gravity of a cup of tea was about 1003, that of strong coffee 1009, and of cafe-au-lait, sweetened, 1035. Tea was more of a pure beverage than coffee, and hence it was possible to use it as a mere luxury, for it required scarcely any digestive effort, and did not "cloy" the palate. The danger of excessive tea-drinking lay mainly in the large amount of astringent matter. This was a most potent cause of dyspepsia among women of the seamstress class, who frequently consumed tea which had been boiled. When the system stood in need of a stimulant, there was nothing equal to a cup of strong coffee; and if it were desired to wean the drunkard from his spirits a real stimulant must be supplied, and not the sickly, bitter, unwholesome stuff which was called "coffee" in this country. In order to make good coffee the berry must be fresh roasted and ground. There was no difficulty whatever in roasting coffee, and this ought to be part of the daily routine of every well regulated household. It was important to use enough coffee; one and a half to two ounces of coffee to a pint of water made a first rate beverage. Elaborate coffee machines for grinding were by no means necessary. If the coffee required for breakfast were put into a common earthenware jug overnight and cold water poured upon it, it might be heated to the boiling point in the morning by being allowed to stand in a saucepan of water over the fire. Violent ebullition was thus avoided, and the aroma was preserved. Chiccory and other allied bodies are in no way substitutes for coffee, for they possess no stimulant properties. Out of ninety samples of ground coffee purchased in London shops only five were found to be genuine.—*London Lancet.*

### What to Drink to Keep You Warm.

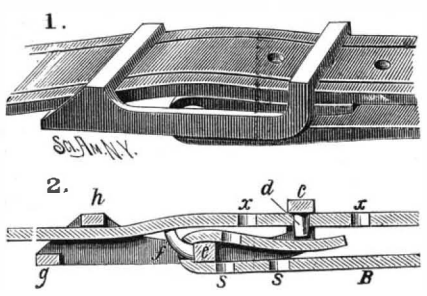
"If you want a drink that will keep you warm a whole night long out of doors," said an old policeman to a friend, "don't drink whisky or rum or any liquor. The heat they afford is short lived, and leaves you cold and weak. They are worse than nothing. But drink a glass of ale and pepper—new ale and common black pepper. It will not affect your head, but it will keep your blood warm in the keenest wind and coldest rain." I never tried the pepper part of that prescription," said a Third Avenue car driver, "but ale is, I know, thought to be very warming. We car drivers have colder work than policemen do, I think, and the old ones among us have tried every drink you ever heard of. A lot of us were talking the whole thing over the other night. Hot rum, hot whisky, brandy and ginger, and all the cold clear alcoholic drinks were discussed. But the majority were in favor of hot coffee. That is the least hurtful, the most heating, and the longest lasting drink I know of."—*New York Sun.*

### Expansion of Portland Cement.

Some interesting experiments on this subject have been made by Mr. Bradlee, a Boston architect. Three glass bottles were filled with cement and closely sealed. One burst in two days, one in eight days, and one in ten days, proving beyond dispute the expansive power of the cement.

### BUCKLE.

The buckle and fastener may be made complete in one solid piece, and consist of a frame composed of side bars united at one end by a raised cross bar, *c*, having a straight tongue, *d*, projecting from its inner side, an intermediate depressed cross bar, *e*, having a curved tongue, *f*, projecting in an outward and opposite direction relatively to the tongue, *d*, and an inner cross bar, *g*, and outer cross bar, *h*, at the opposite ends of the sides. To apply the buckle to a breeching strap, one end of the strap is looped over the bar, *e*, and a hole in it engages with the tongue, *f*; the end portion of the strap is then passed back under the cross bar, *c*, from whence it is passed through a ring and is then run to and under the bar, *c*, and engaged by a hole with the tongue, *d*, and from thence it is passed over the bar, *e*, and between the bars, *h g*. The construction and arrangement will be readily understood from the engraving, Fig. 1 being a perspective view, and Fig. 2 a longitudinal section. The buc-



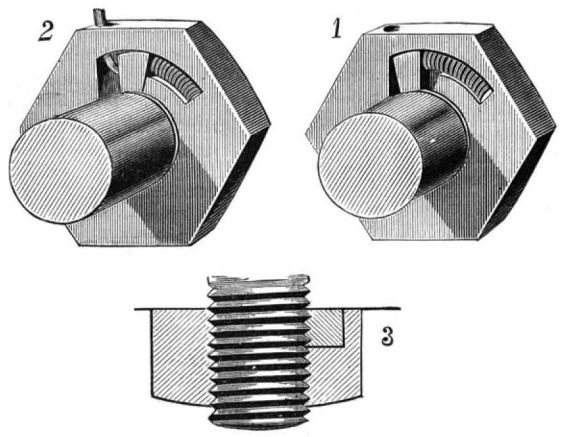

MITCHELL'S IMPROVED BUCKLE.

kle forms a very perfect self-fastener which may be cast in one piece without joint or tongue, and which, applied to a breeching strap, precludes all possibility of the horse's tail catching in it.

This invention has been patented by Mr. William F. Mitchell, of Williams, Ind.

### LOCKING NUT.

The locking dog or block is fitted in a recess at the under side of the nut, the recess opening into the central aperture of the nut, and being formed on its outer face curved or inclined eccentric to the central aperture, so that the dog has two bearings—one against the surface of the bolt and the other upon the inclined side of the recess. The recess is extended at one side in a backward direction to receive a spring (shown in Figs. 1 and 2) that bears upon the dog so as to retain it in place and assist the locking movement. The dog, as represented in the engravings, is of angular form, the inner end being formed with thread sections to fit the thread of the bolt, so as to avoid injury to the thread and locks by a rocking movement. For the purpose of releasing the dog the nut is formed with a hole entering the recess at one side through which a key, as shown in Fig. 2, can be entered, and the dog pressed back into the wider part of the recess, when the nut can be turned backward. Fig.




SAMPSON'S LOCKING NUT.

3 is a section longitudinally through the bolt and nut. As will readily be seen, the dog holds the nut from any backward movement, but does not prevent its being turned forward for tightening or taking up wear.

This invention has been patented by Mr. General W. Sampson, of Springfield, Iowa.

### The U. S. Railway Mail Service.

A recent report to the Postmaster-General reviews work in this department from 1842 to the close of last year. In 1842 the miles of railway mail service were 3,000, and the cost $400,000; last year the mileage was 110,000, and the cost $13,800,000; while at the present rate of growth, in the year 1900 it is estimated the mileage will amount to 200,000, at a cost of $25,000,000. The ratio of cost to mileage has been nearly constant, but the speed has been greatly increased, it requiring 16 hours to take the mails from New York to Washington 40 years ago against 6 hours now. In 1839 the service was divided into three classes: first class, $300 per mile per year; second class, $100; third class, $50, with an extra allowance of 25 per cent in all cases if one-half the service was performed at night. In 1867, when the railway mails were subjected to the process of weighing, astonishing inequalities were discovered. On fifteen routes where the pay was $200 per mile, the greatest weight per day carried by any one road was 19,183 pounds, and the least weight per day by any one road was 367 pounds, for which exactly the same compensation was received.

The first railway post office forced itself into use nineteen years ago. The previous system of distributing offices did not meet the necessities of the service. Experiments with railway or traveling post offices were therefore begun, and its economy has fully justified the new system. Taking the expenses of last year on the old basis, the cost of maintaining the distributing offices would have been $8,000,000, or $3,100,000 more than the new system, which is of immeasurably greater convenience, and avoids the delays of the old one. Forty years ago the mails sent out of New York in seven days weighed in the aggregate 19,000 pounds; now 19,000 pounds of mail matter on the average are sent out of that city by railroads every two hours, or about 150 pounds per minute.

### Japanese Lacquer (Urushi).

HIKOROKURO YOSHIDA.

Urushi is the milky secretion of *Rhus vernicifera*, and is the material for the well-known Japanese lacquer varnish. The tree is cultivated in many parts of the country, throughout almost all latitudes, *e. g.*, at Dewa, Aizu, Hiroshima, and in many places about Tokio; the best urushi, however, is obtained at Yoshino. The tree is very similar in aspect to the ordinary wax-tree, and attains the height of 9 to 12 feet; trees about fifteen years old yield the largest amount of the juice. Two sorts of the juice are generally obtained from a tree, and by different processes; they are distinguished as ordinary "ki-urushi" and "seshime-urushi."

Ki-urushi (or raw lacquer) is the better of the two, and is collected best in June by making shallow cuttings in the stem of the tree, when it exudes as drops from between the outer and inner barks. A single tree yields on an average about 2½ grammes of this kind of juice. Branches and twigs of the tree, some of which are usually cut down each year, when steeped in water for some months and afterward warmed in the fire, give out an inferior kind of juice; this is seshime-urushi, which is used as under varnish after being mixed with some drying oil.

The juice is never sent to market in the form in which it comes from the tree, but is usually mixed with more or less of what is called "mokuyiki" (literally wood-juice), *e. g.*, what is ordinarily called Yoshino. Urushi consists of 60 per cent of the genuine juice with 40 per cent of mokuyiki, while the inferior quality contains as much as 70 per cent of the latter substance. Further, in the hands of varnish makers, some quantity of linseed oil is generally added to the already mixed juice, which, if excess is avoided, does not much impair the drying power of urushi.

Different colors are imparted to urushi by the addition of body-pigments, such as lamp-black, vermilion, indigo, orpiment, etc.; thus red lacquer is prepared with 20 parts of linseed oil, 70 parts of urushi juice, and about 10 parts of vermilion, etc. Such is a rough yet general account of the extraction and preparation of urushi juice for varnish-making. The pure and unaltered urushi is a thick grayish fluid of dextrinous consistence, which under the microscope is found to consist of minute globules, some of darker, the others of lighter color, mixed with small particles of opaque brownish matter, the whole being held mixed in the form of intimate emulsion. It has a characteristic sweetish odor, and specific gravity 1·0020 (20° C.); some specimens, such as that obtained from Hachioji, contained a good deal of bark dust and other impurities, which raise its specific gravity as high as 1·038. If the juice be exposed to moist air in a thin layer at about 20°, it rapidly darkens in color and *dries up to a lustrous translucent varnish.* It contains a small quantity of volatile poison, which acts terribly on some persons, producing very disagreeable itching.

A peculiar acid, which I now call *urushic acid*, is the main constituent of the original juice, as well as of the portion soluble in alcohol. The juice also contains a very small quantity of a volatile poisonous body, which also passes into alcoholic solution, being almost completely driven out during the drying of the acid at 105° to 110°. It is a pasty substance of somewhat dark color, having the characteristic smell of the original juice, readily soluble in benzene, ether, carbon bisulphide, less easily in fusel oil and petroleum of high-boiling point, completely insoluble in water. Its specific gravity taken at 23° is 0·9851; it remains unchanged at 160°, and above 200° decomposes slowly with carbonization. Exposed to the air, it *neither dries up*, nor *shows any sign of change as the original juice does*, and in other respects it is a very stable body. From the alcoholic solution of the acid many metallic salts can be produced, most of which are slightly soluble in alcohol, but almost insoluble in water.

Gum is another normal constituent of urushi, and forms 3 to 8 per cent of the original juice.

As gum is insoluble in alcohol it is conveniently separated by treating that portion of the original juice insoluble in alcohol with boiling water, filtering, and finally evaporating the aqueous solution of gum over the water-bath till the weight of the substance remains constant. In this way a friable light colored substance is obtained, tasteless and inodorous; this is the anhydrous gum.

A mixture of gum and urushic acid (and with water) in the proportion in which they exist in the juice, does not undergo any change whatever, even when exposed to the condition most favorable for the drying of the lacquer. Moreover, part of the gum can be extracted in an unchanged state from the once perfectly dried lacquer; and since it exists in the original juice in the form of aqueous solution, it probably serves to keep the constituents of the juice in a state of uniform distribution and intimate emulsion. It may also act as a binding material, and assist the adhering power of the lacquer when laid upon any surface.

The results, so far arrived at, may be summed up in the following statement:

Urushi juice (lacquer) consists essentially of four substances, viz., urushic acid, gum, water, and a peculiar diastatic matter; and the phenomenon of its drying is due to the oxidation of urushic acid, $C_{14}H_{18}O_2$, into oxyurushic acid, $C_{14}H_{18}O_3$, which takes place by the aid of diastase in the presence of oxygen and moisture.

### Action of Dilute Hydrochloric Acid upon Starch.

BY DR. F. ALLIHN.

Starch cannot be entirely and completely converted into sugar by dilute sulphuric acid, but this can be easily accomplished, as Sachsse has shown, by dilute hydrochloric acid; and, besides, the latter does not decompose the grape sugar so easily as sulphuric acid. The author has recently made a series of investigations upon the saccharification of starch with hydrochloric acid to ascertain the conditions under which the largest quantity of starch should be most rapidly and completely converted into sugar with the least quantity of acid. In all these experiments twelve grms. of starch and 100 c. c. of dilute acid were employed, the acid containing from 1⅓ to 10 per cent of real acid. The reactions were made at the boiling point of each liquid over an open flame, with a return cooler. When the action was stopped the solutions were diluted and a solution of caustic soda added until it was but faintly acid. It was then made up to two liters, and 25 c. c. were taken out and the sugar estimated in this. The process of analysis was that devised and previously described by Allihn (*Chemiker Zeitung*, vii., 1193), namely, by using an alkaline solution of copper in excess, then filtering out the reduced cuprous oxide and reducing it to metal with hydrogen and weighing, then calculating it into sugar.

In his experiments the author employed potato starch, which contained 98·6 per cent of pure starch, 0·9 of ash, and 0·3 of insoluble residue. The results are given in the following table:

| No. | Starch used. | Time. | Sugar formed. | Strength of acid. |
|---|---|---|---|---|
| 1 | 12 grms. | 2 min. | 92·55 per cent. | 10 per cent. |
| 2 | " | 5 " | 92·14 " | " " |
| 3 | " | 15 " | 91·74 " | " " |
| 4 | " | 30 " | 89·55 " | " " |
| 5 | " | 50 " | 87·37 " | " " |
| 6 | " | 10 " | 96·60 " | 5 " |
| 7 | " | 30 " | 94·33 " | " " |
| 8 | " | 50 " | 93·27 " | " " |
| 9 | " | 30 " | 93·27 " | 3⅓ " |
| 10 | " | 60 " | 94·65 " | " " |
| 11 | " | 90 " | 94·49 " | 2 " |
| 12 | " | 30 " | 84·94 " | " " |
| 13 | " | 60 " | 93·68 " | " " |
| 14 | " | 90 " | 95·05 " | " " |
| 15 | " | 105 " | 94·89 " | " " |
| 16 | " | 1 hr. | 87·85 " | 1⅓ " |
| 17 | " | 1½ " | 92·87 " | " " |
| 18 | " | 2 " | 93·84 " | " " |
| 19 | " | 2½ " | 94·65 " | " " |

These results show that when the ten per cent acid is employed the percentage of sugar obtained decreased with the time, as the acid decomposes the sugar to a considerable extent on long boiling. Similar phenomena were observed with five per cent acid when the boiling exceeds half an hour. With three and one-third per cent acid the maximum quantity of sugar is obtained at the end of one hour, and with two per cent acid in one and a half hours, while one and one-third per cent acid takes two and a half hours, and no decrease is noticed then.

The best results were obtained with two per cent acid, which produces 95·02 per cent of sugar in an hour and a half.

Although hydrochloric acid, in spite of its great saccharifying power, may be for commercial purposes too expensive to get rid of after the sugar is made, this acid is very suitable for the preparation of pure glucose on a small scale in the laboratory, as the acid is easily removed by means of caustic soda or sodic carbonate. The crude grape sugar may be purified by recrystallization from methyl alcohol having a specific gravity of 0·810.—*Chem. Zeitung.*

### Hunyadi Janos.

H. Fresenius analyzed the Hunyadi Janos water and found it to contain the following salts:

| | |
|---|---|
| Sodium sulphate | 19·662123 |
| Magnesium sulphate | 18·449451 |
| Calcium sulphate | 1·321953 |
| Potassium sulphate | 0·132943 |
| Sodium chloride | 1·421068 |
| Magnesium carbonate | 0·731347 |
| Iron carbonate | 0·002059 |
| Silica | 0·011218 |
| Carbonic acid (semi-combined) | 0·383868 |
| " " free | 0·012683 |
| Lithium | Traces. |
| Strontium | " |
| Nitric acid | " |
| Boracic acid | " |
| Bromine and iodine | " |
| Nitrogen | " |
| Phosphoric acid | " |

The carbonates are calculated as simple monocarbonates, and all the salts are anhydrous, *i. e.*, without water of crystallization. The cathartic properties are due to the salts of magnesia and sulphate of soda.

## ENGINEERING INVENTIONS.

An improved platform for railway cars has been patented by Mr. Samuel M. Beery, of Omaha, Neb. The object is to devise means so the space between the ends of the platforms may be entirely closed, and to this end the invention provides a special construction of sliding platforms.

A car coupling has been patented by Mr. M. H. Merrill, of New Lebanon Center, N. Y. It has few and simple parts, may be cheaply made, and has a positive self-coupling action, so train men need not pass between cars to couple them; the coupling is of same size as the ordinary link and pin drawhead, and may be readily substituted therefor.

A torpedo holding attachment for railway danger signals has been patented by Mr. James A. Bonnell, of New York city. It consists in a bar or rod to hold the torpedo, and connected with the danger signal shaft, so that when the signal is set for "danger" the rod holding the torpedo will be operated, and the torpedo placed and held on the rail, so it will be exploded by a train passing over it.

An improved steam engine has been patented by Mr. Anton Eberhard, of Philadelphia, Pa. The cylinders are curved upon the arc of a circle, and have four pistons connected in pairs by curved piston rods, connected by levers with the slotted lugs of cross heads whose pivot arms carry the inner ends of pitmen, the outer ends of which are connected by crank pins with the fly wheels of the drive shaft.

An improved car axle has been patented by Mr. Francis P. Smith, of Boston, Mass. The axle is in two sections for independent action when running on curves; one part of the axle may turn freely in a sleeve, and revolve independently when running on curves, while otherwise both parts will be bound together and to the sleeve, so as to avoid slack and looseness, and making the divided axle as substantial as the common solid ones.

## AGRICULTURAL INVENTIONS.

An improved cultivator has been patented by Messrs. George W. Lilly and James E. Norman, of Center, Mo. Its object is to keep the plows of each part of the cultivator frame at the same distance apart laterally, and at the same angle with the line of draught, whatever lateral movement may be given to the frame in guiding the plows.

A straw stacker has been patented by Mr. Joseph J. Cox, of Lawrence, Kas. It is intended for use in conjunction with a thrashing machine, and conveys the straw as dropped from the carrier of the thrasher to the rick where it is to be stacked. It may be drawn from place to place in the rear of the separator, or it may be permanently coupled thereto.

A revolving harrow has been patented by Mr. Thomas McClelland, of Mattoon, Ill. It has a frame carrying rollers with teeth for loosening the soil, and rollers with knives to cut up rods, clods, and lumps, cross bars to hold the knives to their work, a platform and its supports to carry the driver, and a depth regulating weight, the whole promoting thorough harrowing and easy clearing of the harrow teeth from rubbish.

A fertilizer, more especially adapted for tropical countries, has been patented by Mr. William R. Wilkinson, of Brooklyn, N. Y. It consists of special proportions of bone ash, gypsum, sulphate of iron, sulphate of potash, and dried blood. This fertilizer improves the soil permanently, and produces exceptionally large quantities of saccharine matter. The prepared ingredients in their specified proportions make a compound particularly valuable for orange culture and all tropical fruits and vines, promoting rapid growth, vigorous and healthy plants, increase in yield, and improved quality and flavor.

## MECHANICAL INVENTIONS.

A pipe tongs, that may also be used as nippers and as a hammer, has been patented by Mr. James L. Strait, of Thomas, Mo. It is a cheap and strong tool, adapted for quick and easy use in grasping pipes, rods, or bolts, of different sizes, without adjustment.

A machine for forming and cutting links has been patented by Mr. Henry A. Iddings, of Warren, O. The object is to bend and cut the links at one operation, instead of using separate machines therefor. The cutting is done slowly, while the bar of metal is being forced around the mandrel, so the link bar is being made as it is cut, and with only a moderate use of power.

A machine for forming axle skeins has been patented by Mr. Andrew C. Emmick, of Columbus, O. This machine makes skeins ready for welding more rapidly and uniformly than can be done by hand, especially better as to part extending inside the collar, and this may be changed definitely from the round to the square form, to avoid dressing off the corners of wood axles to fit the skeins.

## MISCELLANEOUS INVENTIONS.

Mr. Franklin B. Kendall, of Turnwater, Washington Ter., has patented an improved construction of odorless privies. It has a special arrangement and design of parts to prevent the escape of offensive odors.

A portable door fastener has been patented by Mr. E. F. Pfund, of Sacramento, Cal. It is adapted to be jammed in between the door and the casing and held by a part which is then set against the door, for which the inventor has devised a novel construction.

A machine for making match splints has been patented by Mr. Henry A. Steber, of Utica, N. Y. It consists of a peculiarly constructed die, in which the rows of holes are arranged parallel to planes traversing the die at right angles to each other, and their upper edges sharpened to effect the cutting of the entire block of wood into whole splints, in combination with other special devices and a novel arrangement of parts.

An improved pin tag has been patented by Mr. Oscar J. Cohn, of New York city. The invention consists in the peculiar construction, whereby the wire is bent to form lips with the ends inclined inwardly toward each other and away from the body of the wire, then bent laterally under and outwardly.

An improved pipe coupling has been patented by Mr. Robert McConnell, of Omaha, Neb. The coupling tube has a conical end with an enlarged screw threaded portion back thereof, a collared thimble made to form a female cone, a packing between the cones, and a flanged coupling nut.

An improvement in two wheeled vehicles or carts has been patented by Mr. Charles A. Foster, of Elkhart, Ind. The invention consists in supporting bars carried on the axle, and carrying the cart body on springs, so that it does not partake of the motion of the horse, and the vehicle rides easily.

An improved gas engine has been patented by Mr. Harmer Denney, of Brooklyn, N. Y. It has a special arrangement and construction of parts whereby the igniting gas jet can be cut off very rapidly and effectually, and so the concussion produced by the explosion cannot extinguish the igniting jet.

A safety oil tank has been patented by Mr. Samuel Lander, of Bloomington, Ill. This invention consists of a protecting device for the filling tube, faucet, and vent of submerged oil tanks, to protect these parts from fire and from danger of being struck by lightning.

A reservoir attachment for ammonia ice machines has been patented by Mr. Perry Small, of Guaymas, Mexico. It provides for separating the oil and black lead taken up by the gas in the pump, so the same will leave the reservoir perfectly pure, and the clogging of the pipes by the oil and plumbago is avoided.

A sheet metal fastener, formed from a single blank, has been patented by Mr. George W. Traphagen, of Glens Falls, N. Y. It is more especially intended for securing buckles upon harnesses, carriage tops, and the like, but may also be used as a clasp or staple for general purposes, being cheap, durable, and easily applied.

A buckboard wagon has been patented by Mr. John M. Mayer, of Rondout, N. Y. The buckboard works in combination with the axles and peculiar intermediate springs and braces in such a way that the article is made easy riding, strong, and free from rattling noise and lateral or forward and backward movement.

A magnetic call has been patented by Mr. Henry Thau, of New York city. It combines two or more pulls and pairs of electrical contact points, etc., and a pull having an inclined or beveled shoulder for operating contact springs, a toothed sector and magneto-electric machine, in contact with circuit wires and contact springs.

A cap or shield for buckle straps of carriage tops has been patented by Mr. George W. Traphagen, of Glens Falls, N. Y. Its object is to avoid the labor of stitching the caps or shields in place, and for this purpose the caps or shields have metallic flanges with tongues that can be passed through the material of the carriage top or curtain and clinched.

A press for sacking bran, sawdust, and other substances has been patented by Mr. Arthur L. Battson, of Morrisburg, Ontario, Canada. In connection with a receiving case to inclose the sack and keep it in position while being filled, is suitable mechanism for compressing the bran, saw dust, etc., and the sack is held in place until its cover is sewed on.

A miner's safety lamp has been patented by Mr. John L. Williams, of Shenandoah, Pa. There is a sleeve or tube on the wick tube and a wire extending therefrom into a recess in the bottom of the lamp, the wick tube having a flange with a notch for the other tube, and the whole so arranged that the lamp may be extinguished very quickly without opening.

A flour mill feeder has been patented by Mr. Peter Harnist, of Marine, Ill. It provides for a special construction and arrangement of parts to secure uniformity in feeding flour middlings, grain, and other substances to sieves and rollers in flour mills, whereby the feed is delivered in a wide, thin sheet, so as to be evenly distributed.

A machine for hulling and cleaning grain has been patented by Mr. Samuel K. Todd, of Eugene, Ind. It consists in a special construction and combination of parts whereby the machine acts upon the wheat by abrasion, to reduce the hulls to powder, and by atmospheric suction to withdraw the powder and other dirt.

A machine for making the bodies of artificial flowers has been patented by Mr. Louis Lafon, of New York city. In combination with a revolving needle or spindle, on which the ball is formed out of fiber, is a pattern plate with an aperture of the shape the ball is to have, and in which the ball is revolved while being made to give it the desired shape.

A dough or butter worker has been patented by Mr. William H. Bryan, of Warm Springs, Va. Beaters with handles are pivoted to work in a sort of pan or trough representing a section of a circle, in the arc of which they may also be moved laterally, so as to thoroughly work all the dough or butter between the beaters.

An automatic lamp extinguisher and wick trimmer has been patented by Messrs. Thomas J. L. Smiley and Charles H. Stombs, of San Francisco, Cal. The wick tube has a removable frame with an aperture carrying plates adapted to be opened by the wick in raising it, and so pivoted to the frame as to fall by gravity, so they are automatically closed when the wick is lowered, and the lamp is extinguished and trimmed.

An improved separable button has been patented by Mr. Albert G. Weber, of New York city. The stem secured to the outer disk or head has a groove, the stem being passed into a slot in the inner surface of the inner disk, where there is a locking spring, the object being to render the inner disk or head easily detached from or attached to the end of the shank or stem.

A frictional hinge for mirrors has been patented by Mr. James C. Blair, of Columbus, O. It consists, in combination with the frame of a swinging mirror, of an angular bracket with a split pivot, a second angular bracket with an orifice for the passage of the split pivot, and a wedge for expanding the split pivot, the whole to hold the mirror frame stationary at any desired angle.

A safety attachment for gun locks has been patented by Mr. Jeremiah Deyo, of Denton, Mich. It combines great simplicity with a positive lock or hold of the hammer in one or more positions, and can be easily and rapidly adjusted. It consists in a simple lever or pivoted catch, with a standard for carrying and a spring for controlling it, the whole designed to prevent the premature or accidental discharge of guns.

A headway and leeway indicator for vessels has been patented by Mr. Burton E. Blakeslee, of Cambridge, Md. The invention consists of a device after the general principle of a ship's log, but is more especially designed to indicate the leeway of a vessel, the case being pivoted on its center, and combined with a relatively stationary pointer, so that the scale indicating leeway moves about the pointer.

A regulator for dynamo electric machines has been patented by Mr. J. Edwin Giles, of Hazleton, Pa. It is designed to obviate the difficulties arising from brushes running at a uniform speed, under different changes of current, and intended to insure a gradual movement of one or both of the commutator brushes under ordinary variations, and a very rapid movement of one or both brushes with a sudden and considerable increase in the strength of the current.

A key board attachment for musical instruments has been patented by Mr. Jethro M. Hooper, of Fort Smith, Ark. A perforated paper or metal web, with perforations corresponding to the music, is made to pass over a grooved roller; there are levers corresponding to the keys of the instrument, with bearing points on the keys, so they will drop through the holes of the perforated web by their own weight when the attachment is set in accordance with the design of the patent.

An improved gate has been patented by Mr. John B. Whiteman, of Centerville, Oregon. It has a long rearwardly projecting weighted top bar pivoted to a supporting post and resting upon a recessed cross bar with two tilting bars, the forward ends of the latter inserted in slotted side posts with spring catches; the spring catches have trip cords supported by bars attached to the side posts, so the gate can be opened by operating one of the trip cords.

A peanut cleaner and polisher has been patented by Mr. Charles W. Nicholson, of Assamoosick, Va. This is an improvement on a device for the same purpose patented in 1881 by the same patentee and Richard H. Leigh, and consists in a special arrangement of a cylindrical brush within the cylinder of the machine, geared to run in a direction opposite to that of the cylinder, for more thoroughly cleaning the nuts of dirt and other impurities.

An improved form of carbon for electric lights has been patented by Mr. Walter C. Beckwith, of Allegheny, Pa. The ends of the carbons are so shaped with dovetailed slots and tenons adapted to engage each other, that they may be spliced one upon another, and will then burn right over the splice; there is in connection a holder in which the carbon is similarly fitted, and the arrangement is such that each carbon may be wholly consumed.

A process of coloring photographs has been patented by Mr. Charles L. Wright, of New York city. It involves the use of egg albumen, neutral sulphate of barium, chloride of ammonium, salicylic acid, and glycerine, printing, toning, and fixing in the usual way. Then softening the albumen with concentrated ammonia, and applying the colors in a mixture of albumen, salicylic acid, glycerine, aqua ammonia, and water, and setting the color in prints by passing them through a bath of alcohol, water, and nitric acid.

A process of producing artificial marble and rendering it fireproof and waterproof has been patented by Mr. Richard Guelton, of Brighton, Eng. The fabrication is by means of cements, gypsum, or alum, applied to polished surfaces or placed in moulds, fibers being applied to the surfaces to form the veins. An enamel is obtained by laying on one or more coats of varnish, exposing the article to heat after each coat, and by polishing the varnished surface with pumice stone and finally with tripoli.

An improved projectile for breech-loading rifled guns has been patented by Mr. John G. Butler, of Watertown, Mass. It is designed to allow of the projectile moving through the rifled barrel with less friction than usual, while securing a good enough fit to take the motion of the rifling, so the projectile has one or more circumferential grooves, in combination with sheet metal bands to fit said grooves, the ridges of the corrugations forming air spaces between the bands and the projectile.

A liquid tester, for taking a fair sample of oil or other liquid in any receptacle, has been patented by Messrs. J. O. Schubert and Van H. Bukey, of Parkersburg, W. Va. In combination with a tube of uniform diameter, and open at both ends, there is a valve disk carried by a spring-retained rod, and a vertically acting trip rod engaging therewith, so the tube may be inserted to any depth required in a liquid without agitating the same, and when withdrawn bring up a sample of its quality from top to bottom.

A barrel former has been patented by Mr. Thomas H. Lee, of Memphis, Tenn. It provides means the holding the two heads and the partition or a hoop in line, means for preventing the rotation of the same and for holding the staves parallel with the axis, while they are nailed on to the partition or hoops. The same inventor has likwise obtained a patent for a ventilated barrel, in which the heads and staves are fitted in the ordinary manner, but there is an open space left between each two staves, and there is a central circular partition. The barrels can be easily taken apart and the material packed closely, it being designed to furnish a good means of conveying fruit to market and readily returning the barrels.

## NEW BOOKS AND PUBLICATIONS.

DIE HAUS UND HOTEL TELEGRAPHIE. Bearbeitet von O. Canter. Wien, Pesth, Leipzig: A. Hartleben's Verlag. Pp. 217, mit 104 Abbildund. Price 3 marks=4 francs.

This little book forms the 14th volume of the electro-technical library. The author is a practical telegraph man, and gives a full and practical description of the subjects related to electric bells, annunciators, automatic burglar and fire alarms, electric clocks, telephones, microphones, etc. In the first chapter the different kinds of batteries are described and illustrated, also current breakers, switches, galvanometers, battery testers, rheostats, etc. Ohm's law is explained, also the meaning of such terms as electromotive force, tension of current, and the effects of induction. In the second chapter the bells, push buttons, receiving, sending, and recording instruments are fully explained with excellent cuts. The third chapter is devoted to automatic instruments, alarms, door contacts, foot contacts, clock contacts, electric winding clocks, door closers, thermoscopes, and automatic fire alarms. In the fourth chapter the wires and cables are described, and directions given for finding and remedying defects and other disturbing causes. The book is intended as a text book for those engaged in putting in house telegraphs, and offers instructive reading for all who are interested in the practical applications of electricity. The mathematical formulas are given for calculating resistances, strength of currents, size of wires, and other important practical data. In the appendix the prices (in Vienna) of the different instruments and supplies are given.

## Notes & Queries

### HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their indentification.

(1) C. A. S. V. G. writes: Take a round stove pipe 6 inches in diameter at both ends and 2 feet long; then compress one end to an oval form so as to fit on to an oval opening in a stove, "compressing without stretching." Does the circular end contain a larger area than the oval end? The undersigned says it does. A. The circular end of the pipe has the larger area.

(2) E. F. R. Z. asks: Are there saws made to saw limestone? If so, where could I get one? A. Limestone is usually sawed with thin strips of iron and sand. A small piece may be sawed with a machinist's hack saw. A strip of tin stretched upon a frame like a wood saw with emery and water will do very good work for an experiment.

(3) G. E. writes: Supposing a ship of any nationality to sail from any port whatever, and to circumnavigate the globe, at what point on her course is it customary to add or drop a day from the calendar, in order that on again reaching her point of departure the day of the week according to her reckoning may coincide with the actual local day? A. Marine reckoning is generally assigned to the meridian from which the longitude is reckoned. The chronometers keep the time at such meridian without regard to the position of the vessel in longitude. The log book days are from sun to sun, and are a serial from the commencement of the voyage. If the vessel has sailed around the world, a day has to be added or deducted at some point of the voyage for a new reckoning. This is usually done at a 180° from Greenwich, which is about middle of Pacific.

(4) Le R. T.—Your diagrams of slide valves received. No. 2 is the most correct. No. 1 is bad, and No. 3 very bad. No. 2 would be improved by say $\frac{1}{16}$ inch to $\frac{1}{8}$ inch exhaust lap

(5) J. F. P. asks for the best whitewash. The wash is to be used for rough planks. A. The result of experience in the manufacture of this article is given under the title of "A Durable Whitewash" on page 52 of the SCIENTIFIC AMERICAN for July 23, 1881.

(6) R. M. K. writes: I wish to prepare many pictures (wood cuts, lithographs, etc.) for wonder camera, by transferring on plates of tin or tinfoil slides, to get strong reflection from them on screen. 1. What varnish can I use that will not blister and crack on such slide? A. A good shellac varnish is the article generally used, and will probably answer your purpose. 2. Also repeat method how to "split" a piece of paper, on which there are two engravings on opposite sides. A. How to split a piece of paper will be found on page 99 of SCIENTIFIC AMERICAN for February 17, 1883.

(7) J. H. M. writes: I have a difficulty in soldering small silver articles. I can't get the solder to run till I use so high a temperature that I fuse part of the article which I wish to solder. What solder and what flux should I use, and what part of the blow pipe flame is right? A. A soft silver solder, which is probably the article you need, may be prepared by melting one part of lead; when the latter is fluid add two parts of tin, using a small piece of resin as a flux. In soldering fine work wet the parts to be joined with hydrochloric acid, in which as much zinc has been dissolved as the acid will take up. Borax can be used as a flux. The pointed flame of the blow pipe is best, and should be directed on the parts to be soldered.

(8) A. Z. asks why acetate of soda absorbs more heat than any other material and retains it for a longer period. I have not found the *rationale* of this in any work on chemistry that I have consulted. I have an idea that the heat absorbing and retaining properties of acetate of soda may be applied to some other practical purposes than that of warming railway cars. A. Sodium acetate has a large percentage of water of crystallization combined with it, which is enough to dissolve the salt when the crystals are heated. When this liquefaction takes place, a great deal of heat is rendered latent. As the fluid cools, it solidifies and gives out again the latent heat, thus taking a long time to return to its original temperature.

(9) F. F. writes: I see in your answers to correspondents you mention a furniture polish (shellac vernish). Can you inform me where I can get it, or how it is prepared? A. The following receipt is used by cabinet makers: Very pale shellac, 5 lb.; mastic, 7 oz.; alcohol, (90 per cent), 5 or 6 pints; dissolve in the cold with frequent stirring. This is used for French polishing, etc.

(10) A. E. I. asks: 1. How the rubber is treated in the manufacture of rubber stamps; and 2, what is used for the mould? A. For answer to 1 and 2 see SCIENTIFIC AMERICAN SUPPLEMENT, No. 83. 3. How to make a "red" gold color in electroplating, with a bath that gives a yellow color. A. The anode used should be of the "red" gold variety of metal, which in its turn will become deposited upon the surface to be plated.

(11) C. Bros. write: We use a tubular boiler, the flues of which are rather thin and weak; which method of cleaning the flues would be preferable—with steam from dome or with an iron cleaner? We wish to favor the flues as much as possible. Carry about 20 lb. steam. A. Clean with steam from the dome.

(12) E. D. F. writes: If an iron tube be placed on a boiler the same as water glass tube, with an outlet from the boiler at both ends, and a steam tight piston be fitted in the tube, in what part of the tube will the piston stand if the tube be fastened to the boiler the same as water glass tube is, so that the tube will stand about half full of water? Will the piston rise and fall with the water? A. It will rise or fall with the changes in the level of the water, leaving friction out of the question. Of course the piston will settle in the water, until it displaces a quantity equal to its own weight.

(13) J. B. J. writes: 1. I have charge of an engine 30 x 36 in., 12 in. wrought iron crank shaft, with Babbitt bearing. It is a new engine. Will not run without water when working hard. It is well in line, but the Babbitt metal don't seem to have "backbone" to stand up to the work. What is best to be done in the case? I filled the side bearings about two months ago. The metal used was coarse looking. I don't think it was the right kind, for the trouble still remains. A. Your Babbitt metal is probably too soft. It is made of all qualities and degrees of hardness. Very little of that sold in market is *true* Babbitt metal. 2. What is meant by hammering Babbitt into a box? A. Hammering the metal is for two purposes—to fill the recess perfectly and harden or condense the metal.

(14) J. A. asks: 1. What is the principle of a surface condenser? Is the water that passes overboard from the hot well fresh or salt? A. The water circulated through the tubes and overboard is salt, but the water delivered by the air pump into the hot well should be fresh. 2. What is the principle of a keel condenser? After the exhaust goes into the keel pipes. does it turn into fresh water or does it take water from the sea? Does the air pump take it from the condenser to put it into a tank, then from the tank to the boiler? A. A keel condenser is a pipe outside of the vessel and generally run alongside of the keel to the stern post, and then returned again to the engine and connected to the air pump. The exhaust is into this pipe, and the water of condensation is fresh. It takes no salt water from the sea. 3. What is the principle of a jet condenser? A. In a jet condenser the water to condense the steam is admitted in a spray or jet, which is met by the exhaust steam. The water resulting is a little brackish, resulting from the mixing of the salt water to the condenser with the fresh water of the condensed steam.

(15) A. C. G. writes: 1. We have a boiler with a grate surface of 16 sq. feet, 40 flues 3 in. x 16 ft. What ought to be the size of the smoke stack? A. About 22 in. diameter. 2. What would be the theoretical result of a smoke stack one mile high? A. To reduce the draught. Any height beyond the point where the gases in the chimney are reduced to the temperature of the surrounding atmosphere would tend to reduce the draught.

(16) J. R. M. writes: In putting up a steam gauge, is it necessary to put a bend in the pipe? If so, what is it done for. Should water be allowed to remain in the pipe, or should the steam be allowed to act directly upon the gauge? A. A bend is given to the pipe for trapping the water, so that the water only has access to the gauge, and it is protected from the heat of the steam. The water acts directly upon the gauge, but should be drawn off in freezing weather when the boiler is not in use, otherwise it might freeze and injure the gauge.

(17) R. O. W. asks what deg as oil is, such as tanners use, also sod oil? A. Degras oil is a dressing for oil finished leather, such as calf and harness leather, and is used as a filler. It is imported and on sale by dealers in tannery supplies. The degras is composed of the oil and alkali expressed in making oil dressed leather in Europe, where palm oil is principally used for this purpose. Sod oil is the oil and alkali expressed in the manufacture of oil dressed leather in this country, where fish oils are principally used. In each case their character has something more than that of the simple constituents. on account of their first use for dressing the raw skins.

(18) A. M. asks whether the glass coating described in our issue of August 26, 1882, page 130, will adhere as firmly to sheet iron forms as when applied by oxide. Can it be used with good results on sheet iron forms? A. The enamel stock as described is suitable for sheet iron dishes, that are so made as not to buckle or kink, the same as the porcelain glazed ironware, so much in vogue for kitchen use. We would not recommend it for large surfaces of sheet iron.

(19) P. S. asks how to hang a grindstone on its axle to keep it from wabbling from side to side? A. It requires a pretty fair mechanic to hang a grindstone to run true and stay true. It is supposed that you have no flanges upon the axle. The hole should be at least three-eighths or one-half inch larger than the axle, and both axle and hole square; then make double wedges for each of the four sides of the square, all alike and thin enough, so that one wedge from each side will reach clear through the hole. Drive the wedges from each side. If the hole through the stone is true, the wedges will tighten the stone true; if the hole is not at right angles to the plane of the stone, it must be made so, or the wedge corresponding must be altered in the taper to meet the irregularity in the hole.

(20) C. B. writes: If a tangential line should be extended from any point on the earth's surface into space, what would be the perpendicular distance between said line and the earth's surface at any given distance from the point of contact, say one mile or fifty miles? If this line were to be extended 4,000 miles, the perpendicular would seem to be 4,000 miles, *i. e.*, one-half the earth's diameter, but at one mile the perpendicular would not be one mile nor anything like it. What is the ratio of increment? A. For ordinary purposes the square of the distance in miles divided by the earth's diameter gives an approximate answer in parts of a mile. The following table is nearly correct:

| Distance in miles. | Depression in feet. |
|---|---|
| 1 | 0·667 |
| 2 | 2·669 |
| 3 | 6·006 |
| 4 | 10·677 |
| 6 | 24·024 |
| 8 | 42·709 |
| 10 | 66·733 |
| 12 | 96·095 |
| 14 | 130·796 |
| 16 | 170·836 |

(21) F. P. B. asks: 1. What is the best way of polishing tortoise shell? A. Having scraped the work perfectly smooth and level, rub it with very fine sand paper or Dutch rushes; repeat the rubbing with a bit of felt dipped in very finely powdered charcoal with water, and lastly with rotten stone or putty powder, and finished with a piece of soft wash leather, damped with a little sweet oil; or still better rub it with subnitrate of bismuth by the palm of the hand. 2. What is the way of joining or welding same? A. Provide a pair of pincers or tongs, constructed so as to reach four inches beyond the rivet; then have the tortoise shell filed clean to a lap joint, carefully observing that there is no grease about it. Wet the joint with water, apply the pincers hot, follow them with water, and the shell will be joined as if it were one piece. The heat must not be so great as to burn the shell, therefore try it first on a piece of white paper. 3. How can it be softened so as to force it into moulds? A. The softening of the shell is accomplished by heating it under water and then pressing it into moulds.

(22) S. M. T. writes: If a man should take a light but firm cylinder, 6 or 7 feet in diameter, and 2 or 3 feet deep—like a large shoal tub without a bottom—if he should set the cylinder up on one side, should stand up within it and walk or run, the cylinder would of course revolve around him. Now, could he thus drive the cylinder one mile more quickly than he could run the one mile on the ground, outside of the cylinder, and without using it? A. The man would have to run his mile to the greatest disadvantage. He not only would have to run the full mile, but would have to drive or push the weight of the cylinder, and also overcome the friction and pressure of the air against the cylinder, and would also have to run up hill. We think that he could make the mile quicker by drawing the cylinder after him.

(23) P. S. K. asks: 1. Is the gas that is in beer of the same nature as that produced in carbonated drinks? What is the difference, if any? A. The principal gas in both articles is carbon dioxide, or otherwise called carbonic acid gas. 2. What is the usual composition of good bell metal in making good church bells? A. The composition of bell metal varies; generally about 80 per cent copper and 20 per cent tin; small quantities of silver are sometimes added.

(24) U. H. P. writes: Please give composition of a metal that will cast easy and smooth in metal moulds, be white in color, be of right hardness to polish nicely, and will be easily electroplated with silver. Something suitable to make light ornaments of, yet not too soft to burnish the silver on, and to be as cheap or cheaper than brass, and more easily melted. A. The white alloy on page 312 of SCIENTIFIC AMERICAN for May 20, 1882, will probably be suitable for your wants, if not too expensive.

(25) H. U. writes: 1. I have a graphoscope lens 2¾ inches in diameter, 11⅛ sun focus; supposing it to be a single crown glass, what would be the diameter and focus of the flint glass, and distance between them for a dialytic telescope? I would like all the field view possible. A. The focus of your graphoscope lens is too short for its diameter, and is probably double convex, which is not the best form for a dialytic telescope. As a rule they are not a very good quality of glass. 2. How can I tell whether my lens is a crown glass or not A. You can tell if it is crown by its greenish shade of color by looking edgewise, or by its specific gravity, which should be from 2·45 to 2·80. 3. Would an achromatic object glass $1\frac{5}{16}$ in. diameter, 4 in. focus, do for a finder for a telescope 2⅛ in. diameter, 44 in. focus? If so, what would be the diameter and focus of the eye glass? If not, what glasses would I require? A. A concave flint of 7⅛ in. focus, 1⅜ in. diameter, placed about midway of the focus of the object glass, may give you better satisfaction than no glass at all. Your small object glass is good for a finder; use a plano-convex eye glass of ¾ in. focus, ⅛ in. diameter. One glass is sufficient.

(26) W. S. R. asks what article is used in the manufacture of paper wash basins and buckets to make it adhere together, and what would serve in the same capacity in pressing dry pulp into any shape? Also what would answer if wet pulp is used? A. The articles referred to are generally made by pulping straw, which when in suitable condition is properly moulded and pressed by means of hydraulic pressure into the desired forms.

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

D. G. McD.—This sample has the appearance of being a good fire clay, and if on analysis this opinion is sustained, the clay would be worth $4 to $5 per ton in New York. It would be well to submit it to a preliminary fire test and so examine its refractory power.—H. R.—Mica is found in all of the granitic, gneissoid, and schistose areas of this country. The mica is generally found in layers from 3 to 4 feet between various rocks. There are no means of determining the unexposed mineral. See "Mineral Resources of the United States," just issued by the Department of the Interior.

## INDEX OF INVENTIONS

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**AND EACH BEARING THAT DATE.**

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