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J. A. FAY & CO.'S EXHIBIT OF WOODWORKING MACHINERY AT THE CENTENNIAL.

It is generally admitted that the display of woodworking machinery at the Centennial Exposition has never been equaled in any previous world's fair, either in point of variety, of efficiency, or of numbers of the implements exhibited. The policy of exhibitors has been to give in every case the fullest possible representation of their products; and in lieu of one or two prominent machines working, while the remainder in any one exhibitor's space remain idle, all are shown in operation. In very few instances, moreover, were special machines made for the Exposition, the general rule being to select good examples from the stock on hand. Thus the visitor saw the average tools under ordinary conditions of trial, and at the same time could draw his own inferences as to the excellence of the material used, and the design employed in construction.

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J. A. FAY & CO.'S CENTENNIAL EXHIBIT OF WOODWORKING MACHINERY.

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Vol. II., No. 48.

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THE CLOSE OF THE CENTENNIAL EXPOSITION.

With ceremonies as simple and yet as befitting as those which marked its opening, the Centennial Exposition has closed, and so our grand celebration passes into the history of the country. The present is hardly the time to view it in the light of a single event, still less to attempt to point out its results and probable effect upon the industries of the nation and our future intercourse with the rest of the world. Our participation in its occurrences is too recent, the memory of its details too fresh, for a retrospect; nor can we predicate results on the recent past, during which the excitement and turmoil of a phenomenal political campaign has held the uppermost place in the public mind. We shall rather look for results after the business and trade of the country, now rapidly recovering from the stagnation of the past three years, shall have resumed their normal activity, and after the finances of the nation shall have been settled on some sound, honest, and enduring basis.

That the Centennial, both intrinsically as a display and in the circumstances connected with it, has been successful far beyond the lot of all previous world's fairs, is plainly evident. The exhibits collectively were, with few exceptions, splendid representations of the resources and skill of the contributing nations. Never before has there been gathered such a collection of wonderful productions as the English and German pottery, the French silks and tapestries, the Chinese carvings, the Japanese bronzes, the Austrian art work, the Belgian laces, the superb records of the vast engineering works of Holland, the exquisite Italian mosaics, the Bohemian glassware, the Russian silver and gold objects and precious minerals, the Swedish iron and steel, the magnificent groups of Australian products, and our own labor-saving machinery.

The extortions and privations which visitors to Vienna encountered at every turn were in Philadelphia rarely met with. Within the grounds the provisions for the public comfort were such that even the colossal crowds, which at times filled the buildings, failed to disarrange them. And then the crowds themselves! Where could two hundred thousand enthusiastic people be gathered within such narrow limits for a day, and yet not a single accident, no injuries to individuals, and no acts of lawlessness occur? What a magnificent proof of efficiency, for our railroads to be able to point to the fact that eight million people have been transported to Philadelphia from every portion of the country, over a period of six months, and but one casualty wherein life was lost had occurred! Eleven years ago, these eight million people were engaged in a bitter and terrible internecine war. Now, great national gatherings have taken place day after day, unmarred by a word of sectional strife or ill feeling. For three years the nation has been suffering under a shrinkage of values and a financial stress which has brought ruin to thousands, and of which no one has escaped the evil effects. Yet despite all the privations and suffering incident thereto, a vast national enterprise has not only been successfully carried through, but has included such a representation of the fruits of American industry and genius as has never before been seen.

While we cannot yet point to special results due to the Centennial, we may at least be assured that it has imparted to our people a valuable and healthy appreciation of the "goodness which lieth abroad." Its tendency has been to break down that bulwark of intolerance and self-sufficiency which Brother Jonathan too often deems in accordance with his independent notions of self-sovereignty, and which has caused him to depreciate the productions of older nations. On the other hand, it has opened the eyes of the world to the fact that we are ready to compete for precedence in the trade in certain products, hitherto monopolized abroad, notably our steel, our porcelain, our cotton goods, and our silks. We have also learned to compare our own work with that done in Europe; and having found where we are excelled as well as where we excel, we have stored up a stock of ideas, sure to bear rich fruit in the future.

In these ideas and thoughts suggested, in extended commerce due to the closer intercourse with, and hence better knowledge attained of, other nations, in the consequent impetus to our industries and educational systems, and in a broader cosmopolitan spirit diffused over the whole country, do we look for the best results yet to be gained from the Centennial Exposition.

INTERMITTENT RECORDS AND THEIR INTERPRETATION

A few years ago, men wrote universal history with the utmost precision and confidence, as though the doings and developments of humanity, during all ages and in every part of the world, were perfectly known. The threads of human history, so far as then possessed, plainly converged toward a little tract of country east of the Mediterranean Sea; and believing that the Scriptures contained a divinely inspired account of man's origin there, men not unreasonably inferred that all the world outside their knowledge was actually or practically blank. But for the past half century, intelligent people have ceased to entertain that view, except with great and various modifications, determined by a more or less honest desire to maintain the integrity of the scriptural record. As soon as the matter began to be critically investigated, it became very clear that, so far from being complete and continuous, the chronicles which had been woven so often into exhaustive histories, were disconnected and fragmentary, extremely limited in scope, and wretchedly deficient every way. Even when fullest, they gave but scanty information of the daily lives of the people, the movements of nations, the rise of empires, the progress of invention and discovery, indeed of everything now considered most valuable and important, historically considered.

Gradually historical research and archæological investigation came in to discover and imperfectly bridge over enormous gaps in the history once thought complete; highly important events were found to have been lost track of; during long periods of time no records had been kept, and of records carefully made only disconnected fragments have survived; unmentioned or falsely mentioned empires were found to have flourished side by side with those which had professed to be not only *the* people but the only people of their day, while others a little further off were utterly unknown. Splendid civilizations, lasting many centuries, had contributed nothing to the written chronicles of the nations whose records remained; and others which had apparently burst in full panoply upon the gaze of an astonished world, were found to have had their beginning in barbarism, and to have slowly risen to the lofty stage at which history had formerly found them.

Still more fatal to the ancient view of universal history were the discoveries that, at the generally accepted date of man's beginning, Egypt was in her decline, the grandeur of her civilization having reached its culmination before Satan talked with Eve in the garden, and that other parts of the world which had been accounted historically blank could show, like China and Peru, the remains of civilization certainly as ancient as that of Egypt.

Then geology came forward to show that the six thousand years of Hebrew chronology, or the doubly extended chronology of Egypt, covered but a minute fraction of the time since man made his first recognized appearance on our globe, and that all we know of human history is as nothing compared with the unrecorded ages of which we only know that man existed. Evidence of the gaps in the story of humanity, gaps of enormous duration, are indeed overwhelming. Evidence of what man was doing during those ages is for the most part *nil*. It is possible, however, to bridge over some of those periods by inferences which cannot be considered wholly illegitimate. We know that, back of every civilization which has been critically studied (no matter how abruptly that civilization may have first seemed to come upon the stage of history), there have been found evidences of lower and still lower culture. In some cases it has been possible to trace the successive steps of progress almost continuously from barbarism upward, and everywhere the drift of evidence touching early races is such as to justify the conviction that civilization has always been a product of human effort and time. Even when the antecedents of a civilization are lost entirely, we still know enough of human development not to believe that the nation began when and as it first appeared on the stage of history.

All this is now common place enough, we are well aware; and it would be unworthy of serious rehearsal here were it not for the instructive parallel which may be drawn between it and the historical interpretation of the equally intermittent and fragmentary records of geology, touching which there is still a great deal of misunderstanding.

In the early days of geological observation, men proceeded just as they had done in the case of human history. It was assumed that the rocks contained a divinely appointed record of the earth's history, from which men could gather an exhaustive knowledge of the whole earth's experience. The strata of England and Western Europe were studied with great enthusiasm; their relative ages were determined, and their fossil remains were arranged according to the assumed order of their creation, with more or less forcing to make them tally with the Mosaic days. Everything seemed straightforward and easy. If fish appeared in great numbers in one stratum, it was because they were created then and there; if monstrous lizards swarmed suddenly in another, it was because a new chapter had been begun in the geologic history; and so on to the minutest detail.

But as knowledge increased by the study of outlying strata, grave doubts began to arise with regard to the completeness of the supposed "perfect" record and the correctness of previous interpretations. The times of "first" beginnings had to be pushed back again and again. Formations supposed to have succeeded each other immediately were found elsewhere to be separated by deposits of vast thickness, requiring enormous periods of time for their deposition. Creatures supposed to have come suddenly into being in one age were found to have existed at periods immensely more ancient. Gaps were discovered where none had been suspected; broad distinctions of age and formation were ruthlessly wiped out; and as the work went on, it became more and more apparent that the classifications and chronologic schemes, which had been so confidently adopted, were largely misleading or meaningless. To those who studied geology in books, the completeness and continuity of the geologic record remained undoubted; to those, however, who were engaged in the study of the record itself, its intermittent and fragmentary nature was most apparent. It was seen that only under rare and exceptionally favorable conditions was it possible that any record of life could be made. It was only under still more exceptional conditions that the record, if made, could be preserved. And when the limited scope of geological investigation was taken into the account, the absurdity, of the early deductions considered as comprehensive and exhaustive, became ludicrously plain. Yet when Mr. Darwin appealed to the imperfection of the geologic record, closet geologists everywhere raised a great laugh of derision, as though he had invented the plea to cover the weakness of his case. Public opinion on this point had indeed to undergo the same course of instruction and enlightenment that we have noticed in connection with the history of man, a course which it has not yet by any means completed. Even men who consider themselves competent to discuss publicly the deeper problems of geology, evolution, and so on, not un-

frequently show their unfamiliarity with Nature by repeating the old objections to any admission of breaks in the record of the rocks, apparently unconscious that the present scope of geological knowledge is as limited, geographically viewed, as the range of universal history was a century ago, or that it is simply absurd to argue as though what is known of the earth's history is the whole of that history. Even if we had, duly arranged in our cabinets, every fossil the world contains, we should still fall as far short of a connected history of life as our libraries do of a history of humanity.

From the necessary conditions of the case, it is and must always be simply presumptuous to make sweeping assertions of what may or may not have been, in the absence of positive evidence. We can only assume that the unknown most probably conformed to the known in general character: that, if there is found in any region a sudden accession of vestiges of high civilization, it is more likely that a civilized people suddenly invaded that country and took possession of it, as the whites have this country, than that a peculiar civilization came suddenly into existence by direct creation. And similarly, if we find a stratum of rock suddenly (geologically speaking) filled with the remains of a higher form of life than the underlying strata showed, it is more reasonable to attribute the change to migrations, such as we have evidence of, than to creations, of which we have no evidence. And when all the evidence we have points to the evolution of higher types of civilization or of life from lower types: and since we know that, in our histories of earth and man, the unrecorded periods clearly exceed enormously in duration those of which we have even partial records; it is altogether more prudent to be modestly guided by the known than to give ourselves up, as the unscientific are prone to do, to wild imaginations and the traditions of those whose means of knowledge were demonstrably inferior to ours.

THE STEREOSCOPE.

We are indebted to the late Sir Charles Wheatstone for a series of investigations on binocular vision, which finally culminated in the invention of that now very popular little apparatus, the stereoscope. It was in 1823 that Wheatstone called attention to a fact until then hardly noticed, namely, that the perception of relief in objects is the result of the superposition of the images, one on each eye; but these images slightly differ from each other. The mind, guided by the experience of many years, receives in this way the impression of various distances; and Wheatstone discovered that this impression may also be given to the mind by two pictures if each is drawn so as to correspond, respectively, to the image received by each eye. In order to prove this, Wheatstone invented the stereoscope. Considered from the standpoint of pure Science (apart from its practical application for amusement, instruction, and research, and the binocular microscopes and telescopes that have grown out of it) this discovery of Wheatstone's is perhaps as interesting as any other invention of recent date, not excepting the kaleidoscope, the telephone, the pseudoscope, and the revolving mirror for measuring the velocity of light, etc. Sir David Brewster, who was erroneously supposed by many to have invented the stereoscope, used often, while insisting on the importance of this new conquest in physical science, to describe this instrument unhesitatingly as the most remarkable gift with which the study of binocular vision had been enriched.

The first stereoscope by which Wheatstone demonstrated his discovery was a reflecting stereoscope. Two vertical mirrors were placed so as to make, respectively, an angle of 45' with the axes of the eyes, and in such a position as to reflect the rays coming from the right and left into the eyes, the mirrors being joined at a middle point between the axes. Two perspective drawings, correctly made, so as to correspond with the image which the real object would make in each eye, were then so placed, at the right and left, as to cause these images in the mirrors to coincide in the act of vision, and the illusion was perfect. Wheatstone found later that he could dispense with the mirrors and simplify the apparatus by using two prisms, to which he had lenses attached so as to magnify the drawings. Brewster finally had prismatic lenses made, joined by their thinnest edges, by which small drawings, placed at the distance of, say, three inches, could be made to coincide for the vision. It should, however, be mentioned that Duboscq, of Paris, was the first to give to the stereoscope the simple practical form in which it is now seen in the trade; but its popularity did not become established until photography came to its aid, to make binocular pictures perfect in all their details.

It was at the first universal exposition, in London, in 1851, that Duboscq exhibited a stereoscope, and then for the first time the instrument became noticed by the public, although it had been known to scientists for 18 years, during which time Dr. Carpenter and others had continually, in lectures on physical sciences, exhibited the instrument and demonstrated the principles of Wheatstone's discovery. According to the statements of one manufacturer of optical instruments, a long time elapsed before the people began to appreciate the beauties of the stereoscope; and for several years no sales of any importance could be made. But at last its merits were realized, and suddenly a large demand sprung up. The stereoscope soon became in fashion; and the manufacture of the different forms of the instrument (varying in price from 50 cents to $100), the grinding of the prismatic lenses, and the production of the photographic pictures (on paper and on glass) have now become an important branch of business, in which thousands of artists and workmen are occupied.

A recent application of the spectroscope, especially useful for the student of Science, consists in the reproduction of drawings of geometrical figures, illustrating the various forms used in the study of stereometry, such as the projection of solids in descriptive geometry and spherical trigonometry, and especially in crystalography. In the latter science, it may be made especially useful, as, in this way, not only the crystals themselves, but also the forms resulting from the interpenetration of two crystals, may be explained better than can be done in any other way. The relation of various systems of crystalization, the transition of one form into another, the relation of the nucleus to exterior forms, the directions of cleavage, the position of axes of crystalization, the laws of double refraction, and various other more or less intricate subjects may thus be made simple to the average understanding: and these studies may awaken some interest in this important subject, and simplify it to those who cannot afford to buy the expensive and bulky models of crystals. A number of stereoscopic pictures may thus be made equivalent to a collection of models costing as many dollars as the pictures cost cents.

ARTIFICIAL BUTTER.

There has been for some time past a prevalent impression that, if the manufacture of artificial butter has not died out, at least no product of this description is now industrially made which has any standing in the market, or which cannot, by any one, be properly distinguished from the genuine article. It is true that the public, both in this country and more especially in England, has had placed before it in the newspapers more records of failures in artificial butter making than of the successful efforts therein; and these, together with the popular prejudice which exists against the material, are sufficient, perhaps, to account for the general impression referred to. The facts, however, we are assured by competent authority, are altogether against any such conclusion, for quite recently no less than fifty artificial butter factories were counted in this city; and large quantities of artificial butter are sold in the market by wholesale dealers, or are purchased direct from the manufactories by large retailers, and offered to the customer as genuine butter. There is, of course, a duplicity in this business which is reprehensible; but if people cannot distinguish the made from the natural product, and if the former is, as reported by Professor Chandler, actually more healthful than the average cow butter sold, it would be difficult to prove any damages save to the moral sense to all, and to the over-qualmish prejudices of a part, of the community.

It will be seen furthermore that, the above being the case, the problem of succesfully producing the imitation product has been solved, and in that we may recognize an important step in scientific progress, which it is worth while to consider briefly in the light of previous efforts. As the successful process is based mainly on the invention of Hippolyte Mège, patented in this country in December 1873, the previous patents, obtained by Bradley in 1871, and by Peyrouse in the same year, as well as that taken out by Paraf in April, 1873 (which last is charged to be a piracy of Mège's ideas) need not be referred to. The best points of Mège's invention are found combined in the reissue of his patents, dated May 12, 1874, and among them these two essential and important operations, namely, the extraction of the oil from the fat, at a low temperature, and the conversion of the oil, by churning with milk, into butter. The caul fat, being washed, is hashed, melted in a water bath at 125° Fah., and, after becoming separated from the membrane, is allowed to solidify. It is then pressed, and the oil treated in different ways according as the resulting product is intended for immediate or future use. It will suffice here to say that the product thus obtained has a grain, and seemingly has no resemblance to genuine butter save in color. With reference to the many other patents issued since the date of Mège's, it may be said that, as a rule, the common defects, of grain, lack of savor, and inferior keeping quality, are present in all; and the products may more fairly be described as chemically prepared tallow than as butter.

The above statements are made on the authority of Dr. Henry A. Mott, E. M., a promising young chemist of this city, who for some years back has been engaged in investigating the subject we are here examining. His researches have included the actual manufacture and testing of the various compounds patented; and their result is found in the present, or "true," as he terms it, process for producing artificial butter. To Dr. Mott belongs the credit of this discovery, although the ownership of his process is in the hands of others; and its salient feature is that he produces, not tallow disguised as butter, but butter itself. This will be seen at once from the fact that chemical analysis of cream butter gives water 12·29. and solids 87·71 parts per 100: of artificial butter, water 12·005, solids 87·995. The amount of casein in the artificial product, the detailed analysis shows to be a little higher than in the natural butter (0·745 to 0·19) but not sufficient to make any difference. Comparing the fats proves that there is a very small amount of butyrin in the artificial product, and herein lies the chief disparity: which amounts to an absolute virtue, because, while sufficient butyrin exists to afford the necessary odor and flavor to the artificial product, there is not enough contained to render the butter rancid by decomposition.

Dr. Mott's process of manufacture is as follows: The fat, after being weighed, is thoroughly and repeatedly washed in tepid and cold water. It is then disintegrated in a meat hasher, and forced through a fine sieve. Next, it is placed in the melting tank, which is surrounded by water at 146° Fah., and there kept until the temperature of the fat reaches 124° Fah. During this process the material is constantly stirred. After the scrap has settled, the clear yellow oil is drained off in cans, and left for from 12 to 24 hours in a room at 70° Fah. to granulate. The refined fat is now packed in cloth into small packages, about 8 inches long by 1½ inches thick by 4 inches wide, and these are placed on metal plates, and piled one above another in a press. Gradual pressure is applied, when the oil is driven out, and cakes of pure white stearin left. The oil, being cooled to 70° Fah., is next churned with sour milk, annatto, and soda, 100 lbs. of oil being used to 15 or 20 lbs. of milk, 3 ozs. of annatto solution, and ¾ oz. of bicarbonate of soda. The mixture is agitated for ten or fifteen minutes, and then led into a tub of pounded ice, with which it is thoroughly mingled. This process completely removes the grain. After the ice melts, the solidified oil is crumbled, and 30 lbs. of it are introduced in a churn with 25 lbs. of churned sour milk. Here it takes up a percentage of the milk, as well as the butter flavor and odor. Lastly, the butter is worked and salted in the usual way, and is packed in firkins, etc., for the market.

Hon. X. A. Willard, President of the New York State Dairymen's Association, an able butter expert, admits his surprise at the flavor, and declares the butter the best yet made. The cost of manufacture is about 13 cents a pound, the selling price 25 cents to wholesale dealers; so that, so far as the saving is concerned, there is very little, over the cost of genuine butter. The economy, however, would doubtless become manifest were the people willing to accept the material for what it is, and thus enable the industry to become established on a broader foundation.

Dr. Mott's report on artificial butter, recently read before the Chemical Society of this city, contains complete details of his processes, together with a review of those previously patented, besides full chemical analyses, complete estimates, and plans for a factory capable of producing 500 lbs. of butter daily, and drawings of apparatus, etc. This valuable paper, too lengthy for these columns, appears in full in the SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 48 and 49, current volume.

THE SALT BLUFFS OF VIRGIN RIVER, NEVADA.

The mineral wealth of Nevada is by no means confined, as many may suppose, to Big Bonanzas and similar stores of precious metal hid within its seemingly barren mountains. In many places its sterile plains—the beds of recently evaporated seas—are underlaid with extensive strata of cruder though possibly not less important commodities, among which common salt is certainly not the least valuable.

Perhaps the most important of the formations of this character are the vast deposits of rock salt along the valley of the Rio Virgin, in the southeastern corner of the State. Their discovery is quite recent. Lieutenant Wheeler, in charge of the survey of the region west of the 100th meridian, first visited their neighborhood in 1869, and again two years later, at which time the only indication of their presence appears to have been a curious natural well, which Mr. G. K. Gilbert describes and figured in his report on the geology of those parts. It lies near the confluence of the Rio Virgin and the Colorado, in a smooth gravelly plain sloping gradually toward the latter, and presents a round, craterlike opening nearly three hundred feet across at the top. The sides are of unconsolidated *detritus* horizontally bedded, the upper thirty-five feet being of half-sorted gravel and sand, and the lower fifteen feet of saline sand showing a slight efflorescence. At fifty feet below the land surface is a water level about a hundred and twenty feet across, and below the water the slope of the bottom can be seen continuous with the bank for fifteen or twenty feet. The water is too salt for drinking. There is no sign that the well ever overflowed, the water is not thermal, and no marks of geyser action are to be seen. Mr. Gilbert suggests that the well might have been opened by the solution of a salt deposit, which is extremely probable in view of the vast extension of saline strata along the river valley.

A correspondent of the San Francisco *Chronicle*, who lately made a special visit to the salt quarries now being opened up at various points from six to twenty miles above the Colorado, reports that the rock salt occurs in "mountains," and is quarried like marble or granite. The salt mountains begin about six miles from the mouth of the Rio Virgin and extend along its valley a distance of thirty miles. For the first six miles or so, the salt rock appears like common coarse gray granite, and is said to contain 92 per cent of pure salt.

The quarries here lie along the east side of the river and within half a mile of the river bank. On the western side, twenty miles up, the salt is as white as snow on the surface but beautifully transparent within. The blocks of salt thrown out by blasting look like cakes of clear ice, so crystalline that fine print can be read through several inches of it.

The Rio Virgin is a muddy turbulent stream about a hundred feet wide and very shallow. Where it joins the Colorado, the latter is perhaps seven hundred and fifty feet wide and from ten to fifty feet deep at low water. The head of navigation is at Collville, twenty-five miles below, but small barges of a few tuns burden are towed up to the mouth of the Virgin for cargoes of salt for supplying the mines of El Dorado cañon and elsewhere. The Virgin joins the Colorado at a point six hundred miles above its mouth, and about fifty miles below the outlet of the Grand Cañon. The region about the salt mines is altogether barren and desolate.

PAINTING the surface with ink soon relieves the pain of a small superficial burn

IMPROVED FIREPROOF AND BURGLARPROOF SAFE.

It has been suggested that the simplest fireproof safe is found in a hole in the ground. The present invention improves upon this idea by suspending a safe by a chain in a well, and also by locking it there so as to prevent burglars from raising it. A, in the engraving, represents a well of strong masonry in the cellar under the safe, B, in which is a watertight case, C, of galvanized iron, surrounded, except at the top and bottom, by water. Into this case the safe is lowered by a chain, pulley, crank shaft, counterweight, etc. A staple is attached to the bottom of the safe, and a bolt, K, which is operated through the medium of the arm, *a*, and rock lever, *b*, by rod, Z, passes into said staple and so holds the safe down. *m*, in the small diagrams, is a sliding bolt, which, in connection with the tumblers, L, controls the locking bolt, K. The tumblers are connected to rods, O P, respectively, extending up through the floors to the room in which the safe is used, to be manipulated conveniently. Q is a trap door in the floor of the room, over which the safe stands when raised.

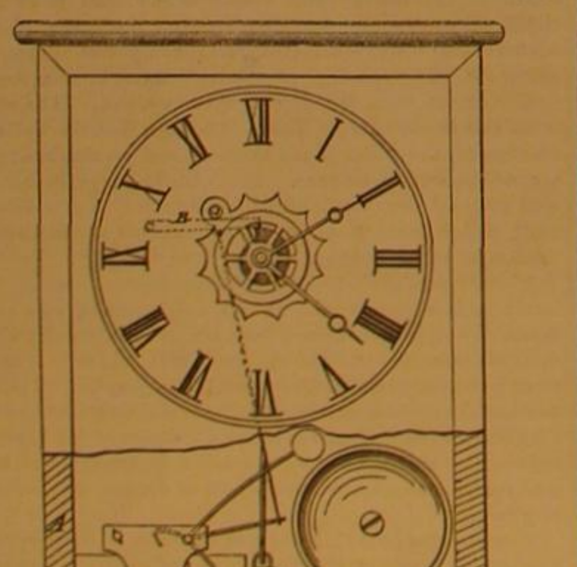
The invention was patented through the Scientific American Patent Agency, September 26, 1876, by Mr. I. J. Gray, of Pentwater, Mich.

In Case of Fire.

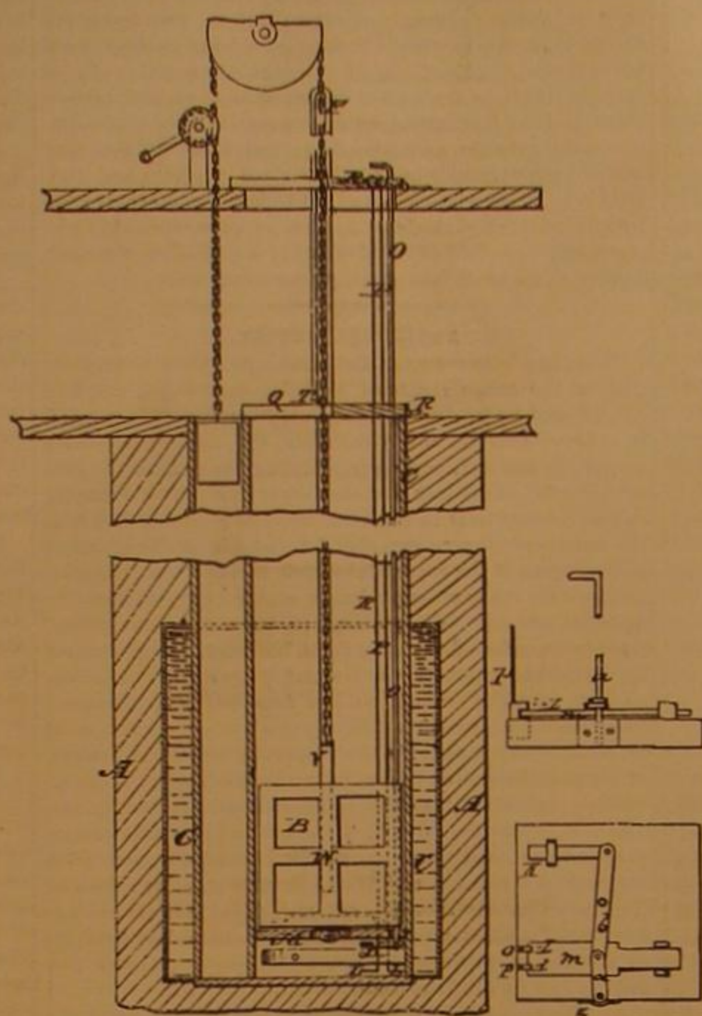
The season is at hand when fires most prevail, and when the precautionary hints of the late Dr. Hall are most important to be heeded. They are as follows: Keep doors and windows of the structure closed until the firemen come; put a wet cloth over the mouth, and get down on all fours in a smoky room; open the upper part of the window to get the smoke out; if in a theater, church, or school room, keep cool; descend ladders with a regular step to prevent the vibration. If kerosene just purchased can be made to burn in a saucer by igniting with a match, throw it away. Put wire work or glass shades over gaslights in show windows, and in bedrooms with curtains; sprinkle sand instead of sawdust on floors of oil stores; keep shavings and kindling wood away from steam boilers, and greasy rags from lofts, cupboards, boxes, etc.; see that all stovepipes enter well in the chimney, and that all lights and fires are out before retiring or leaving the place of business; keep matches in metal or earthen vessels, and out of the reach of children; and provide a piece of stout rope, long enough to reach the ground, in every chamber. Neither admit any one if the house be on fire, except police, firemen, and known neighbors; nor swing lighted gas brackets against the wall; nor leave small children in a room where there are matches or an open fire; nor deposit ashes in a wooden box, or on the floor; nor use a light in examining the gas meter. Never leave clothes near the fire place to dry; nor smoke or read in bed by candle or lamp light; nor put kindling wood to dry on top of the stove; nor take a light into a closet; nor pour out liquor near an open light; nor keep burning or other inflammable fluids in rooms where there is a fire; nor allow smoking about barns or warehouses.

TIME DROP ATTACHMENT FOR ALARM CLOCKS.

This is an ingenious device connected with ordinary clock mechanism, which may be attached to the door of a furnace to turn on the draft; with the faucet of a water pipe,



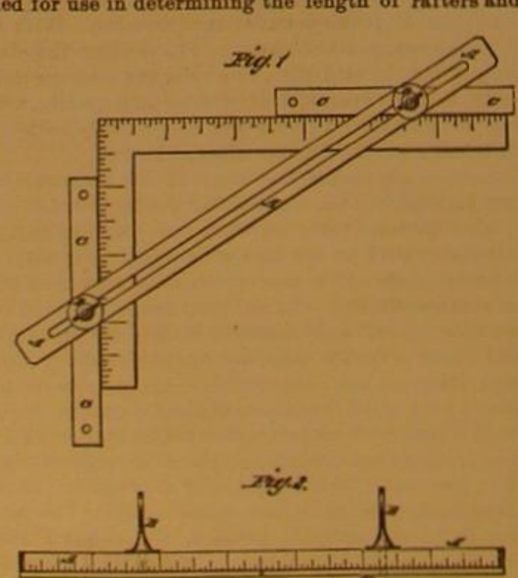
to turn off or on the water; or with the valve of a gas pipe, to turn off the gas at any time. A rod, C, passes through the bottom of the case of the clock, and has a loop formed upon its upper end, to enable it to be hung upon the teeth of the wheel of the alarm mechanism, B. To the lower end of the loop rod, C, is pivoted the end of a lever, D, which is pivoted to the bottom of the clock, A, when said clock is attached to a wall and to the bottom of a shelf. The other end of the lever, D, rests against the arm of an obtuse angled lever, E, which is pivoted at its angle to the bottom of the clock, or to the shelf to which said clock is attached, so that its other arm may project beyond the end of the said bottom or shelf. The loop rod, C, the lever, D, and the obtuse-angled or cam lever, E, are so arranged that the operation of hanging the loop rod, C, upon a wheel of the alarm mechanism may raise the free end of the obtuse-angled lever, E, into a horizontal position, so that it may receive and hold any object hung upon it. With this construction, as soon as the alarm mechanism starts, the loop rod, C, will drop, which withdraws the end of the lever, D, from the arm of the angle lever, E, so that the object hung upon or from its other arm may drop. In case it is not wished to sound an alarm when the alarm mechanism, B, starts, the bell, or hammer, or both, may be detached. The lower end of the loop rod is provided with a handle for convenience in hanging it upon a wheel of the alarm mechanism. The object, in falling, may release a weight which performs the required operation. This device was patented through the Scientific American Patent Agency, September 26, 1876, by Mr. Charles Cottrell, of Newport, R. I.



GRAY'S FIREPROOF SAFE.

IMPROVED BEVEL.

Carpenters and builders will be interested in a new instrument which we illustrate herewith, and which is intended for use in determining the length of rafters and the bevels of their ends, when the width of the building and the desired pitch of said rafters are known. The device may also be used for getting the length and the bevels of the ends of braces, and for other similar purposes. A represents a bar, upon the edge of which is formed a scale of division marks, numbered to represent the length of the rafter or brace, and which should be made upon a scale of an inch to the foot to make it correspond with the division marks of an ordinary square. The bar, A, is slotted longitudinally to receive the clamping screws, B, which are screwed into straight bars, C, placed upon the lower side of said bar, A, as shown. In using the instrument the bar, A, is laid diagonally across the arms of an ordinary square, and is adjusted upon the long arm of the square at a point representing the half width of the building, and upon the short arm at a point representing the desired pitch of the rafters. The bars, C, are then adjusted against the edges of the arms of the square, and are clamped in place by the screws, B. The instrument is now set to give the length of the rafters and the bevels of their ends. The instrument may be used without a square, by having lines drawn upon the under side of the bar, A, to represent the different positions of the bars, C, for different lengths and pitches of rafters.



The device was patented September 26, 1876, through the Scientific American Patent Agency, by Mr. George H. Bradshaw, of Fayetteville, Tenn.

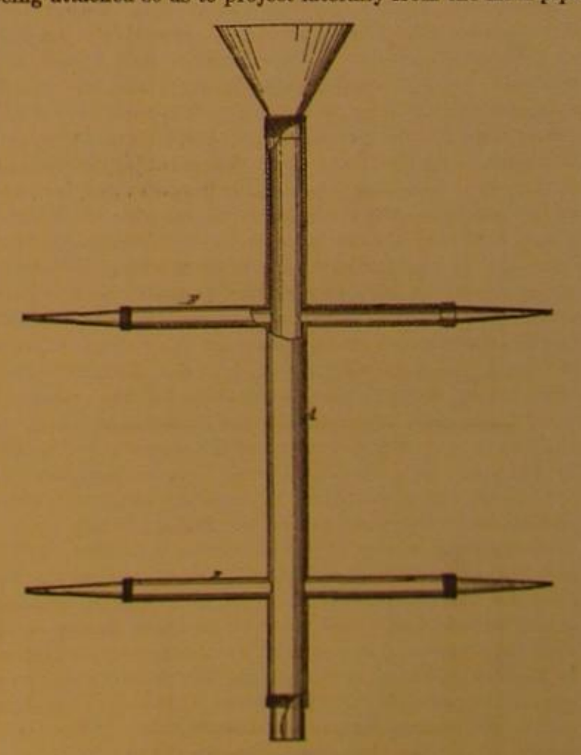
Enameled Cooking Vessels.

Cast iron cooking vessels, coated on the inside with a white porcelain or enamel, are now extensively used, and are generally supposed to be as safe as they are convenient and cleanly. It has been assumed that vegetable acids, which act more or less energetically upon metallic surfaces, do not affect this porcelain lining, and that vessels protected by it may therefore be used for cooking acid fruits, preparing pickles, and kindred processes. It seems, however, that there may be "death in the pot," even when it is enameled. A Scotch chemist, in a paper recently read at Glasgow before the Society of Public Analysts, states that some kinds, at least, of this porcelain lining are very readily acted upon by acid fruits, common salt, and other substances used for food, and that thus large quantities of lead and even arsenic are dissolved out during culinary operations. Analyses were given of three enamels taken from cast iron pots made by as many different manufacturers. All contained arsenic, and two of them lead; but it is not so much on account of the presence of these substances that the enamels are objectionable, but because of their highly basic character, which renders them peculiarly susceptible to the action of even feebly acid solutions. The percentage of bases in the three enamels was 38·58, 53·73, and 55·28, respectively. A one per cent solution of citric acid, boiled in the third, roughened and destroyed the enamel at once, dissolving out enough lead to give a dense black precipitate with hydrosulphuric acid. An enamel that will not bear so moderate a test as a one per cent solution of citric acid is certainly not fit to be used for culinary purposes.

If the enamels employed in this country are similar to those in Europe, as they probably are, our readers should be cautious in using vessels coated with them. We have not experimented upon them as yet, but may do so and give the results at some future time.

A NEW IRRIGATOR.

Mr. Frederick Taylor, of Covington, Pa., has patented, through the Scientific American Patent Agency, September 26, 1876, an improvement in irrigating apparatus, which, as shown in the engraving, consists of a tube, A, with a pointed and perforated end to be set in the ground near the plants; the water from this tube slowly escapes through the perforations and thus gently moistens the ends of the plants. A number of conically pointed and perforated tubes, B, are attached to a main pipe for holding the water to irrigate a number of plants or hills from one supply, the pointed pipes being attached so as to project laterally from the main pipe.



These irrigators may be used independently of the main pipe by setting them upright on the point in the ground and filling them. For elevating the main pipe, and for adjusting the laterals as required, they are made of flexible material; but the points are of metal.

Chloroform has been administered to a child during sleep, and a painful operation was performed, the child sleeping on and awaking in the morning unconscious of anything unusual having occurred.

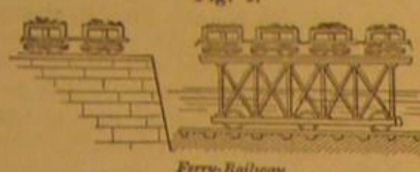
LOCOMOTIVES AND RAILWAYS.

Our selections this week from Knight's "Mechanical Dictionary" (published in numbers by Messrs. Hurd & Houghton, New York city) include a number of interesting engravings of locomotives, among which will be found represented the early machines of Stephenson and others, now carefully preserved as historical relics. We also give illustrations of two railways of curious construction. The

FERRY RAILWAY,

Fig. 1, has its track on the bottom of a water course, and

Fig. 1.



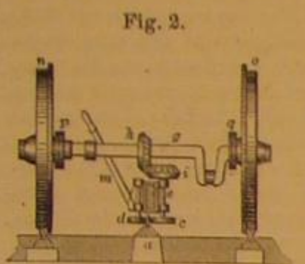
Ferry-Railway.

the carriage which runs thereon has an elevated deck which supports the train. Chains are attached to the carriage and connected to engines on each side of the stream, and in this way the huge vehicle is pulled from shore to shore. A ferry of this kind is in existence at St. Malo, France, and there are others in various parts of Holland. It is a cheap substitute for a railway bridge. Fig. 2 represents Vignolles and Ericsson's

CENTRAL FRICTION RAIL,

which is grasped by apparatus from the locomotive, so that the latter is thus assisted in ascending grades. The rail consists of a flat piece of iron fixed in a vertical position in chairs, *a*. *c*, *d* are horizontal friction rollers, *c* being fixed and *d* movable on their respective shafts. To the driving axle, *g*, is attached bevel gear, *h i*, which rotates the shaft, *e*, of the driving roller, *c*. The friction roller, *d*, may be pressed against the rail by the lever, *m*, which is so connected as to be easily operated by the engineer. The driving wheels, *n o*, may be released from the power of the engine by disengaging the clutches, *p q*, so as to throw the whole force of the engine upon the griping rollers, *c d*, when ascending a grade. In Fig. 3 are represented

Fig. 2.

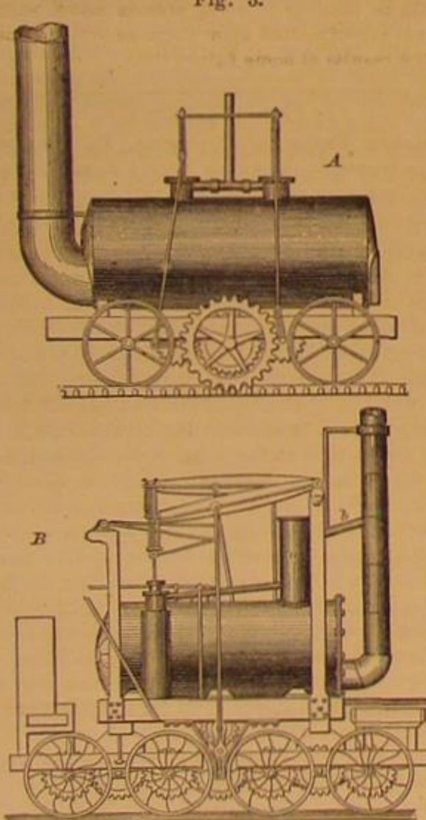


Vignoles and Ericsson's Central Rail.

BLENKINSOP'S AND HEDLEY'S LOCOMOTIVES,

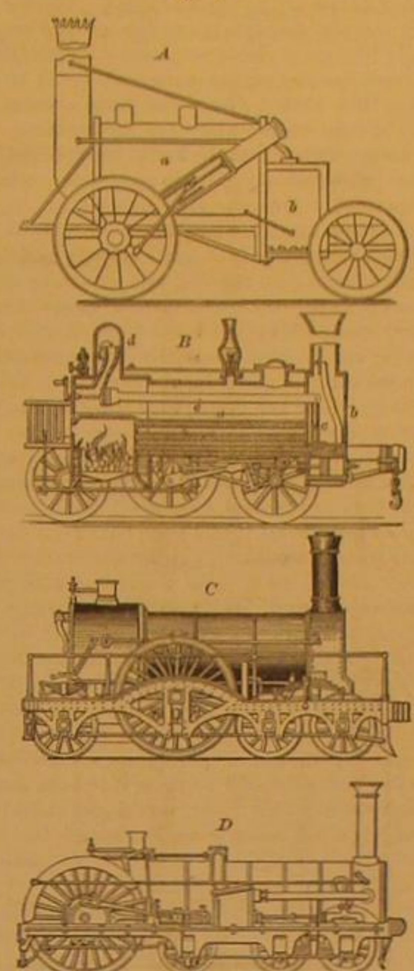
two of the earliest constructed machines. Blenkinsop's locomotive, in 1811, was usefully employed at the Middleton colliery in hauling coals on a tramway, the engine having spur wheels working into a rack on one side of the track. The engine, A, Fig. 3, was otherwise supported on four wheels. The fire was built in a large tube passing through the boiler, and the tube was bent up at the end to form a chimney. Two vertical cylinders were placed above the boiler, and the pistons were connected by crossheads and connecting rods to cranks on the axles of spur pinions, which geared into the main spur wheel, which formed the driver. It was long used on a colliery railway between Leeds and Middletown, 3½ miles distant, and perhaps was the first successful locomotive in regular use. It drew trains of 30 tuns weight at 3½ miles per hour.

Fig. 3.



A, Blenkinsop's Locomotive (1811).
B, Hedley's Locomotive (1813).

Fig. 5



A, Stephenson's "Rocket" (1829).
B, English Locomotive (Longitudinal Section).
C, Gooch's Express Engine (English).
D, Crampton's Express Engine (English).

In the spring of 1813, William Hedley built a locomotive with four smooth drive wheels, to run on a smooth rail. The machine failed to accomplish much, on account of its small boiler. Hedley thereupon, the same year, built another engine (shown at B, Fig. 3), having a return-flue boiler, and mounted on eight driving wheels, which were coupled together by intermediate gear wheels on the axles, and all propelled by a gear in the center, driven by a pitman from the walking beam. Hedley's locomotive was objected to by residents of Newcastle, on account of the smoke. He therefore passed the smoke into a large receiver, *n*, and turned the exhaust steam upon it. From the receiver the steam and smoke were conveyed by a pipe, *b*, to the chimney, which device soon developed into the steam blast. "Puffing Billy" was at work more or less until 1862, when it was laid up as a memorial in the British Patent Office Museum. Hedley died in 1842.

DODDS AND STEPHENSON'S LOCOMOTIVE.

In 1815, Dodds and Stephenson patented an engine (shown by side and end views, Fig. 4), in which the power might be applied either through wrists, at angles of 90° to each other on the driving wheel, or an endless chain working in gearing on the axles.

In 1829, the Liverpool and Manchester railway, then the most extensive and finished work of the kind ever undertaken, was completed, and the directors offered a reward of $2,500 for the best locomotive which should fulfill certain imposed conditions. Among these were that it was to consume its own smoke, and draw three times its own weight at a rate of not less than 10 miles an hour, and the boiler pressure was not to exceed 50 lbs. per square inch. The weight was not to exceed 6 tuns, nor the cost $2,750.

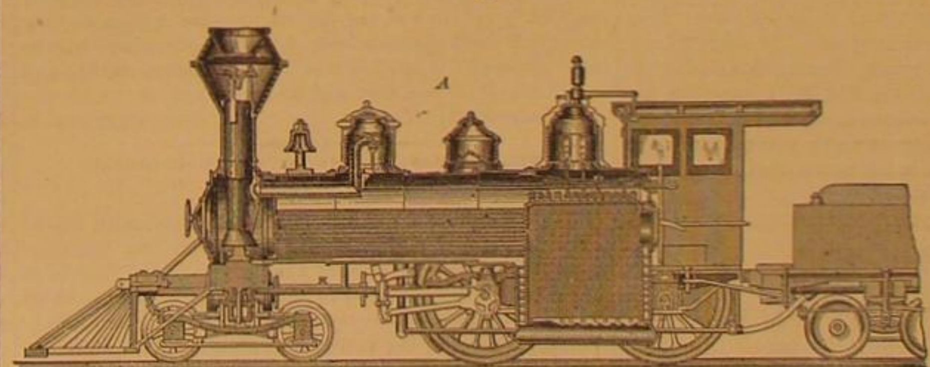
THE "ROCKET."

Three engines competed for the prize: the Rocket, constructed by George Stephenson; the Sanspareil, by Thomas Hackworth; the Novelty, by Messrs. Braithwaite and Ericsson. The Rocket weighed 4 tuns 5 cwt., and its tender, with water and coke, 3 tuns 4 cwt. It had two loaded car riages attached, weighing a little over 9 tuns and 10 cwt. The greatest velocity attained was 24¼ miles per hour, and the average consumption of coke per hour 217 lbs. See A, Fig. 5. The Sanspareil attained a speed of 22⅝ miles per hour, but with an expenditure of fuel per hour of 692 lbs. The Novelty carried its own water and fuel. In consequence of successive accidents to the working arrangements, this engine was withdrawn from competition. A fourth engine, the Perseverance, by Burstall, not being adapted to the track, was withdrawn.

The Rocket engine was superseded in 1837, being condemned for life to the collieries. Here it proved itself capable of a rate of 60 miles an hour; but being again convicted of levity while on duty, it was cashiered and its place filled by heavier machines of 12 tuns. After a few years of inglorious retirement, some one, not totally oblivious of how it would look in history, recalled the old soldier from his limbo, and now he enjoys the company of his elder brother, Hedley's Puffing Billy, in the English Patent Museum.

In Fig. 5, A is an elevation of the Rocket. The boiler, *a*, is a cylinder 6 feet long, and has 25 tubes. The fire box, *b*, has two tubes, communicating with the boiler below and above, and is surrounded by an exterior casing, into which the water from the boiler flows and is maintained at the same level as that in the boiler. B is a longitudinal vertical section of a modern English locomotive, which may serve as a contrast to Stephenson's first crude effort. The boiler is surrounded by two casings, one within the other, united by stays. The tubes, *a*, are of brass, 124 in number, and the boiler has longitudinal stays connecting the ends. *b* is the smoke box, into which the blast pipe, *c*, discharges. *d* is the

Fig. 6

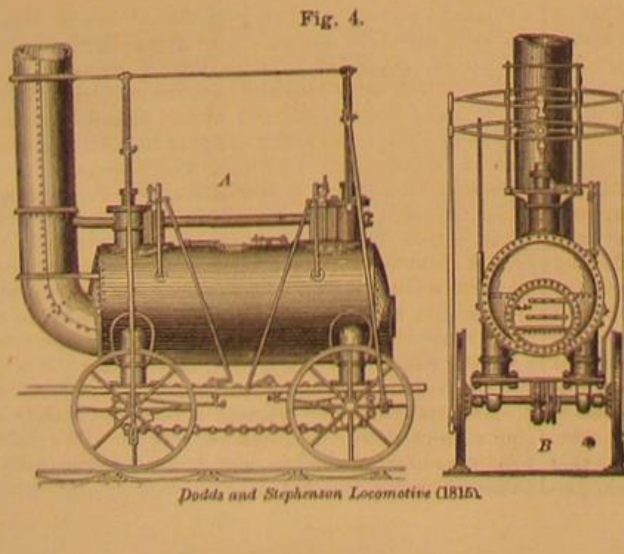


Baldwin Locomotive (Central Longitudinal Section).

Fig. 7.

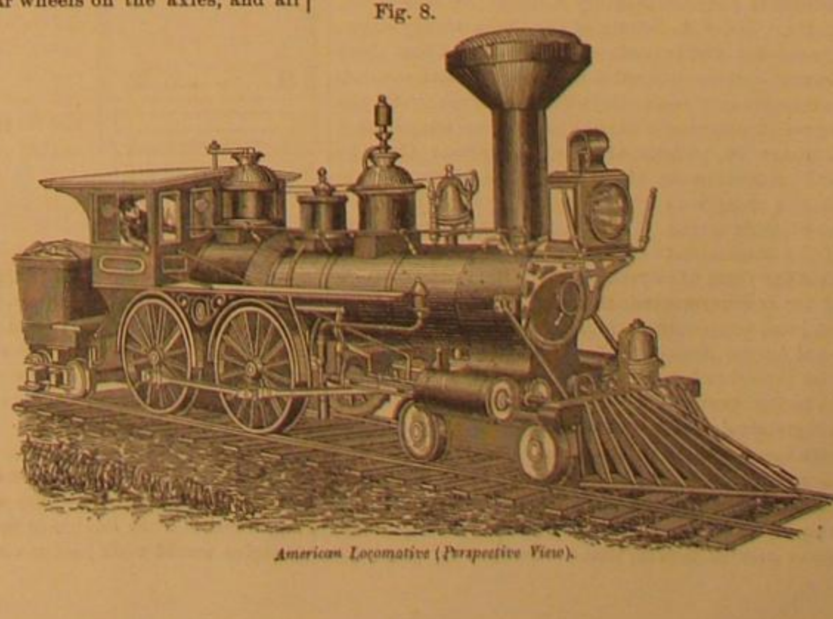
Baldwin Locomotive (End Elevation and Transverse Section).

Fig. 4.



Dodds and Stephenson Locomotive (1815).

Fig. 8.



American Locomotive (Perspective View).

steam dome, into which the steam from the upper part of the boiler enters, its amount being governed by a regulator controlled by a winch. This serves to obviate in great de gree the effects of priming. The steam pipe, *e*, has two branches, each entering one of the boxes containing the valves by which the flow of steam to the cylinders is controlled. C is an express engine designed by Gooch for the Great Western Railway, where an unusual rate of speed is maintained. The boiler has 305 tubes, 2 inches in diameter. The cylinders are 18 inches diameter and 24 inches stroke, the driving wheels 8 feet in diameter, the heating surface of the fire box 153 square feet. D is an express engine designed by Crampton. It is adapted for the usual gage.

Fig. 6 is a central longitudinal section of an approved form of American locomotive as made at the Baldwin Locomotive Works, Philadelphia. Fig. 7 is a perspective view. Fig. 8 is a front elevation, one half of which shows a transverse section through the boiler. The engine has four dri vers, 60½ inches in diameter, and a four-wheeled swing bolster truck, and weighs, with water and fuel, about 65,000 lbs. The flues, 144 in number, are 2 inches in diameter, and 11 feet 5 inches in length. The fire box, of cast steel, is 66 inches long, 34½ inches wide, and 63 inches deep. Water space 3 inches sides and back, 4 inches front. Grates, cast iron. The cylinders are horizontal. Valve motion graduated to cut off at any point of the stroke. The tires are cast steel, and the wheel centers of cast iron with hollow spokes and rims, the wrist pins of cast steel, the connecting rods of hammered iron. The truck wheels are 28 inches in diameter. All the principal parts of such engines are interchangeable.

Attempts are being made, by adaptation of the furnace and boiler, to run locomotives by means of liquid fuel. Differences also occur in the construction of the heating parts, according to the character of the fuel—coal, coke, wood, peat, etc.

The ordinary speed attained on English railways is greater than that usual in this country. The Great Western express from London to Exeter travels at the rate of 57 miles an hour including stoppages, or 55 miles an hour while actually running. Midway between some of the stations a speed of 65 miles an hour has been reached. A speed of 75 miles is equivalent to 35 yards per second, so that if a row of stakes one yard apart were driven at the side of the road, they would, at this velocity, appear undistinguishable one from another. Were the driving wheels of the locomotive 7 feet in diameter, they would revolve 5 times in a second, each piston would traverse the cylinder 10 times per second, while there would be 20 discharges of waste steam per second, causing a continuous sound instead of the cough which is heard when the engine is moving slowly.

Very high speeds have been attained, on special occasions, on American roads, probably fully equaling any time ever made in England. For instance, it is stated that a train, conveying some officials of the New York Central Railroad, made the distance from Rochester to Syracuse, 81 miles, in 61 minutes, said to be the fastest time ever made in America.

The life of a locomotive engine is stated, in a paper read before the British Association, at thirty years. Some of the small parts require renewal every six months. The boiler tubes last five years, and the crank axles six years; tires, boilers, and fire boxes, seven to ten years. The side frames, axles, and other parts, thirty years. During this period, the total cost of repairs is estimated at $24,450 in American money, the original cost of the engine being $8,490. It therefore requires for repairs, in eleven years, a sum equal to its original cost. In this time it is estimated that an engine in average use has run 220,000 miles.

Correspondence.

The Sun's Retrograde Motion and the Weather.

To the Editor of the Scientific American:

Some time ago, I showed, in your columns, that both lunar acceleration and retardation in the earth are pure results or outgrowths of increase in the sun's motion; and still later, I showed, through the same channel, that inequality in the moon's mean motion is a result of solar retrograde motion: and now, with your permission, I will show that solar retrograde motion, or the sun's velocity, has much to do with our terrestrial winds and weather.

It is recorded in Harper's *Monthly Magazine* for November, 1876, that Mr. Charles A. Schott, of the Coast Survey Office, has, by great labor and investigation, discovered that there is what we may call an oscillation of the winds and weather in about every seventy years. Says the magazine: "All the stations agree in showing a rapid rise in the temperature about February 20. There are also indications that the hottest and coldest epochs change somewhat from year to year, making a complete circuit in seventy years through a range of about six weeks. On comparing the average direction of the wind with the average temperature, it appears evident that for years of northerly winds the temperature is lower, and for southerly winds it is higher So that secular changes in local temperature are attributable to corresponding changes in the direction of the winds. These latter changes, on the other hand, must be a part of a system of oscillation in the general currents of the atmosphere, which may be ultimately due to slight variation in solar radiation." Here I wish to note three things: first, that the wind and weather are supposed to circulate round the earth in some 70 years; second, that change in the winds may possibly be due to slight variation in solar radiation; and third, that I see, from another printed source, that a certain "German philosopher, Professor Prestel," ascribes weather changes "to the moon." Allow me to present my views.

The sun retrogrades in the plane proper of the ecliptic 50¼ seconds, annually; and so of course does the earth, in her own orbit, as it were; and it takes her 20 minutes and 20 seconds, in other words, 1 year, 20 minutes, and 20 seconds, to reach the same point in the heavens that she was at, say, on December 31 last at 12 o'clock at night. Twenty minutes and twenty seconds amounts to one day, or one rotation of the earth, in 70¾ years. In 70 years and 8 months, therefore, the earth loses one day on the stars; and it will be seen in a moment or two that she loses the same amount, in the same space of time, on the winds and the weather; for the winds do not circulate round the earth, as supposed, but the earth turns—retrogrades round—to receive the winds, supposing them to blow from the same quarter.

To give a proper idea of what we mean, suppose the sun to be moving retrogressively at great velocity, and the earth in consequence to be ever meeting and stemming an etheric current: suppose too that the earth's rotary motion is stopped, and that nothing but her orbital motion and the sun's is going on. In such a case, the etheric current would ever strike the earth on one point of her surface; that would be the point or side of her that is ever lying next to the current. Now suppose that she retrogrades round her axis in a year, an amount equal to the 1-365¼ of a rotation—an amount equal to 20 minutes and 20 seconds—the point on her surface that directly breasted, so to speak, the etheric breeze last year would not breast it this year; but one, a little more than 5° east from it, would. Thus, by the earth's westerly or retrograde motion, as it were round her axis, the ever parallel current of storm seems, to all appearance and to meteorological evidence, to circulate easterly round the earth, while in reality it is the earth that is turning round to receive the ever parallel-flowing etheric breeze: a current that must ever flow directly from the sun as radiance, or be the result of the earth's being drawn, as it were, through ether by virtue of the sun's velocity, as a vessel propelled through water meets the still water as if it were flowing in a current against it. This, I say, would give the winds and weather an apparent easterly motion round the earth in some seventy years: and that is exactly as Mr. Schott finds it. I cite again from Harper's *Magazine*:

"Mr. Schott finds no perceptible secular change in the temperature of the country, nor any decided connection between our temperature and the variations in solar spots. For ten stations the mean temperature has been commuted for every day of the year, and it appears from these that changes in the normal temperature of any day extend over large tracks of country, and progress in an easterly direction." Thus I connect even the winds and the weather with solar retrograde motion, and I think that the moon has nothing to do with the weather. She, in every 18 years, and all along through the 19th year, so conjoins with the sun and earth that the four—sun, earth, moon, and storm current—are in line, or parallel with each other, and so a sort of periodic 19 years storm occurs. But the moon has no more to do with raising it than the surface of the earth has with the so-called seventy years oscillation, that is, the seventy years and eight months oscillation.

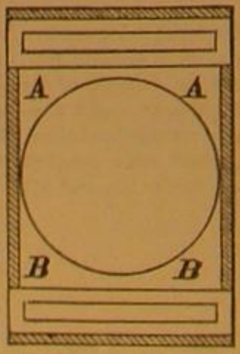
When astronomers, meteorologists, and other scientists, can clearly see the sun and the whole solar system moving retrograde in the plane proper of the ecliptic, they will be much more able to tell how and why phenomena occur; and it will cost them less time and labor too, I think.

Gloucester city, N. J. JOHN HEPBURN.

The Corliss Engine at the Centennial.

To the Editor of the Scientific American:

While watching the movements of this celebrated engine a few days ago, I noticed among its details two improvements upon former engines of the Corliss style. The most important of these consists in the placing of the valves in the heads of the cylinder instead of in the cylinder casting. This disposition of the valves does away with the eight triangular cavities in each cylinder which form the steam ports, namely, A, the inlet, B, the exhaust ports. The diagram shows a cross section at one end of a cylinder through the center of the ports, the aggregate capacity of these ports being equal to from two to four per cent of the steam used in working the engine. By placing the valves in the heads of the cylinder, they are brought almost in contact with the piston (when at the end of its stroke) from end to end of the ports, thus effecting a saving of the two or four per cent of steam usually wasted, and of course enhancing the economy of the engine in like proportion.



Could a like improvement be made in the valve gear of locomotives, the consequent saving of fuel ought to give the inventor a fortune in a short time. In locomotives, from five to ten per cent of the steam used is wasted in the huge passages between the valve and piston: and more, another benefit (aside from the direct saving of from five to ten per cent of steam, owing to the more perfect appropriation of the steam used, consequent upon the close proximity of the valves to the piston) is lost. Some engineers argue that short steam ports are of but little benefit in any case, especially in engines working under a high degree of expansion. By what line of sophistry they arrive at such a conclusion, I know not. They might, by the same reasoning, say that an engine would work just as economically with steam passages long enough to contain half of the steam used. It makes no difference whether the steam is exhausted from the cylinder at 90 or at 5 lbs. pressure to the inch; the percentage of waste will be precisely the same. The cubic capacity of the steam passages between the valve and the bore of the cylinder represents exactly the cubic quantity of steam used over and above what is needed to work the engine; and the sooner locomotive builders realize this, the sooner they will be prepared to reduce the length of these wasteful passages.

Another improvement noted in this engine consists in the interposition of a short link between the rocker arm and the arm upon the valve stem, in such a way as to cause the valve to open and close quickly, and to remain open and almost stationary for a considerable interval, thus giving a very free exhaust and a timely and rapid opening and closing of the valves. F. G. WOODWARD.

Worcester, Mass.

The Bude Canal in Cornwall, England.

To the Editor of the Scientific American:

The Bude Canal, from Bude to Launceston, is said to have been working for fifty years. It was intended to transport ore from Launceston to Bude, but is now principally used to carry coal, and sand from the coast for manure for the farms. In order to carry the canal over the highest points of the land, a very simple and wonderfully effective plan has been carried out. The canal is made in sections, each on a level; and each two sections are joined by an inclined plane, on which are laid grooved rails. The barges, which are built for the purpose, are hauled bodily out of the canal laden with, say, 4 tuns of coal or sand, and drawn up the tramway with a chain, and launched again in the next section of canal, which starts from the top of the hill. There are in the entire length of the canal six of these planes, three between Bude to the highest point, and three down into Launceston. At Marham, about 1½ miles up the canal from Bude, is the first ascent. I judged the length of the incline to be 800 feet, and the gradient 1 in 6; the total ascent, therefore, is about 130 feet. The barges are small, of about 5 feet beam, and 15 feet in length, and are loaded with 4 tuns, total weight being 5 tuns each when loaded. Fitted on the flat bottoms are four wheels, which run in the grooved rails, laid like an ordinary tramway, in two lines up the incline. An endless cable passes between the rails, up one and down the other, and round large wheels at either end. These wheels are fixed horizontally. The wheel of the upper end has a strong shaft or axis, which descends into a chamber below, where, by means of cogged wheels, it is connected with an enormous water wheel, the moving power This water wheel is overshot, and has a diameter of 60 feet. The barge to be hauled up having been placed in position and fastened to the endless cable chain, the water wheel is set in motion, and the barge is rapidly drawn to the top of the incline and floated again in the upper canal. About two miles further up I came to Hobbacott, where is the second incline. This is longer and steeper, and is worked in a different manner. This incline is 900 feet long; total rise, 275 feet. At the top are two wells, 20 feet in diameter and 225 feet deep. At the bottom of each is an escape for water to flow out into the lower canal. Suspended in these wells, by massive cables from a horizontal roller, are two huge iron buckets, capable of holding 60 hogsheads of water each, and weighing, when full, 16 tuns. These are so arranged that, when one bucket is at the top of one well, the other bucket is at the bottom of the other. The bucket which is at the top of the well is filled with water from a sluice, and is allowed to descend; and in doing so, it raises the bucket in the other well, which comes up empty, the water having escaped through a valve which opened mechanically when the bucket reached the bottom. The alternate rising and falling of these buckets sets in motion the endless chain cable on the incline; and by means of cogged wheels, the power is so multiplied that the descent of the bucket, weighing 16 tuns, into the well 225 feet deep, suffices to haul a barge weighing 5 tuns up the entire length of the incline, 900 feet, in the space of 4½ minutes. The whole of this machinery is worked by two men and a boy, with no further expense than the oil for the machine.

About nine miles further up the canal, at its highest point, is a vast reservoir messuring 60 acres, which supplies the water for working the canal.

London, England. B. R. PLANTE.

The Supposed Planet Vulcan.

To the Editor of the Scientific American:

Please to add my testimony to that of others regarding the intra-mercurial planet. Unfortunately, when I saw the planet, supposing it to be known to astronomers, I did not attach such importance to the subject as to induce me to make memoranda, and at this distance of time can only think that it was about the year 1860. I was residing then in Washington Territory, and was superintending some work on a prairie, a few miles from Fort Vancouver, on the Columbia River. A range of mountains was in the distance, from behind which the sun had reached an altitude of about 30° above the horizon, when a small boy asked me what was the matter with the sun. On looking at it I saw a planet, not as your correspondent saw it, but as a perfectly rounded, well defined dark spot, having with the disk a smaller relative proportion than that you have illustrated, and situated nearer the disk's diameter. I watched its progress till its completion without a telescope, merely glancing with partially closed eyes, at very short intervals. It was in the hight of summer, and the hour was so early that no one but our party, that I have heard of, saw it. I am

sorry I can give so few data regarding an event of which I am as certain as of my own existence. The clear but peculiar skies of that region in summer may account for the distinctness of the view.

Washington, D.C. RICHARD COVINGTON.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES—Number XV.

PATTERN MAKING.

Our second example, Fig. 106, is a design for another kind of gland, such as is often fitted to glands for pump rods and spindles. For the small sizes, the glands are usually cast

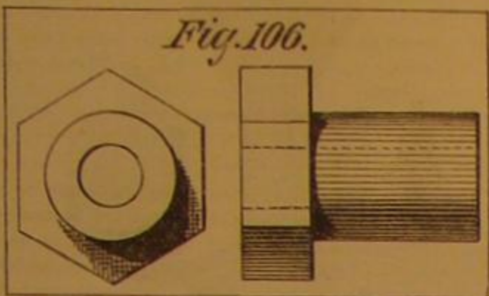


Fig. 106.

solid, and the hole is drilled out in the lathe, in which case, providing the gland is not very deep, it would be molded vertically, with the head in the nowel, and would be turned out of the solid piece of wood in the style of our previous example, treating for the moment the hexagonal part as a flange, whose diameter must be turned to the size of the hexagon across the corners. After the turning is done, we mark the hexagon as follows. We set a pair of compasses as nearly as possible to the radius of the turned piece that is to form the hexagon, and divide that piece off into six divisions, in the manner shown in Fig. 107; for the radius of a circle will divide its circumference into six equal parts. So that, if the compasses are correctly set, one trial will be sufficient; but if not, we must readjust the compasses and go around again. Then, from these points, we square lines, as shown in Fig. 107, at 1, 2, 3, 4, 5, 6; and then, with the paring

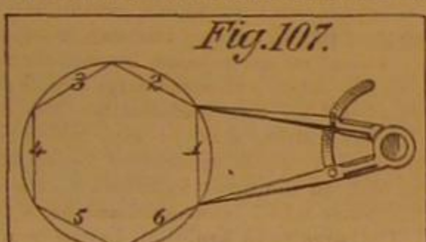


Fig. 107.

chisel, we pare off the sides to the lines. It is not necessary to actually draw the hexagon on the circumference by joining the lines of division on the top of the flange; for a straight edge, being applied as the paring proceeds, will be all that is necessary to produce a true hexagon. Nevertheless it is possible that error may have crept in, though we have performed the above operation with the greatest of care; it is therefore imperative upon us to apply correcting tests to our work, such as a pair of calipers to try if each pair of the opposite sides are parallel, also the bevel to verify if each angle of the figure contains 120°. Hexagon shapes are so common that a special hexagon gage is very useful; and such a gage, of the most approved form, is shown in Fig. 108, together with its method of application, the edges, A B, being to try the hexagon, and C D to square

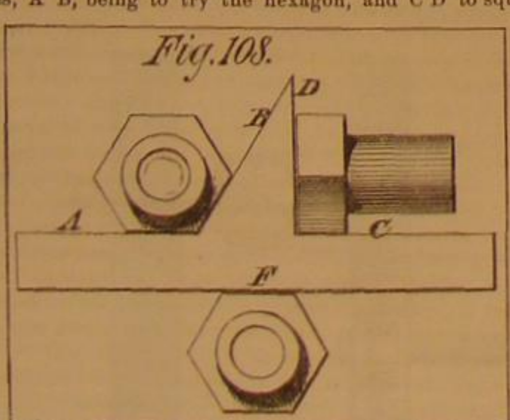


Fig. 108.

the edge to the face, and the edge, E, being used as a straight edge. If, however, we have not such a gage, we may set the bevel square, shown in Fig. 23, in the following manner: Take a piece of board planed on one side and on one edge, and let A B, in Fig. 109, represent the planed edge, from which we mark with the gage the line, C D. Then taking any point, such as I, in the line, C D, as a center, at a convenient distance we describe with a pair of compasses the arc, F G. We then take the compasses, and, without shifting their points at all, we rest one point on the intersection of the lines, C D and F G, and then mark the arc, H. If then we draw a line from the intersection of the arc, F G, and the arc, H, to the center, I, upon which the arc, F G, has struck, the lines, H I, I C, form the angle required; and we may apply the stock of the bevel square to the planed edge, A B, and set the blade to the line, I H, as denoted by the dotted lines. The bevel being set, we test the work as it proceeds, first cutting down one hexagonal side and then applying the bevel to gage the angle of the others; and as the diametrically opposite sides are finished, we apply the calipers. The lines of division upon all good pattern work are made very fine, in fact merely distinguishable; and the instrument by which they are drawn is shown

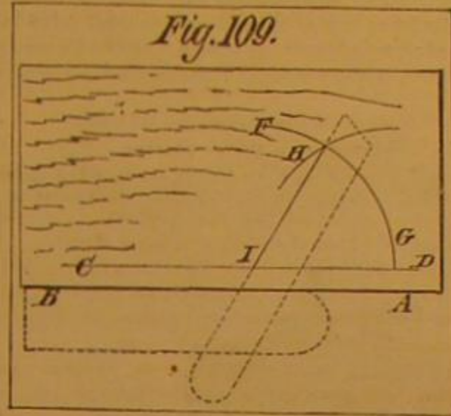


Fig. 109.

in Fig. 110. It is called a cutting scriber, and the end at A is beveled off at both sides, like a skew chisel, forming a knife edge. The end, B, is ground to a point, and both ends

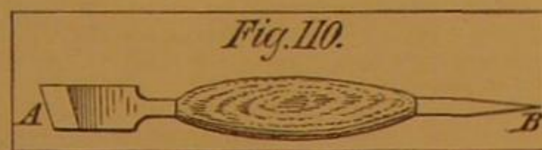


Fig. 110.

are finished on an oilstone. The point end is for drawing lines along the grain, while the cutting edge, A, is for drawing lines across the grain of the wood. The wooden handle in the center is to enable the operator to hold it more firmly. It sometimes happens that the size of the hexagon is given across the flat sides instead of over the angle; and when that is so, we proceed as follows: We describe upon a piece of board, as in Fig. 111, a circle of a diameter equal to the given distance between the flat sides. We then take a hexagon gage, or else set the bevel square to an angle of 120°: and applying it to the planed edge of the board, we draw the line, C D, in Fig. 111, in which figure, A is the circle of the size of the flat sides of the hexagon, and B E are the planed edges of the board. We next reverse the bevel; and from the opposite edge of the board we strike the line, F D, cutting C D at the point, D, where both the lines cut the circumference of the circle, A. Then from the center of the circle, A, we draw the circle, G, intersecting the point, D. The diameter of G will be the size of the hexagon across the corners.

If the gland is a long one, it will be better to make it in

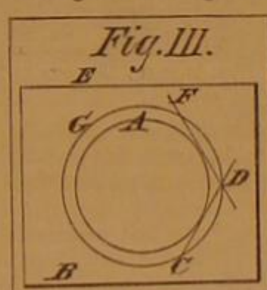


Fig. 111.

Fig. 112.

halves, letting it part across two corners, as shown in Fig. 112. When a gland of this kind is made in halves, the corners at the parting are liable, from their weakness, to chip off, and it is therefore proper to make it of hard wood.

Water Supply for Towns.

The subject of water supply is one that is now engaging the attention of the authorities in many large towns. The extended drought in the Eastern States during the past summer has revived in this vicinity the enquiry for advice as to the best means of providing an inexhaustible supply of water.

The city of Orange, N. J., and the adjoining town of Montclair, both rapidly growing places, have during the past summer been exceedingly short of water, to the inconvenience of many of the citizens. Montclair lies at the foot of Orange Mountain, and the city of Orange scarcely one mile from the base of the same mountain, on which inexhaustible springs are found by digging only a few feet. It occurs to us that the above places, as well as many other towns, similarly situated in the vicinity of mountains, might readily be supplied in the manner in which the city of Dubuque, Iowa, has recently (by accident) acquired a novel and practical water system. Some time ago, in one of the bluffs, a lead-mining company met obstruction from water; and to obtain relief the bluff was tunneled, when it was found that a copious fountain had been struck, which ran to waste for several years. But the water was most excellent, the supply exceedingly liberal, and the head so elevated that the idea of utilizing it was seized by a company, the property purchased, and a system perfected which gives the cheapest and best water supply known in the country.

Origin of Wire Rope.

Mr. Andrew Smith, C. E., of London, in the year 1828, first applied wire rope as a substitute for catgut, in aid of another invention of his for metallic shutters. The rats have destroyed the strength of the catgut line by eating it; the position of the sheave or pulley was so placed and so narrow in the groove that none but a small substance could be applied to that particular case. Necessity, after all, was the the mother of invention. Time rolled on, and the author watched anxiously the working of this experimental metallic cord; four years were spent in experimenting, in order to test its strength in comparison with hempen rope and chain, as regarded weight, size, strength, price, durability, and economy. This required time, patience, and a heavy outlay of capital. On January 12, 1835, the first patent was obtained by Mr. Smith, and in 1839 he had obtained his fourth patent.

Stick to a Legitimate Business.

Well directed energy and enterprise are the life of American progress; but if there is one lesson taught more plainly than others by the great failures of late, it is that safety lies in sticking to a legitimate business. No man—manufacturer, trader, or banker—has any moral right to be so energetic and enterprising as to take from his legitimate business the capital which it requires to meet any emergency.

Apologies are sometimes made, for firms who have failed, by recurring to the important experiments they have aided, and the unnumbered fields of enterprise where they have freely scattered their money. We are told that individual losses sustained by those failures will be as nothing compared with the benefits conferred on the community by their liberality in contributing to every public work. There is little force in such reasoning. A man's relations to a creditor are vastly different from his relations to what is called the public. The demands of the one are definite, the claims of the other are just what the ambition of the man may make them.

The histories of honorably successful business men unite to exalt the importance of sticking to a legitimate business; and it is most instructive to see that, in the greater portion of the failures, the real cause of disaster was the branching out beyond a legitimate business, in the taking hold of this and that tempting offer, and, for the sake of some great gain, venturing where they did not know the ground, and could not know the pitfall.

The Inventor of Gas Lights.

The inventor of gas lights is said to have been a Frenchman, Philippe Le Bon, an engineer of roads and bridges, who in 1782 adopted the idea of using, for the purpose of illumination, the gases distilled during the combustion of wood. He labored for a long time in the attempt to perfect his crude invention, and it was not until 1799 that he confided his discovery to the Institute. In September, 1800, he took out a patent, and in 1801 he published a memoir containing the result of his researches. Le Bon commenced by distilling wood, in order to obtain from it gas, oil, pitch, and pyroligneous acid; but his work indicated the possibility of obtaining gas by distillation from fatty or oily substances. From 1799 to 1802, Le Bon made numerous experiments. He established at Havre his first thermo-lamps; but the gas which he obtained, being a mixture of carburetted hydrogen and oxide of carbon, and but imperfectly freed from its impurities, gave only a feeble light and involved an insupportable odor, and the result was that but little favor was shown to the new discovery; the inventor eventually died, ruined by his experiments. The English soon put in practice the crude ideas of Le Bon. In 1804, one Winsor patented and claimed the credit of inventing the process of lighting by gas; in 1805 several shops in Birmingham were illuminated by gas manufactured by the process of Winsor and Murdock; among those who used this new light was Watt, the inventor of the steam engine. In 1816 the first use was made of gas in London, and it was not until 1818 that this invention, really of French origin, was applied in France.

How the Centennial Revives Business.

Much has been said by the press throughout the country about the visitors to the Centennial, and the advantages to be derived by the Exhibition. But the *American Builder* advances an idea which we have not seen alluded to elsewhere:

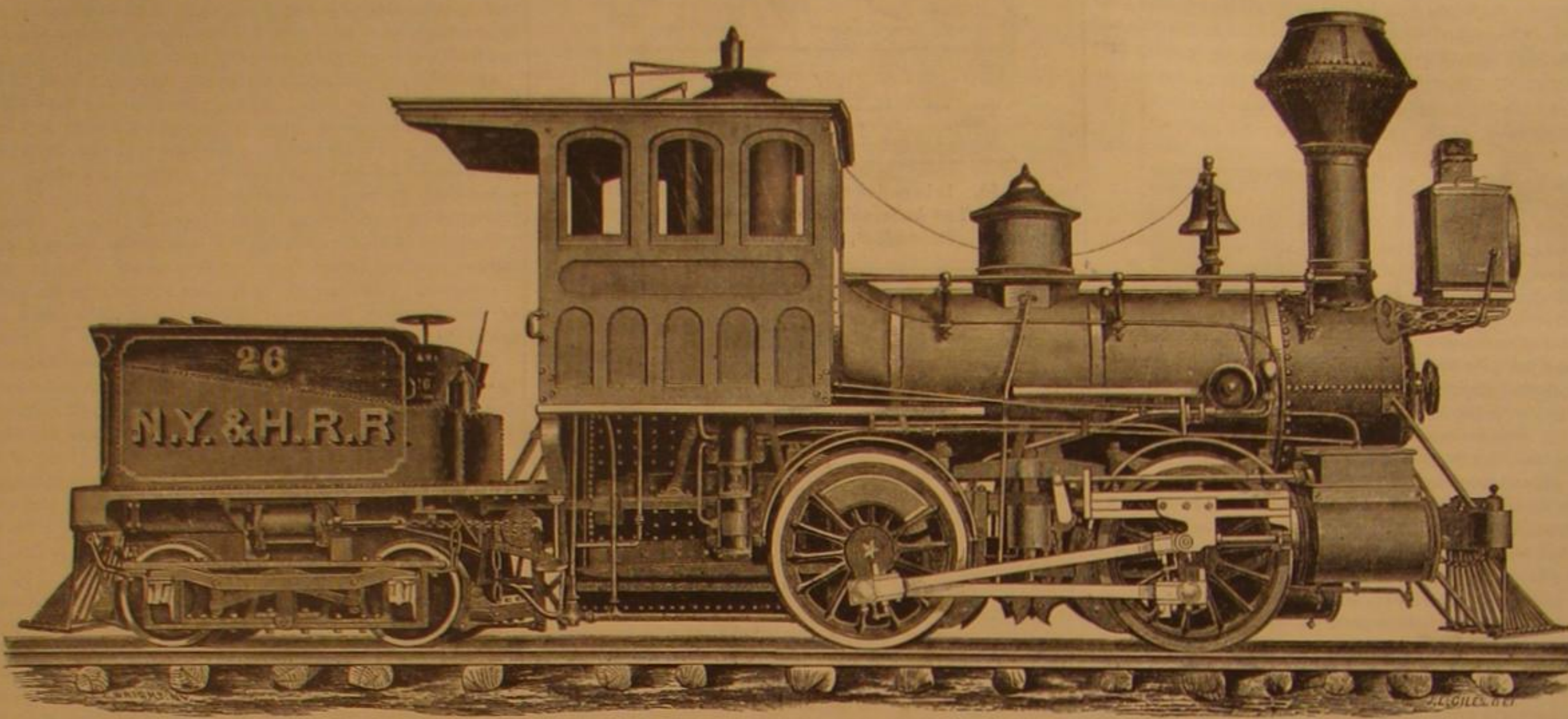
Every merchant and most well-to-do farmers and mechanics have visited some one of our large cities. But never before did they bring their wives and daughters. This last is the marked feature of the travel this year. For the first time, in a number of cases, the wife, mother, and daughters have passed the borders of their native States. To them the crowded car, the well lighted hotel, the thronged streets, the new customs, are a revelation. They will carry back to their homes new wants and desires. Insensibly, perhaps, there will be a change in household and personal habits. The furniture of the parlor and sleeping room will have additions and changes. Clothing once esteemed as tasteful will be replaced by other styles, not more expensive, but of different shades and shapes. The mechanic or the farmer will have new and enlarged ideas of his power as a part of our political and economical forces. This increased knowledge is one of the principal reasons why such expositions are encouraged; and it is to play no unimportant part in the present marked revival of business activity.

To electrotype insects, ferns, etc., immerse the object in a solution of nitrate of silver in wood naphtha. When partially dried, the object should be treated with ammonia, the result being a double salt easily reduced. After thorough drying, expose the article to the vapor of mercury, when the surface becomes completely metallized in a few minutes. It may then be placed in the bath and metal deposited in the usual way.

BRASS cooking pans should be cleaned inside with vinegar and brick, then rinsed, thoroughly dried at the fire, and wiped with a clean cloth. White enameled pans require only a little soda and warm water to keep them clean and free from grease.

RAPID TRANSIT LOCOMOTIVE.

We give a plate representing one of the three new tank engines built for the New York and Harlem Railroad, by the Schenectady Locomotive Works. They are intended to run local trains between the Grand Central Depot, 42d street, New York, and Williamsbridge, a distance of eleven miles, including that portion of the Underground Railway on Fourth avenue, between Grand Central Depot, 42d street, and Harlem river. These trains are at times very heavy, owing to excursions, races, etc.: and as the stopping places are very close together, very powerful engines are required for the service. Their general plan will be recognized as that which has long been advocated by Mr. M. N. Forney. The frames which extend back of the fire box are continuous, although they do not appear so on the engraving. The Westinghouse brake has been applied to the truck and also to the driving wheels. Owing to the great weight on the latter, and the power which the brake exerts on them and also on the truck, the engine can be stopped very quickly; and as there is plenty of adhesion, it can be started without much danger of slipping. The following are the principal dimensions: Gage of road, 4 feet 8½ inches; total wheel base, 20 feet 11 inches; distance between centers of front and back driving wheels, 6 feet 8 inches; total weight of locomotive in working order, 72,000 lbs.; total weight on driving wheels, 49,500 lbs.: diameter of driving wheels, 48 inches; diameter of truck wheels, 26 inches; diameter of cylinders, 15 inches; stroke of cylinders, 20 inches; outside diameter of smallest boiler ring, 44¼ inches; size of grate, 35x53 inches; number of tubes, 144: diameter of tubes, 2 inches; length of tubes, 9 feet 6½ inches; square feet of grate surface, 12·88190; square feet of heating surface in fire box, 81; square feet of heating surface in tubes, 710·4; total feet of heating surface, 804·28; exhaust nozzles, double; diameter of nozzle, 2¼ inches; size of steam ports, 1x13 inches; size of exhaust ports, 2¼ x13 inches; throw of eccentrics, 4½ inches; outside lap of valve, ¾ inch; inside lap of valve, $\frac{1}{16}$ inch; size of main driving axle journal, 6½x8 inches; size of other driving axle journal, 6½x8 inches; size of truck axle journal, 3¾x6 inches; diameter of pump plunger, 4½ inches; stroke of pump plunger, 3½ inches; capacity of tank, 1,200 gallons.—*Railroad Gazette.*



RAPID TRANSIT LOCOMOTIVE, UNDERGROUND RAILWAY, NEW YORK CITY.

Common Sense Chairs.

For several months we have had in use sundry examples of the "Common Sense" chairs, as made by Mr. F. A. Sinclair, of the Union Chair Works, Mottville, N. Y., and we are therefore enabled to speak from experience concerning their merits. As to comfort, they compare favorably with the most expensively upholstered or stuffed chairs, and are superior to the latter in durability of materials and economy of price. The "Common Sense" chair is made wholly of wood, with elastic wood woven backs and seats. Mr. Sinclair has evidently discovered the art of physiologically forming and proportioning the parts of the chair so as to secure the greatest amount of ease.

Furthermore, his flourishing establishment is an example of what may be achieved by intelligent effort and persevering industry. From a small beginning, with his own labor, his works have grown until now he employs twenty-five men, aided by improved machinery. The best ornamental woods are used, which are kiln-dried, worked, and joined in the most substantial manner. His illustrated catalogue shows several varieties of chairs, with the prices, which are quite moderate.

COUNTER GEAR FOR LATHES.

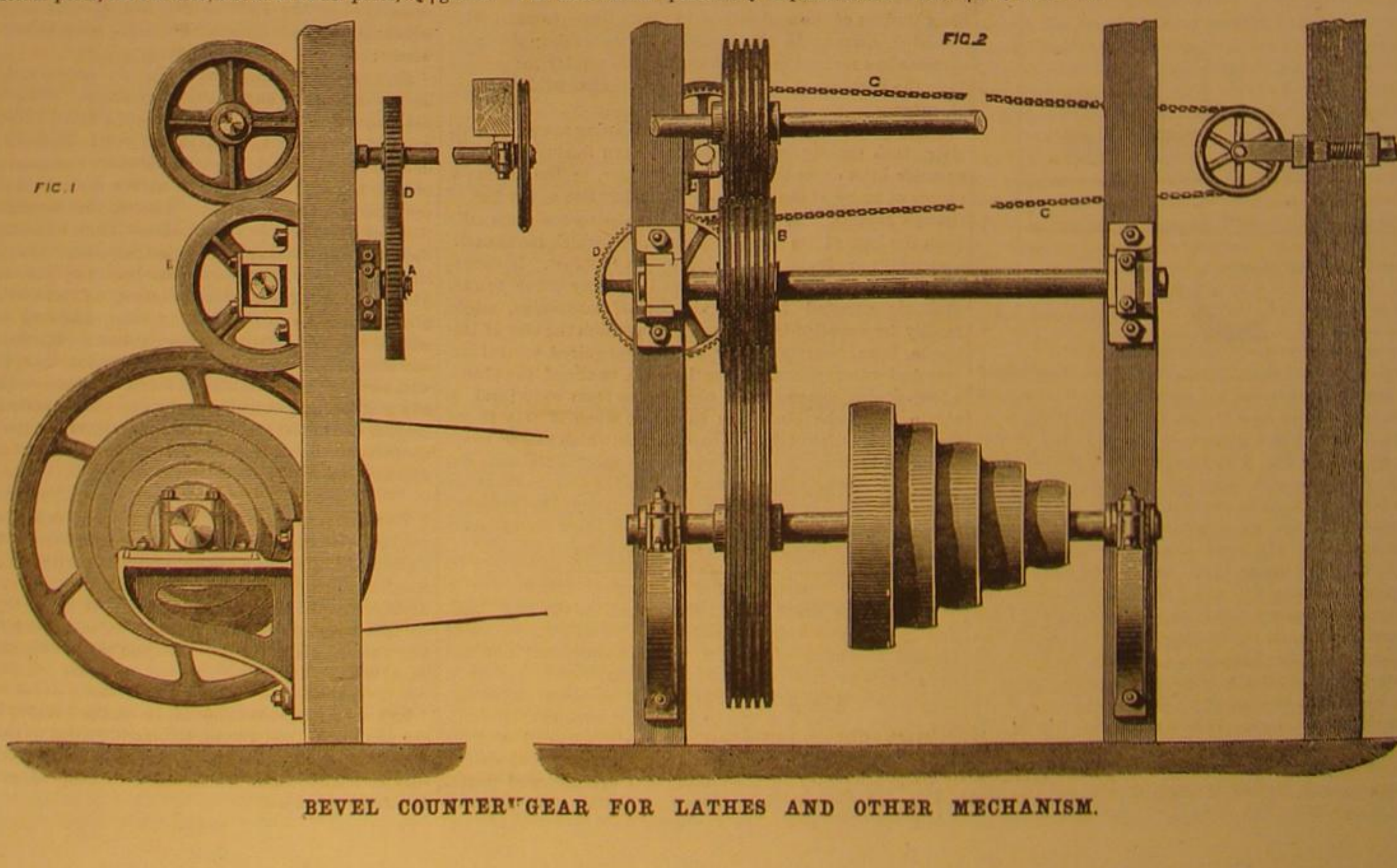
Our engraving shows a new driving gear for lathes, etc., now being introduced by Messrs. Hind, of Nottingham, England. The illustration practically explains itself. Friction wheels are used. That marked B can be wedged out between or withdrawn from the other two by a screw on the axis of A. This latter wheel can be moved by the endless chain, C C.—*The Engineer.*

An Ice Water Head Dress.

In cases of hyperpyrexia, the rapid reduction of the patient's temperature by means of local application of cold is known to be highly beneficial, and in many cases is executed in a rather rough manner by sponging the head, etc. But this presents many inconveniences, such as unnecessary fatigue to the patient, and probability of wetting portions not requiring the application of moisture. Mr. Knowsley Thornton has perfected an ice water cap, composed of a coil of India rubber tubing, bound together so as to fit the patient's head. One extremity of the coil is connected with a pail or other vessel containing iced water; the other is placed in any convenient outlet for the water to trickle away. Its effect in cooling the brain makes it most valuable in cases of this description.

A Dangerous Plant.

The *Revue Horticole* draws attention to the fact that contact of the skin with the leaves, and more especially the roots, of the *rhus juglandifolia* or *vernicifera* is likely to be followed with great irritation from the stinging juices which exude from them. The symptoms much resemble those caused by the *rhus toxicodendron*, or poisoned sumach, long used in England as an irritant, and still in use in America. There is an intense itching, followed by swellings and, perhaps, severe and obstinate ulcers. Though some people can handle the plant with impunity, yet to most it is dangerous; therefore, as it is now in great request in consequence of the beauty of its foliage, let them beware how they handle it.



BEVEL COUNTER GEAR FOR LATHES AND OTHER MECHANISM.

THE CASTOR OIL PLANT AS A TREE.

In France, under favorable circumstances, castor oil plants sometimes grow to the hight of ten or even 12 feet, and have leaves nearly a yard in width. In England, they give indications of becoming arborescent in autumn; but the cold weather which soon afterwards sets in puts a stop to further progress in that direction. The tree ricinus, shown in our engraving, is not a distinct species; on the contrary, it is the type of all the varieties with which we are acquainted, and may be met with continually in warm climates, like those of the Riviera and Algeria, and even as far north as Montpellier, in France, provided it be protected against frost by straw or matting.

The common castor oil plant, says a correspondent of the English *Garden*, likes a warm aspect and a light rich soil. It is easily, as all of us know, raised from seed, which should be sown in heat early in spring. As soon as the young plants are old enough to handle, they should be pricked out separately into pots, and again placed in heat. They must be well watered and shaded until they have become thoroughly established, and should be allowed plenty of air on fine days, otherwise they will throw out long, weak shoots that very materially detract from their beauty. Their growth being very fast, the roots soon fill the pots in which they are placed, and when that occurs they must be shifted into larger ones. Towards the end of this month they may be gradually hardened off, and finally transplanted out of doors in good rich soil when all danger from frost is over, care being taken to give them plenty of water in dry weather. When castor oil plants are once transplanted, their roots spread so rapidly that they cannot be lifted and potted again successfully; therefore, if they are to be grown in pots, they must always be kept potted, shifting them, of course, into larger ones from time to time. The only care which they require during the winter is frequent but moderate watering, giving them air whenever the weather is favorable. Thus treated, castor oil plants may be kept in growth and beauty for several years in succession, when they will form trees, which, if not as large as that here represented, or those grown in more favored climates, will at least add beauty to our gardens in summer. The most notable varieties are *ricinus sanguineus*, the stem, leaf stalks, young leaves, and fruit of which are of a blood red color; *r. Borboniensis*, which in southern climates attains a great hight; and *r. giganteus*.

THE CASTOR OIL PLANT.

BIXA ORELLANA—ANNOTTA.

It is from this shrub, the foliage and flowers of which is now figured, that the annotta of commerce, commonly called annatto, is produced. Plants of it are seldom seen except in botanical collections; but they are not devoid of ornament by their fine green leaves and chaste pink flowers. When grown from seed, the plants attain a large size before producing flowers: but when raised from cuttings they flower freely when in a comparatively dwarf state. Cuttings of half-ripened wood strike readily in heat under a bell glass. The plants require a summer temperature of 75° to 85°, and a winter temperature of 50° to 60°. This shrub grows spontaneously in South America, and is cultivated in the East Indies. The fruit is like a chestnut, a two-valved capsule covered with flexible bristles, and contains a certain number of seeds smaller than peas. These seeds are covered with a soft, viscous resinous pulp, of a beautiful vermilion color and unpleasant smell like red lead mixed with oil, and it is this matter which constitutes annotta or annatto. The mode in which it is obtained, says the *Journal of Horticulture and Cottage Gardener*, is by pouring hot water over the pulp and the seeds, and leaving them to macerate, and then separating them by pounding them with a wooden pestle. The seeds are then removed by straining the mass through a sieve; and the pulp being allowed to settle, the water is gently poured off, and the pulp put into shallow vessels, in which it is gradually dried in the shade. After acquiring a proper consistence, it is made into cylindrical rolls or balls, and placed in an airy place to dry, after which it is sent to market. It is most common in the English market, and is in the form of small rolls, each 2 or 3 ozs. in weight, hard, dry, and compact: brownish without and red within. The other process of manufacture is that pursued in Cayenne. The pulp and seeds together are bruised in wooden vessels, and hot water poured over them; they are then left to soak for several days, and af.erwards passed through a close sieve to separate the seeds. The matter is then left to ferment for about a week, when the water is gently poured off, and the solid part left to dry in the shade. When it has acquired the consistence of solid paste, it is formed into cakes of 3 or 4 lbs. weight, which are wrapped in the leaves of arunda or banana. This variety is of a bright yellow color, rather soft to the touch, and of considerable solidity. Labat informs us that the Indians prepare an annotta greatly superior to that which is brought to us, of a bright shining red color, almost equal to carmine. For this purpose, instead of steeping and fermenting the seeds in water, they rub them with the hands, previously dipped in oil, till the pulp comes off and is reduced to a clear paste, which is scraped off from the hands with a knife, and laid on a clean leaf in the shade to dry. Mixed with lemon juice and gum, it makes the crimson paint with which Indians adorn their bodies; and they employ the leaves and roots in cookery to increase the flavor and give a saffron color.

Annotta is principally consumed by painters and dyers; but it is also used to color cheese with, a pale yellow or flesh color. The Dutch use it for hightening the color of their butter, and it is used for the same purpose in some American and English dairies.

BIXA ORELLANA.

A Hospital in a Crater.

The Board of Physicians of the Neapolitan Hospital for Incurables have determined to build a hospital in the crater of Solfatara, lying between Naples and Pozzuoli, in Southern Italy. The vapor that arises from the crater has been found to be charged not only with sulphur but also with arsenic, and it is said that several persons suffering from lung diseases have been restored to health by inhaling this vapor for a few weeks.

Facts About Air and Mine Ventilation.

At a recent meeting of the North Staffordshire Mining Institute, a paper by Mr. Wardle, of Burslem, was read on this subject. He said the temperature of the earth increased as they descended at about 1° Fah. for every 50 feet to 60 feet. At the deep coal pit at Dukinfield, the temperature was constantly 75° Fah. at a depth of 2,151 feet, and at a depth of 17 feet it was only 1° Fah., which gave an increase of 1° Fah. for every 89 feet only. The average degree of temperature of the earth was 1° Fah for every 55 feet in descent to a depth of 1,800 feet, and afterwards 1° Fah. for every 44 feet. At 10,000 feet, the temperature would be 212° Fah., provided all other circumstances remained the same: at 20 miles, 1,760° Fah.: and at 50 miles it would be 4,600° Fah., heat sufficient to melt any known metal. Thus, the deeper the shafts of their coal mines, the greater the amount of natural ventilation they would obtain. A current of air, traveling at a speed of 10 feet per second, gave a pressure of 0·492 lb. to the square foot at 16 feet, =0·989; at 51·34, =6·027; and at 200, =39·2, as experienced on the surface of the earth. These might be described as, first, a breeze; second, a light gale; third, a gale; and, fourth, a hurricane. Increased velocity of wind meant greater friction or higher water gage. Air was perfectly elastic; by pressure it could be squeezed into less bulk; and if that pressure were withdrawn, it filled the same space as formerly. Heat had the same effect upon it as pressure. A cubic foot of air weighed 223 grains; a cubic foot of water weighed 1,000 ozs.; a cubic foot of watery vapor weighed only 272 grains. So that the more vapor there was in the air, the lighter it would be. Friction was estimated by the force required to overcome it. Friction of air increased or decreased in the same proportion that the extent of the rubbing surface exposed to the air increased or decreased. A circular airway offered less resistance in proportion to its area than any other form, because its circumference was less in proportion to its area than the perimeter of any other figure. Airways should be as large and with as smooth a surface as possible. Splitting the air current was preferable to taking the whole current of air round the workings in one body. Generally speaking, splitting the air increased the quantity of air obtained by a given expenditure of power; but the benefits to be derived from splitting were limited by the area of the shaft.

The Twinkling of the Stars.

The scintillation of stars, and its close connection with changes of weather, has, as is known, much interested Humboldt, Arago, Kaemtz, Secchi, and many others; and recently it has also been the subject of valuable spectroscopic researches by M. Respighi. M. Montigny, who some time ago investigated scintillation in relation to the special characteristics of the light of different stars, publishes in the *Bulletin* of the Belgian Academy, No. 8, an elaborate report upon his researches into the connection existing between scintillation and various meteorological elements. The chief results, arrived at after a discussion of 1,820 observations made on 230 days on 70 different stars, are as follows: The intensity of scintillation (measured by a special apparatus, the *scintillomètre*) increases invariably with the occurrence or approach of rainy weather, and with the increase of tension of vapor in the air on one side, and the increase of pressure and decrease of temperature on the other: the influence of the two former factors being far more sensible than the combined influence of the two latter. The scintillation, which is on an average stronger during winter than during summer, increases with the arrival of moist weather at all seasons. It increases also not only on rainy days, but one or two days before, decreasing immediately after the rain has ceased. Moreover, the intensity of scintillation increases during strong winds, and with the approach of barometric depressions, or *bourrasques*, the increase being most pronounced when the depression passes near to the observer. It then largely exceeds the average increase corresponding to rainy days; and the influence of great movements in the atmosphere totally counteracts the contrary influence of a lowering of pressure. M. Montigny is thus correct in saying that a continued investigation of scintillation would be of great service, not only for the prevision of weather, but also for the general study of meteorology, affording a very useful means for the exploration of the higher regions of the atmosphere.—*Nature.*

Appleton's Encyclopædia.

The new revised edition of this magnificent work is now completed, and forms one of the most valuable and important collections of popular knowledge ever brought out in this country. The printing materials, engravings, etc., have alone cost the publishers over half a million dollars. The reader will be able to form an approximately correct idea of the magnitude and sterling character of the work by consulting the publisher's advertisement given on another page. The work more than justifies what is there stated.

Continued from first page.

The large engraving which occupies our initial page this week represents one of the most complete exhibits in the whole magnificent array of woodworking machinery. It is that of Messrs. J. A. Fay & Co., of Cincinnati, Ohio, with many of whose excellent machines our readers are already familiar through the illustrated descriptions which have appeared in these columns. In the manufacture of these implements, extensive experience, talent, and the greatest care are brought to bear. All shafts and turned fittings are finished to standard sizes, screws are turned, heads and threads made on a regular system, holes are bored and tapped exactly to correspond, every revolving part is carefully and accurately balanced, all bearings are reamed and scraped, none but the best materials are used, and finally a rigid trial and inspection renders each machine, before issuing from the factory, in the best possible condition. The implements exhibited at the Centennial are by no means all of the different productions of Messrs. J. A. Fay & Co., but are selected with much discrimination, so as to typify generally the variety manufactured by this firm. We describe them below in detail, referring to each, as will be seen, by a distinguishing number placed on the engraving.

THE NO. 6 PLANING, MATCHING, AND BEADING MACHINE is marked 1 in the illustration. It is claimed to be the most important implement of the class displayed, on account of its admirable construction and the speed with which it finishes the work it is designed to accomplish. The principal advantages are enumerated as follows:

There are 6 feed rolls, 8 inches in diameter. The weight of the No. 6 machine is 10,600 lbs., and it surfaces two sides 24 inches wide, 6½ inches thick, and matches 14 inches thick. For a more detailed description, the reader is referred to page 147, Volume XXXV of the SCIENTIFIC AMERICAN.

At No. 2 in the engraving is represented the

NO. 4 LARGE SIZE OUTSIDE PATENT MOLDING MACHINE.

This will work any size of molding up to 9 inches wide, also plane, match, and bead narrow flooring, etc. The main spindle is 1¾ inches in diameter, provided with an outside bearing; it is made from best English cast steel, and runs in patent self-oiling boxes, lined with the lining metal. The side spindles have patent self-oiling steps and bearings, and adjust vertically. The outer spindle adjusts laterally, and swings to any angle desired. The inside vertical spindle is arranged to adjust to and from the stuff, without altering the cutters. The under cylinder has a vertical movement, also a peculiar arrangement enabling the operator to take a greater or less cut without altering the cutters. The cylinder is combined with the rear bed, and is adjusted on the main bed, the false or rear bed moving with the cylinder, making it very convenient to adjust. The feed works are driven by improved gearing, which is heavily weighted, and has two changes of speed. The feed rolls are hung in swinging cranes, and, by the means of a lever at the rear of the machine, are instantly elevated from the stuff, when it is desired to withdraw it before passing the cutter heads. The bed drop is 13 inches. The machine is furnished with pressure bars, springs, steel wrenches, guides, and every thing needed for speedy adjustments. It is made to work either 3 or 4 sides, as may be desired, of 8, 9, and 10 inches wide or under.

THE NO. 2 INSIDE PATENT MOLDING MACHINE, WITH BEADING ATTACHMENT,

is represented at 3. This machine will work moldings on one or both sides, 12 inches wide and under, and up to 5 inches in thickness, also plane, tongue, groove, and bead 12 inches wide.

The cutters may be set at varying angles and are capable of sticking any style of molding, by using cutters on all four sides, thus equalizing the cut and utilizing the power. The under cylinder has a vertical adjustment, graduated to different thicknesses of cut while in motion; and by simple loosening one bolt, the pressure bar and stands can be swung entirely clear of the cylinder, giving free access to the cutters for purposes of sharpening or adjusting.

A patent beading attachment upon the pressure bar, over the under cylinder, gages the depth of the bead from the surface of the board, thus securing an automatic adjustment of the beading shaft at all times.

The upright spindles can be moved vertically or horizontally while in motion, the outer spindle to any angle desired. Devices are provided for preventing the possibility of movement after the heads are brought to the desired position; and there is a chip breaker for holding the fiber of the wood while the side cuts are being made. An equal pressure is maintained on the lumber being worked, regardless of any equalities in the thickness. The rolls are connected by expansion gearing, which allows the upper roll to adapt itself to the varying angles on irregularly sawn lumber.

At 3 is represented the

PATENT CARVING AND PANELING MACHINE,

the object of which is to produce carvings and recessed or relieved panels on the surface of lumber, edge molding, ornamenting, fret and bracket work, etc. It is especially adapted for fine furniture, coffin and piano manufactories, etc. A hollow iron column gives an ample support for the cutter spindle and also for the table, which is adjusted and regulated to form the required depth of moldings or carvings by means of hand wheel and screw, and has sufficient vertical movement to admit of working stuff of four inches thick and under.

THE NO. 2 VARIETY WOOD WORKER

is represented at 5. This is one of those remarkable tools capable of performing the work of several machines. It is adapted to planing out of wind, surfacing straight or tapered work, rabbeting door frames, etc., rabbeting and facing inside blinds, jointing, beveling, gaining, chamfering, plowing, making glue joints, squaring up bed posts, table legs, newels, etc., raising panels, either square, bevel, or ogee, sticking beads, working circular molding, ripping, cross-cutting, tenoning, etc.

When facing or planing out of wind, the vertical and lateral adjustments can be made simultaneously, thus constantly retaining the proper distance between periphery of cut and the edge of table. All of the different functions of the machine are secured by the use of two tables. For sawing, an extra table can be inserted between the other two, making a solid and continuous saw table. The arbor is of steel, of large diameter, and revolves in bearings supported on the column. One bearing is cast solidly to the column, and the other is movable, and is readily detachable for the purpose of substituting different heads. This is a very advantageous feature.

Another combination, possessing a still wider range of capabilities, is depicted at 6. This is the

NEW PATENT UNIVERSAL WOOD WORKER,

claimed to be the only wood worker built in which both sides may be operated, and either side started or stopped without interfering with the other. As a planer, it is adapted for ordinary surfacing and thicknessing, planing out of wind, surfacing square, beveling, or tapering pieces, facing up bevels and baluster, etc. As a molding machine, it will work moldings, either simple or complex, up to 8 or 9 inches in width, stick sash and doors, tongue and groove; and on the wood worker side it will produce waved, oval, elliptical, circular, and serpentine and rope or twist moldings. Among its other uses are chamfering, cornering, rabbeting and jointing window blinds, gaining, panel-raising on one or both sides, tenoning, ripping, cross cutting, grooving, hand matching, making glue and table joints, mitering, nosing, squaring up, and a multiplicity of other operations limited only by the skill of the operator.

The molder and wood worker sides are securely connected upon one solid column with a substantial base, and the two sides of the machine are driven from one countershaft, which conveys power either separately or simultaneously.

The molding side is so arranged as to form a complete four-side molder. The side spindles are fixed to and move with the table, which has a vertical movement of 16 inches. The feeding rolls are arranged for fast or slow feed.

The wood worker side is constructed on the same principle and embraces the same general features as the patent variety wood worker above described.

At 7 we represent the

NO. 3 SASH AND DOOR TENONING MACHINE,

adapted for sash and door, cabinet, wheel, car, and railroad shops. The upper and lower cutter heads are adjustable so as to vary the thickness of the tenon or depth of shoulder, the carriage remaining stationary. Gages and stops with the carriage render setting out unnecessary. The copes are raised and lowered with the cutter heads, but may be independently set. Both cope and cutter head shafts are protected against endwise vibration. The upper cutter head is arranged to cut one shoulder of the tenon longer if desired, saw spurs are used in lieu of knife spurs, and the cutters operate with a drawing stroke. There is a binding pulley which keeps the belt right and self-adjusting, and the bonnet may be conveniently swung back out of the way to afford access to the cutters. The

ELLIS PATENT BLIND SLAT TENONING MACHINE,

shown at 8, is adapted to any length or width of slat, working both ends, cutting the shoulder and rounding the tenons simultaneously at one and at the same operation. The machine, which has a hand feed, is provided with two adjustable arbors and frames, carrying a set of circular saws for forming the shoulder and rounding the tenon. Connected to the arbor frames are revolving disks, into which the slat is inserted and rotated in contact with the saws or cutting tools. We are informed that it is capable of working 20,000 slats per day.

At 9 is shown the

PATENT SELF-FEED BLIND SLAT TENONING MACHINE,

which differs from the machine last described. It differs somewhat from the Ellis machine, as the slat is fed endwise through rotating chucks, the shoulder being pressed against an adjustable gage for regulating the length of slat. By the peculiar construction of the revolving cutting tools, two tenons are cut and divided with one cutter head, simultaneously and at one operation. A pressure upon the treadle causes a rotation of the slat, and at the same time depresses the chucks, carrying the slat against the cutting tools, enabling them to form a perfect tenon on each end. It will work any length of slat from 1½ inches up to 24 inches, and will make any size of tenon desired.

TWO PATENT BAND SAWING MACHINES

are depicted in the engraving, one for ordinary curve sawing, the other (10) intended for the furniture, wagon, sash and door, and agricultural shops, etc. An important feature is the method of keeping the saw at its proper tension, allowing at the same time some flexibility to the parts, to compensate for any sudden impact, and prevent breaking of the saws by buckling or friction upon the back or sides. There is also a shipper with frictional brake for arresting the saw motion, and the table is provided with irregular adjustment for bevel sawing.

At 11 is represented a

PATENT BAND RESAWING MACHINE

It will re-saw lumber up to 30 inches in width, and from 6 inches in thickness down to the thinnest stuff that admits of re-splitting. It is also arranged for sawing boards from the side of a plank, and is equally well adapted for hard or soft wood. Its working capacity is said to be from ten to fifteen thousand feet per day, depending on the kind and width of material. The saw kerf is about $\frac{1}{16}$ inch thick, and a saving of 20 per cent in lumber is claimed to be effected, shown by the fact that, by the use of this machine, two $\frac{5}{8}$ inch panels, planed on both sides, can be produced from 1 inch lumber, whereas, by other methods, 1¼ inch lumber is required.

The wheels are 5 feet in diameter, and the distance between their centers is such that there is but a comparatively small portion of the saw blade left unsupported, and there is consequently less liability to deviate from a straight course. The upper wheel revolves on a 2½ inch shaft running in long self-oiling bearings, has a vertical adjustment of 13 inches, and can be adjusted so that the saw will run at any desired point on its periphery.

The feed rolls are connected by expansion gears, operated by friction. This friction is operated by a shaft connected with a lever in front of the column, by different movements of which the feed is instantly started or stopped, and graduated from fine to coarse. The feed is strong and powerful, and is under complete and immediate control of the operator.

There are also improved devices for cleaning the saw, etc. For full particulars, the reader is referred to the description previously published in these columns. The machine represented at 12 is a

PATENT COMBINATION EDGING AND RIPPING SAW TABLE,

designed for edging and ripping up lumber for the flooring machine. It is claimed to have all the advantages of a good self feed edging saw; and at the same time, the feet can be thrown off and the stuff passed by the saw in the ordinary manner. By a novel device, when slitting lumber, the operator is enabled to elevate the saw so as to just cut through the board, thus economizing the power by a reduction of the friction on the saw, presenting a better cutting angle of the teeth, and consequently making a smoother cut and requiring less sharpening of the teeth. The fence or gage has a parallel movement of 8 inches, and is quickly adjusted for different widths without the necessity of measuring, the table being provided with a gage spaced into inches and parts of an inch.

It is also provided with a binder pulley, hung in a swinging frame, operated from the front of the machine by means of a rod and handle by which it can be raised or lowered to slacken or tighten the belt, and thus stop or start the saw. The machine will make a straight cut without any guide, by simply letting the feed roll take the board through as started. This feature will be appreciated when sawing boards with a crooked edge, which require straightening before other strips can be sawn from them.

In order to meet the need of a cheap and good boring machine, for either straight or angular boring, the

UNIVERSAL HORIZONTAL BORING MACHINE,

represented at 13, has been designed. The table is adjustable for boring at any desired upward or downward angle and the fence for any lateral angle.

The traversing steel spindle is operated by means of a powerful jointed treadle, fitted with an improved step, which is provided with a steel point, forming a bearing for the end of the spindle, thus greatly reducing the wear, caused by the spindle pressing against a shoulder. The treadle has a weighted counterbalance, giving a quick return to the spindle. The spindle is fitted with cone pulley, with three changes of speed, and adjusting collars to graduate the depth of the hole to be bored.

At 14 is shown a novel

PATENT BAND SAW SETTING AND FILING MACHINE,

which, it is claimed, will set an ordinary band saw blade in three minutes, more accurately than can be done by hand in an hour. The saw being adjusted, the wheels are set far enough apart to straighten the blade, which is then pinched by a cam and wedges. The dies are set on the points of the teeth, and are adjusted with set screws on top. This sets the points over without bending them at the roots, preventing the warping of the saw which is liable to occur in setting by hand.

Lastly at 15 we illustrate a

HAND AND POWER FEED SURFACE PLANING MACHINE.

This is provided with steel-lipped cylinder, pressure bar, shaving bonnet, and adjustable tables. It will surface 24 inches wide up to 6 inches in thickness.

This completes our list of machines, which, as embodiments of the new and ingenious devices, and as showing admirable adaptation to their several purposes, may justly be regarded as representing the best work of both inventor and manufacturer. It is hardly necessary to add that their superior qualities are appreciated in foreign countries as well as in our own, and that the large trade which their makers now control, with Japan, Australia, South America, England, New Zealand, and elsewhere, is one which reflects great credit upon our home industries. The machines have received the largest premiums at local fairs in this country, a medal at the Vienna Exposition, a medal for excellence and superiority at the late Chilian Exposition, Santiago, Chili, South America, and also medal of honor and special commendatory reports from the Centennial jurors of awards

CENTENNIAL NOTES.

THE FRENCH POTTERY DISPLAY.

France, in her section in the Main Building, makes a marvelous display of pottery, which must be studied piece by piece before any idea can be obtained either of its extent or value. Indeed some of the vases exhibited, made in the Sévres factory during the first years of its existence, are of immense value, especially in these times, when all old china, owing to the taste for making collections of the same, fetches prices out of all proportion to the intrinsic value of the objects.

Porcelain is of two kinds, "hard and soft paste," distinguished from each other by their relative density, a quality governed by the comparative proportion of silex entering into their composition. The first porcelain of French manufacture was "*pâte tendre*" or soft paste, and this was principally made at Sévres. In 1761 the secret of making hard porcelain was discovered, and the manufacture of "*pâte tendre*" was thereupon discontinued. Hard porcelain is produced from kaolin and other materials, and usually goes through three processes in its manufacture. The first process, which is the most commonly used for pieces of average size, consists in the placing of the paste in a lump upon a mold, which, in the case of a plate, for instance, would represent the bottom half. The mold and paste are then put on a rapidly revolving brass cylinder in front of the workman, who, by a quick movement of the hand and moistening with a sponge, causes the paste to assume the desired form for the upper half, as by its pressure against the mold it assumes that of the lower half. So also in the case of the cups; the mold is merely for the exterior portion, the interior being shaped by hand. The second process is used for large pieces, such as vases, soup tureens, etc. The paste is placed on the revolving brass plate in a lump, and the workman, by means of steel tools, causes it to assume the shape sought for. The third process, which admits of the production of the most minute latticed or diagonal figure work upon the body of the piece, to which it also gives an almost paper-like thinness, is one in which the paste, reduced to a liquid form, is run into molds. Some of the French vases are so magnificently painted as to possess a high value as works of pictorial art alone. There is a toilet set on which the color was melted on the glaze, so that the appearance is of polished *lapis lazuli*, on which the most curious effects of light and shade are produced. In the basins, where the pigment in burning has dropped to the bottom, there seem to be several inches of water, so deep is the color; while on the base of other pieces, where the color has dropped off, the ware is mottled blue and white. One Paris firm makes a specialty of porcelain with a mother-of-pearl glaze produced by the use of uranium salts; another exhibits *majolica*, where the portions in relief are produced by pressure applied to the back of the object, just as *repoussé* work is done in silver. Ordinarily such decorations are made separately and attached to the article.

THE LARGEST GLASS PLATES EVER IMPORTED

into the United States are exhibited in the French section. They are two immense sheets measuring 22 feet in hight by 10 in breadth, mounted in maroon colored frames.

THE FAMOUS TAPESTRY,

exhibited in the French department, consists mainly of the fabric known as *haute lisse*, or high loom. This, as its name implies, is made on high looms of considerable size. At the top and bottom of the framework composing the loom are horizontal cylinders. Around the upper one, the threads composing the warp are rolled, and around the lower one the tapestry, as it is completed yard by yard, winds itself. Between these two cylinders is stretched the warp, upon the threads of which the artist marks in white chalk the outlines of his picture. To these he adds, for the purpose of fixing the light and shades, tracings from his pattern. Then, with this latter conveniently placed for reference, he stations himself against the back of his tapestry, and, with his many-colored worsteds and silks, commences the weaving of his picture. The vertical threads of his warp are divided by a heddle or cross stitch, which keeps half of them in advance of the rest; but those behind can be brought forward by means of small cords or *lisses*, one of which is attached to each warp thread. Between the two sets of threads the workman introduces his left hand and takes up as many of them as is necessary. Through these he passes his curiously shaped wooden needle from left to right, and with its point piles the stretched thread, which in turn is passed back in the contrary direction through the space opened by shifting the front and back threads. The manipulation of the threads, the combination and proper use of the many colors and shades of worsted and silk, and the working out of the design require a skill and delicacy only attained by long practice.

FRENCH SCIENTIFIC APPARATUS.

France, long celebrated for the products of her opticians and scientific instrument makers, is well represented in this line of goods.

Of opera glasses there is an extensive exhibit, embracing the largest and smallest in cost as well as in size. The finest glasses shown are, perhaps, those mounted in aluminum, a metal admitting of a polish equal to that of silver, and of extreme lightness. This metal, however, though considerably lessening the weight of the glass, adds almost 200 per cent to its cost.

Derogy, Paris, shows a large collection of photographic apparatus, noticeable among which are a set of extra large object lenses, some very powerful condensing lenses, and specimens of the Derogy system for photographers' use. This system, which combines in one instrument the power of making, at a given point and with a single objective lens, six pictures of different dimensions, consists, in the addition to ordinary apparatus, of two extra lenses: one convergent, for making the object smaller, and the other divergent, for making the object larger. With these lenses, placed singly, as the occasion demands, in the position assigned to them, the necessity of changing the object glass to produce different sizes of pictures is obviated.

A telescope, valued at $6,000, with an object glass 12¼ inches in diameter, is shown by Secretan, Paris. Its magnifying power is 600 times. In this exhibit is an admirably designed camera lucida, or, as it is here called, *megalographe*. For microscopic drawing and pattern drawing for industrial purposes, this instrument possesses many advantages. It differs from the ordinary camera lucida, inasmuch as it admits of drawing directly from objects under the microscope, or from designs produced by the turning of the kaleidoscope. It is provided with three tubes, one microscopic, the second kaleidoscopic, and the third simple. A prism on a detached tube of its own is adjustable to either of these, and by means of mechanical contrivances the point of view may be changed as occasion demands.

WEIGHTS AND MEASURES.

An automatic balance, in use in the Paris Mint since 1874, is a most ingenious machine. Its object is to determine the weight of twenty franc pieces, and to divide them into classes, according as they are standard, light, or heavy weight. At one end of it is an inclined trough, in which the pieces are placed; and, as one by one they reach the end of the incline, they slide upon the weigh pan of a small scale, having at the other end of its beam a counter weight of precisely the standard weight for a twenty franc piece. Beneath the weight pan is a hopper, and in front of this latter the mouths of three tubes, terminating in boxes destined for the reception of light, heavy, and standard weight pieces. Should the piece, after reaching the scale, prove heavy, the weigh pan would be borne down by it, and this, acting upon the balancing needle indicator, causes it to move towards the piece. This movement acts upon the hopper; and when the piece is thrown off the scale, it passes directly into the tube leading into the box for heavy pieces. Light and standard weight coins cause the needle to go towards the counter weight, or to remain within the limits allowed to the standard weight; and these movements act upon the hopper as above described, and send the coins into their appropriate boxes.

THE AWARDS FOR THE LYALL LOOMS.

The positive motion loom, which was one of the most important American inventions exhibited at the Centennial, has deservedly received from the expert judges the highest commendation. The report states that the reasons for the award are "variety, extent, and importance of the looms exhibited; invention of the positive motion, its wide range of applicability, fitness for the purpose intended, and excellence of design, construction, and working utility and economy." The Messrs. Lyall, whose exhibit, it will be remembered, we described and illustrated recently, have also received another award for a lock-stitch shuttle machine: in which the vertical needle bar is reciprocated from a rotating shaft by an epicycloidal movement: on account of the apparatus being, in the judges' opinion, "the most rapidly running sewing machine." This is the machine which we saw binding corsets at the rate of 2,500 stitches per minute by the counter.

THE CLOSING CEREMONIES OF THE EXPOSITION.

At sunrise on November 10, the thunders of salutes from a battery on George's Hill in the Exposition grounds, and from the United States ship Plymouth, announced to the people of Philadelphia and the hundred or so thousand visitors there gathered that the last day of the Centennial had arrived. By ten o'clock the Exhibition buildings were thronged; but at that hour, to the disgust of those who had secured commanding positions whence to view the ceremonies on the grand platform at the end of the Main Building, a steady cold drizzle of rain began, which by noon became a continuous pour. With characteristic promptitude the authorities at once prepared the interior of the judges' edifice; an army of carpenters put up a new platform in a twinkling. Theodore Thomas, his orchestra, and his chorus, were packed in the galleries; and when the procession of dignitaries, headed by the President of the United States, entered the structure, everything was in good order, and the confusion which had seemed imminent was happily arrested.

The triumphant strains of Wagner's Inauguration March were followed by a brief prayer; and then, after one of Bach's grand choral fugues had been rendered, Mr. Morrell, the chairman of the Centennial Executive Committee, made the opening address, in which he briefly reviewed the general advantages of the Exposition. The *Te Deum* by the chorus preceded a speech by President Walsh, of the Centennial Board of Finance. Speaking of what the Centennial has accomplished, he said: It has afforded an opportunity to show that the administration of an exhibition on a grand scale may be liberal in its expenditure without useless extravagance; that its laws may be strictly enforced with impartiality, and without harshness; that its regulations may secure the efficiency of its departments and uniformity in their action; that its whole course has been free from financial embarrassment, or even a payment deferred; and that notwithstanding every part of its machinery was in constant motion, no one of the immense throng within the limits of the Exhibition was sensible of its restraint.

Director General Goshorn's address was in about the same strain. Finally General Hawley, the President of the Centennial Commission, came forward, and, in a few appropriate words, acknowledged our national gratitude to our foreign visitors, and thanked the city of Philadelphia and the general government. As, at the conclusion, the audience joined in the hymn "America," the original flag of the American Union, displayed by Paul Jones on the ship Bon Homme Richard, was unfurled, and national salutes of forty-one guns were fired from the land battery and the war vessel After the burst of cheering which the display of the historical banner elicited had subsided, President Grant advanced to the front of the platform, and in a low voice said: "Mr President and Gentlemen of the Centennial Commission, I now declare the International Exhibition of 1876 closed." Then as he waved his hand, a telegraph operator behind him touched the key of an instrument, the signal 7-6 rang forth from all the gongs and bells, and at that instant the great Corliss engine slackened its motion, became slower and slower, and then stopped. The great audience reverently sang the Doxology and dispersed. As they left the grounds, the huge English road engine came puffing out of the gates, dragging two cars loaded with filled packing boxes. The Exposition was indeed over.

New York Academy of Sciences.

A special meeting of the biological section of this society was held on Monday evening, October 30, at the library of the New York Aquarium.

Professor A. E. Foote, of Philadelphia, exhibited a specimen of rutile in quartz, said to be the finest in the world. The crystals were about 5 inches long, thicker than a knitting needle, and doubly terminated. This specimen was found at Hanover, N. H., and formerly belonged to Dr. Chilton. The professor also exhibited a large and beautiful emerald from Mungo, New Granada, and a fine specimen of rubellite (a variety of tourmaline) both from the same collection, now the property of Dr. Foote.

Professor Hubbard exhibited a fossil tooth of an elephant, weighing 13 lbs., from near Rochester, N. Y.

Some seeds and nuts of tropical sources were also presented, and referred to Professor Martin to determine their species.

THOUGHTS ON EVOLUTION.

Professor E. C. H. Day, chairman of the section, made a brief address on evolution. The speaker first declaimed any dependence of evolutionism on Darwinism; the latter may prove false, and yet that does not disprove the former. The idea of evolution has been generally accepted in physical matters, in astronomy, in geology, etc., and it is only when applied to life that it meets with opposition. He then explained that the doctrine of evolution is not atheistical, but implies greater wisdom on the part of the Creator than does special creation. He drew comparisons between the length of the life of man, three score years and ten, and the supposed age of the world, representing the former as $\frac{1}{10}$ inch on a line from 120 feet to ten blocks long. He attempted to explain how the honey ant, although a neuter, could be the result of natural selection; also the disappearance of large and powerful animals before smaller ones of more intelligence. The disappearance of hair on the back, in passing from ape to man, was explained on the supposition that animals that walk upright and rest in a perpendicular position do not need its protection, while it is a positive injury as a refuge for insects and as affording a better hold to an adversary in a hand-to-hand conflict.

Dr. Newberry replied with some well put remarks on our inability to argue the question with our present limited knowledge, and advanced the usual objection persistence of species.

FISH CULTURE

was the subject of some very practical remarks by Mr. Frederick Mather. He stated that the Chinese had been credited with practising fish culture for a long time, but it had only amounted to the transfer of unhatched eggs to ponds that they wished to stock. Fish culture was introduced here twelve years ago, and now America is ahead of the world. Some of the advantages of the artificial over the the natural are that far more eggs are impregnated in the former operation, that, the young being protected, more of them live to maturity, and that we are able to transport them safely over long distances, a lot of salmon eggs having recently been received in good order from California. There are some fish, however, the eggs of which, forming a slimy mass, require different treatment; others do better when left to Nature. The speaker exhibited some of the eggs and young fish just hatching out, and stated that light was very injurious to them at this stage, as the eyes are very large and sensitive, being plainly visible before the fish leaves the egg.

He also exhibited a most remarkable

PAIR OF SIAMESE TWINS,

two tiny salmon hatched from one egg and bound together in a manner quite like the human twins recently deceased. Although quite lively, he predicted for them a short life because they hatched head first, which is a bad omen for the vitality of the fish.

At the conclusion Mr. Coup invited the members present to visit the Aquarium, where an opportunity was offered them to see millions of these little fish in the very act of leaving the egg, as well as the other curiosities, of interest to ichthyologists.

ONE tenth of one per cent of the whole atmosphere contains oxygen enough for the supply of the whole population of the world for 10,000 years.

Bank Clerks.

The Boston *Commercial Bulletin* says that the bank clerks of Boston are as capable, industrious, and faithful a set of bank officers as can be found in any city in the world. But after all, it states, the place to find an extensive army of well trained bank clerks is in the Bank of England. This institution, with its capital of ninety millions of dollars and dating back to 1694, today employs 900 clerks. The building in which these clerks do their work covers five acres of ground. It has not a single window upon the street, the light of day being admitted only through open courts. It has a clock in the center of the bank with fifty dials. The Bank of England is situated in the center of London; but it has one branch at the west end of the city, and many branches in the provinces. Though the Bank of England employs a very heavy force of clerks, it would seem, from a glance at its business, that it ought to keep them well employed and fairly remunerate them. Its sole work in its issue department is to give out notes to the public. The profit the bank derives from its issue department is the interest received upon the $70,000,000 government debt and securities, which, at the rate of 3 per cent, is $2,100,000 a year. By its dealing in coin and bullion, it has the reputation of making $150,000 a year. The amount of Bank of England notes afloat generally averages about $100,000,000, and has lately reached $165,000,000. The deposits in the Bank of England, out of which it of course makes a great deal of money, range from $60,000,000 to nearly twice that sum.

The Adulteration of Oils.

We subjoin some extracts from the "Report on Adulterations and Sophistications" presented to the American Pharmaceutical Association at its meeting, in Boston, last autumn. Three signatures were attached to the report, namely, Adolph W. Miller, chairman, James R. Mercein, and M. L. M. Peixotto; but Mr. Mercein stated that the whole of the work had been performed by the chairman.

Oil of almonds. We are informed on most excellent authority that the so-called French oils of almond, both fixed and essential, are obtained exclusively from peach kernels.

Oil of bergamot. We were shown a highly complex formula, said to be used by the manipulators in Germany for skillfully reducing this oil. Almost three fourths of the compound consisted of the oils of orange, copaiba, lemon, a little neroli, and several others. We were informed that large quantities of this sophisticated oil are disposed of in Europe.

Oil of Ceylon cinnamon. Albert P. Brown found this oil to be adulterated with sassafras and cloves. The oil of the leaves of the Ceylon cinnamon is also frequently sold in place of the true oil of the bark. The former is a brown, viscid, essential oil of clove-like odor; it is sometimes called heavy oil of Ceylon cinnamon.

Oil of erigeron. A specimen of this oil was sent to the writer by Mr. Joseph L. Lemberger, which was so largely adulterated that the true odor was entirely overpowered by that of turpentine.

Oil of juniper berries was offered to the writer by a highly respectable firm of wholesale liquor dealers, who, in their desire to have a really pure and superior article, had themselves imported it direct from Holland, having ordered the very best that was obtainable. As a very much greater quantity had been sent than their order called for, they were anxious to dispose of a portion of it. The gentlemen were so very sure about the absolute purity of their oil, for which they had paid a liberal price, that they were loath to believe their own eyes when, after agitation with an equal quantity of water, only 20 per cent of their so-called oil was left, the remainder being alcohol.

Oil of lemon, put up in original cans and genuine imported cases, branded "E. B. Co.," was found by the writer to contained 25 per cent alcohol. There is every probability that both seals were counterfeit, as the letters composing them were slightly different from those found on the top of genuine cans from Brehmer & Sanderson. The metal on which the seals had been impressed also presented a dull and tarnished appearance, while it is usually perfectly bright and clean.

Oil of melissa. The oil of lemon grass, obtained in the East from *andropogon citratus*, is very frequently substituted for the true oil of melissa, which is distilled in Germany from *melissa officinalis*.

Oil of origanum rarely reaches this country. A few pounds imported by the writer cost about $5 per pound. The so-called commercial oil of origanum is obtained in France from *thymus vulgaris*. The original packages are even distinctly marked *essence de thym rouge*. As has been already stated, this oil is very frequently mixed with turpentine in large proportion. Its chief consumption is among the manufacturers of patent liniments, who are totally indifferent as to quality, if they only obtain an original package.

Oil of peppermint was met with also largely with castor oil and alcohol. Twenty-six lbs. of this adulterated oil yielded, when distilled by the writer, 8½ lbs., of pure oil, about a gallon of castor oil remaining in the still. The proportion of alcohol, which had been present, is represented in the loss.

Oil of rose geranium is now so frequently substituted by the ginger grass or palma rosa oil, obtained from *andropogon schœnanthus*, that it is somewhat difficult to procure the true oil of *pelargonium odoratissimum* or *radula* in commerce.

Oil of sarsafras was purchased by the writer from a party who represented that he had personally distilled it, and it was found on evaporation to leave a residue of 14 per cent of rosin.

Oil of verbena is almost out of the market, being everywhere substituted by the oil of lemon grass, *andropogon citratus*

Oil of wintergreen was offered to the writer by a tall Jersey man, who professed to have distilled every drop of it himself, and who therefore claimed to be able to guarantee its absolute purity; and it proved to contain just two thirds of its volume of alcohol. It is somewhat remarkable that even this large proportion of alcohol could scarcely be recognised by the senses, and that, as far as could be judged by the taste and smell, this was an unusually fine specimen of oil of wintergreen. Several other lots have been met with containing various proportions of oil of sassafras.

Oil of wormseed. Joseph L. Lemberger has favored us with a specimen of the oil, smelling very strongly of rancid turpentine.

Oil of wormwood has been met with, extensively mixed with turpentine

Olive oil is largely substituted by some of the cheaper fixed oils found in this market. Very little of that which is sold by grocers is even imported from Europe. A New York merchant, who is extensivelv engaged in bottling this article in imitation of the imported style, informed us that for the cheapest grade he is in the habit of putting up refined cotton seed oil, and for a somewhat better brand the oil of benne. The expressed oil of mustard, a by-product in the manufacture of table mustard, is also applied to the same purpose. Our French friend, whom we have before alluded to, also kindly informed us that in his country the ground nut oil (*arachis hypogæa*) is used to an enormous extent for admixture with olive oil, so that but very little of the latter is exported strictly pure.—*Chemist and Druggist*.

Microscopic Detection—Wool and Hair.

The *American Naturalist* furnishes some interesting facts on this subject. The United States Treasury Department has admitted calf hair goods free from the duties levied on those composed in part of wool: and evidence having been furnished that some fabrics, claimed as made of hair, contained more or less wool, a commission was appointed, in which Dr. J. G. Hunt, the well known microscopist, was associated, for the examination of these fabrics. The possibility of distinguishing in manufactured mixture the hair of the cow and calf and that of the sheep has been denied by some microscopists, especially as these fabrics vary on different parts of the same animal. The commission has, however, been able to classify and distinguish them. Wooly hairs have no pith, and no perceptible taper. Their mean diameter varies from a five-hundredth to the thousandth part of an inch. At irregular intervals they have one-sided spiral thickenings, causing the wool to curl. They occur on sheep, camels, goats, and llamas; and many other animals have a portion of these wooly hairs. On the other hand, straight hairs are shorter, thicker at base, and tapering. The pith is a large part. The scales on the outside, of which there are twenty to forty in a hundredth part of an inch, lie smoothly. In wool they project more or less, and are from fifteen to thirty to the hundredth part of an inch. With these and other distinctions before them, the commission found, by first bleaching the colored fibers in mineral acids, and then mounting them in glycerin, and by using high powers, that in a few samples there was no wool; in a larger proportion there was a small quantity; in a very large number of samples there was from five to ten per cent, as well as a much larger proportion; and in one case it was difficult to find five per cent of genuine cow hair.

A BLOCK of iron about 2½ inches long by 1¼ inches square, flat at the bottom and drawn out for a handle with a wooden end, like a soldering iron, is an excellent implement for removing old and hard putty from sashes. When hot (not red hot) the iron is placed against and passed slowly over the putty, which becomes softened by the heat and is rendered easily detachable from the wood.

A VERY small quantity of oleic acid dropped upon a sample of gum copal, and but slightly warmed, will dissolve that gum completely.

Recent American and Foreign Patents.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED FREIGHT CAR.

Edward D. Shaffer, Moncton, New Brunswick, Canada.—This invention consists in the arrangement of a vertical partition dividing the car into two parts, also openings in the top and bottom of the car for admitting and discharging grain, and inclined partitions, forming, with said vertical partition, two hoppers for the grain to be transported.

IMPROVEMENT IN GRAIN CAR DOORS.

James M. Duncan, Covington, Ind.—The door is made in two parts, each part being pivoted at its upper and outer corner to one of the door posts, and capable of swinging in a vertical plane. The separating line of the door is an arc described from the pivot of one of the doors, making the edge of one door convex, and that of the other concave. It also consists in a hinged bar for sustaining the door when closed, which rests in recesses in the door posts, and in brackets for supporting the bar and doors when opened. The advantages claimed are that the door closes tightly, that it avoids the necessity of nailing the doors when loading, and also makes them lighter.

IMPROVED DRAIN TRAP AND VENTILATING COWL.

Edward G. Banner, London, Eng.—The first device is a balanced lever trap for preventing inflow of noxious gases from drains through the pipes leading from water closets in dwelling houses. The construction is such that the greater the pressure of the returning sewage against the trap, the more tightly is the trap closed, so that no flood water, sewage, or sewage gas can be forced past it. The same inventor has also contrived a new ventilating cowl. In order to withdraw a current of air from soil pipes etc., the shaft is carried up from the soil pipe; and upon the top of the shaft is mounted a revolving cowl, provided with a valve of peculiar construction, for preventing any down draft.

IMPROVED MACHINE FOR SAWING STAVES.

George W. Richardson, Arlington, Ky., assignor to himself and W. T. Davis, same place.—This consists of a stationary circular track, around which the saw runs. The saw is turned by a friction pulley, opposite to which is a friction roller, in a notch of tne track, which presses the saw against the driving pulley. The table for the work is arranged at another notch in said track, for the passage of the staves and other objects sawn off.

IMPROVED SHINGLING BRACKET.

David M. Moore, Windsor, Vt., assignor to himself and James H. Cook, same place.—This is an adjustable bracket for staging, elevated seats, or other purposes; and consists of pivoted braces with prongs or teeth at the lower ends, and connected by pivot rods, that may be adjusted to greater or less width of the bracket by suitable bolts.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CULTIVATOR.

Charles R. Hartman, Allison, Ill.—This cultivator may be used for cultivating tall plants, will not be broken by the plows striking an obstruction, and will not be turned to one or the other side by one or the other horse getting a little in advance.

IMPROVED FENCE.

William Stacy, Cottage, Iowa.—This fence is portable and yet not liable to be blown down or pushed over. Each panel is formed of two or more horizontal boards, having a cross bar attached to each end, and a cross bar attached to their middle parts. To one end of each panel is secured an arm, which projects to enter the end of the adjacent panel, where it is secured in place by a pin. The fence is held erect by a brace formed of two inclined bars, which cross each other near their upper ends, and the lower parts of which are connected by a cross bar. The lower parts of the panels are kept in place by a key.

IMPROVED COTTON SEED DRILL.

Henry Steckler, Jr., New Iberia, assignor to himself and Richard Frotscher, New Orleans, La.—This consists of a dropping wheel that is provided with a series of holes at some distance from its periphery. Through a perforated rim, V-shaped wires are passed, that serve to stir up the seed in connection with radial side stirrers, dropping the same on an oscillating fork, pivoted below the opening of the seed receptacle, to be conducted by the funnel-shaped opener or plow to the ground.

IMPROVED HARVESTER DROPPER.

William H. Akens, Pennline, Pa.—This is an improved device for delivering the cut grain from the platform of a reaper, and in neat gavels at the side of the reaper, and out of its way in making the next round.

IMPROVED PLOW.

Adam Schuetz, Carondelet, Mo.—This is an improved plow for forming ridges for planting sweet potatoes, and which may be easily adjusted to adapt it for any of the uses of an ordinary plow.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED COTTON PRESS.

James H. Davis and William White, Winnsborough, Tex.—This consists of a contrivance for driving the screw, which works the follower by a worm when doing the work, and a toothed wheel when returning the follower: also, of a removable case which receives the pressed bale and carries it away on a truck to be tied, while another box takes its place to receive the next bale.

IMPROVED WRENCH.

Andrew M. Mortimer, Salt Lake City, Utah Ter.—The stationary jaw is attached to a shank. A movable jaw slides upon the shank, and to it is rigidly attached a bar, in such a position as to be opposite the edge of the said shank. Upon the adjacent edges of the shank and bar are formed ratchet teeth, which engage with each other to hold the movable jaw in place while the wrench is being used. To the bar is attached a loop, through which the shank passes, and through the bend of which passes a set screw, which rests against the spring. When the wrench is being used, the strain upon the jaws holds the teeth of a bar in gear with the teeth of the shank, a spring keeping the movable jaw from getting out of place while shifting the wrench upon the work.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED HOSE SPANNER.

John E. Taber, Fall River, Mass.—In this spanner, the end that embraces the hose coupling is enlarged and provided with a groove that is of sufficient width to take in a lug pin, and of sufficient length at each side of the handle to insure a good bearing on the surface of the coupling, so that the spanner draws laterally on the lug pin when applied. Apertures are cut in the sides of the groove thus formed for permitting the escape of snow or mud.

IMPROVED PAINT BRUSH BINDER.

Lewis Tanney, Beaver Falls, Pa.—This is a metallic binder for paint brushes, formed of two semi-cylindrical plates, having semi-circular disks attached to their upper ends, and having eyes formed upon their side edges. The cross plate has eyes formed in its end edges, and there are suitable fastening wires.

IMPROVED ELECTRO-MAGNETIC LOCK.

Hilborne L. Roosevelt, New York city.—This relates to an improved electric lock for office doors and other purposes; and it consists in the armature of an electro-magnet that retains a swinging arm with two sliding and spring-acted bolts, of which one is withdrawn for opening the door, when the arm is released, by the attraction of the armature, and by the action of the spring of the second bolt, which is actuated and set by the closing of the door, ready for throwing open the first bolt on the action of the magnet.

NEW HOUSEHOLD INVENTIONS.

IMPROVED STOVE PIPE ATTACHMENT.

George H. Hancock, Richmond Factory, Ga.—This consists of a standard secured to the stove, with an adjustable clothes-drying fork or rack, and an adjustable lamp support. The attachment forms a convenient clothes-drying and lamp-supporting device, which may be placed on any stove and set to any position required.

IMPROVED BASIN FAUCET.

Edwin S. Rich, New York city.—The novel features in this invention consist, first, of a flange extension of the interior collar into nozzle of the faucet; and, secondly, of an additional stem valve and seat arranged above the compression valve, so as to close the water passage when the compression valve is removed.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

Notes & Queries

A. J. can polish starched linen goods by following the directions on p. 203, vol. 31.—C. W. will find a description of a calcium light on p. 219, vol. 30.—C. K. R. will find directions for making friction matches on p. 75, vol. 29.—C. F. will will find directions for hardening millpicks on p. 170, vol. 25.—M. W. can make vinegar by the process described on p. 106, vol. 32.—A. B. R., C. W., B. L., J. K., J. C. M., E. T. H., F. W., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) W. H. L. asks: Does a person, in lifting one wheel of a 4-wheeled wagon off the ground, lift more or less than a quarter of the whole weight? A. More than a quarter if the vehicle is rigid and the load equally distributed.

(2) A. Y. asks: Is there any practical way of leveling without a theodolite? A. You can construct an instrument with an ordinary builder's level, that will enable you to get the hight. As such matters are discussed in special treatises, and would occupy too much space for these columns, we must refer you to some good book on the subject. There is a cheap level in the market, which is accompanied by full directions for use.

(3) A. C. F. asks: What is the proper speed for grindstones, wet and dry? A. Circumferential velocity, 1,800 to 2,000 feet per minute.

I have a 10 horse power locomotive boiler; it will hardly make steam enough for a 10 horse power engine. Would it be practicable to wall in the boiler and form an arch over the top, arranging it to lead the heat (after leaving the flues) under the boiler towards the firebox, along the side of the firebox toward the front, then up and over the top of the boiler, back to rear end, and up the stack? A. If you have a strong draft,you may gain something by the change.

(4) T. P. F. asks: If two launches were built, one 30 and one 40 feet long, the same in every particular except length, which would run the fastest? A. The first.

(5) B. P. R. asks: 1. In a hot blast or air-tight steam boiler furnace, which is the best way to supply the air, under the grates or on top of the burning coal? A. Under the grates. 2. How many lbs. steam to the square inch will a boiler 24 feet long by 40 inches diameter, of ¼ inch iron, stand with safety? A. About 60 lbs. 3. What dimensions of smoke stack ought I to have for the boiler, with two flues, each 14 inches in diameter? A. The cross section of the chimney should not be less than about $\frac{1}{8}$ of the grate surface.

(6) J. S. C. asks: Is the statement that a body will weigh less at the equator than at the poles based on an actual test by weighing, or is it theoretical? A. Based on actual test.

(7) C. F. S. asks: 1. How large a boat will a boiler 44 inches high and 20 inches in diameter, and an engine with 3½ inches stroke and about 3½ inches bore, drive, and at what speed? A.The machine will be suitable for a boat from 18 to 30 feet long. 2. What size of wheel and what pitch should I use? A. Use one 20 or 24 inches in diameter with 3 feet pitch.

Where does ice form in freezing, on top or at bottom of the water? A. You can probably settle the matter to your satisfaction by observations on a pond in which ice forms. First there will be a thin sheet of ice, which gradually thickens on the under side.

(8) J. K. asks: Why will not iodide of potassium form in large crystals when made according to United States Pharmacopœia? A. In order to obtain good crystals of K I, it is necessary that the crystallization should proceed as slowly as possible in a cool place, and under a good vacuum. The best results are obtained when large quantities of the materials are operated upon at once. The solution of the iodide should be as neutral as possible.

(9) M. asks: 1. Is the common commercial potash in solution a good fertilizer for a grape vine when applied to the soil about its roots? If so, of what strength should it be used? A.We would not recommend the use of potash. 2. Are ground or pulverized bones good for the same purpose? A. The finely ground bones mixed with soil or peat make a very desirable manure. It would be better, however, to treat the ground bones with about one third the weight of oil of vitriol (specific gravity 1·70) in order to obtain the soluble superphosphate. The acid should be diluted with about 2 parts of water, and well stirred in with the bone dust; it should then be allowed to stand for about 12 hours, when enough loam should be stirred in to absorb all the liquid. This is one of the best manures known. 3. If these articles were applied to a loamy or porous soil, situated 10 feet from a well of water, would there be any danger of contamination to the water? A. No.

(10) E. M. L. asks: In cutting up tortoise-shell, a lot of small scraps are made. How can they be worked up into a solid mass, by dissolving, or otherwise? A. The larger scraps might possibly be utilized for small inlaid work. Send us a few of the scraps and we may possibly be able to suggest some other application.

(11) W. S. C. asks: What produces the phosphorescent light known as fox fire? A. We do not recognize the name, but suppose you refer to the strongly phosphorescent solution of phosphorus in hot olive oil. Bisulphide of carbon or one of the essential oils may be made to replace the olive oil as the solvent. It would, perhaps, be well to state that the employment of the bisulphide solution of phosphorus is liable, when the liquid is in contact with the air, to produce spontaneous combustion.

(12) S. W. J. asks: What is a simple and harmless preparation for turning dirty brownish red hair to a white color? A. There are methods by which this might be accomplished, but we cannot recommend any of them.

(13) F. S. M. asks: Which is the best way to make a solution for silverplating? I have made a solution, but the silver comes off again. I made it by dissolving some silver in nitric acid; and after making the salt dry, I put it in a solution of cyanide of potassa (K Cy) in water. It plates very well: but when I come to burnish it, it all comes off again. A. Your method of preparing the solution is a good one; the trouble doubtless arises from the inefficient manner of preparing the articles. Different metals require different treatments. As a rule, the first thing to be done is to remove the greasy films with which most objects are covered; this is effected by boiling and rubbing in a solution of caustic soda, made by boiling about 2 lbs. of common soda crystals with milk of lime, produced by slacking ½ lb. of quicklime with hot water, and well stirring. After this alkaline bath, the objects should be washed in several waters or in a running stream. They are next cleaned in acids, again washed, and then transferred to the depositing solution. Copper, brass, and German silver articles should be immersed in a pickle composed of water 100 parts, oil of vitriol 100 parts, nitric acid (specific gravity 1·3), 50 parts, hydrochloric acid 2 parts. It is well also to coat the surface with a thin film of mercury. This is effected by means of a solution of 1 oz. mercury in sufficient nitric acid, with three times the quantity of water, diluted to one gallon; there will form a gray or blackish deposit over the surface, which, on brushing softly, gives place to a brilliant coating of mercury; the object should be transferred to the depositing cell the instant this is obtained.

(14) J. McJ. asks: What will remove dried collodion from white cotton, without injuring the fabric? If there is anything that will decompose it, it will be preferable to a solvent. A. Try steeping the cloth in cold water,and then rubbing it together so as to break up the films.

(15) A. C. says: How thick should the copper and zinc plates be, and of what thickness should the wire be, of the galvanic battery mentioned on p. 234, vol. 34? A. The plates may be made of any convenient thickness. No. 14 or 16 copper wire is used for the connections. 2. How should the zinc be suspended? A. From a wooden or metallic frame resting on the top of the jar.

(16) G. B. McC. asks: Is it possible for the water to be carried out of the boiler through the pump? We were sawing with a portable steam mill, and shut down at night with the usual amount of water. In the morning there was no water in the boiler, and we had to fill her up through the safety valve. There is a check valve on the feed pipe close to where the pipe connects with the boiler. A. It would not be possible, if the check valve were tight, which, judging from your account, might not have been the case.

(17) A. H. asks: 1. Please give me full directions for making a good condenser for an induction coil. A. Cut tinfoil up into sheets of the desired size, and make of them two piles like the leaves of a book, one pile containing one more sheet than the other. Upon the extreme end of each of these piles place a tinned wire or strip of metal, and by means of a soldering iron run all the edges together so as to make a perfect metallic connection. Cut sheets of paper large enough to allow a margin of at least an inch round three sides of the foil. The paper should be thin, not highly glazed, and should show no acid reaction by reddening when moistened with a neutral solution of litmus; it should be baked thoroughly dry, placed in a vessel of paraffin kept well over its melting point, and then drained sheet by sheet as smoothly as possible. A well baked piece of wood somewhat larger than the paper is laid upon a table, its face soaked with paraffin and a sheet or two of paper laid upon it; upon this is laid the largest pile with its soldered end projecting, and all its leaves turned back except the lowest one, which is to be rubbed smoothly out on the paper; lay over this two sheets of the paper, and on top of this the other book of foil, so placed that it lies exactly over the first sheet except for the margins at the opposite ends; turn back, as with the other, all its leaves except the first, and upon this place two sheets of paper; continue this process, laying back, upon the paper, sheets of foil from the books alternately, and between each foil two sheets of paper. When all are in place, cover with two or three sheets of paper and a board like the first; the whole should then be compressed by clamps and warmed up to the melting point of paraffin, increasing the pressure to drive out all excess. The first board should be provided with a binding screw at each end, and the wire of the corresponding foils should be soldered to it. 2. Which will produce the best result, 3 lbs. silk-covered wire No. 37, or 5 lbs. No. 32? A. Three pounds of No. 37 will give the longest spark.

(18) A. D. asks: 1. Does the addition of glass to lead make it ring like silver? A. The product is quite sonorous. 2. Will glass combine with lead? A. Oxide of lead is soluble in molten glass.

(19) L. B. & Co. asks: What will hold up soapstone in solution? A. Such rocks can only be rendered soluble by fusion with alkalies or alkaline carbonates in excess, and subsequent treatment with boiling water and acids. The rock (in small quantities) may be partially decomposed and dissolved by means of strong hot solutions of hydrofluoric and sulphuric acids.

(20) S. asks: What degree of heat is necessary to make brass malleable, so that it can be hammered or drawn out? A. It is generally drawn cold, being previously annealed.

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

We have received minerals as follows, in packages without names of senders: Two specimens of micaceous red hematite, an excellent ore of iron. Two specimens of clay of good quality, a mixture of finely divided silica and silicate of alumina, which might be employed in polishing, in making some varieties of vitrified wares etc.—A. E.—It is augite, and contains some oxide of iron.—W. E. T.—They are both iron pyrites, and contain no precious metal.—N. V. C.—It is brown coal.

COMMUNICATIONS RECEIVED.

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

On the Centennial Awards. By G. B.
On Sound. By J. A. F.
On Foul Air in Wells. By M. B. O'N.
On the Moon. By J. D.
On Cutting Speeds. By T. J. B.
On Trisecting an Angle. By J. McM.
On Smoky Chimneys. By F. G. W.

Also inquiries and answers from the following:
B. D.—G. B. P.—L. H. E.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells paraffin? Who sells gutta percha? Who sells crude India rubber? Who sells proprietary stamps? Who sells the best astronomical telescopes? Whose is the best aneroid barometer?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

October 17, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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Cultivator, E. Pratt (r) 7,353
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Curry comb, G. H. Hawrican 183,302
Curtain fixture, Miller & Silsby 183,411
Cutter heads, balancing revolving, A. Hall 183,260
Desk and sewing machine cover, A. Cunningham 183,286
Desk attachment for chairs, Parr & Woodhouse 183,325
Diamonds, cutting, T. F. Tully 183,474
Die and shoe for quartz mills, Bartol & Louzarder 183,362
Disinfecting water closets, etc., E. Howard 183,264
Domestic distilling apparatus, T. L. Lynch 183,268
Drain trap, E. G. Banner 183,279

DESIGNS PATENTED.

9,580.—BRACELETS.—H. Carlisle, Jr., Philadelphia, Pa.
9,581.—SPOONS.—H. W. Hirschfeld, West Meriden, Conn.
9,582.—FLOOR OIL CLOTHS.—J. Meyer, Lansingburg, N.Y.

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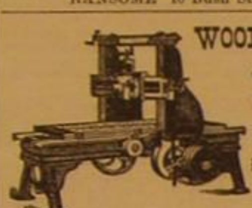

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