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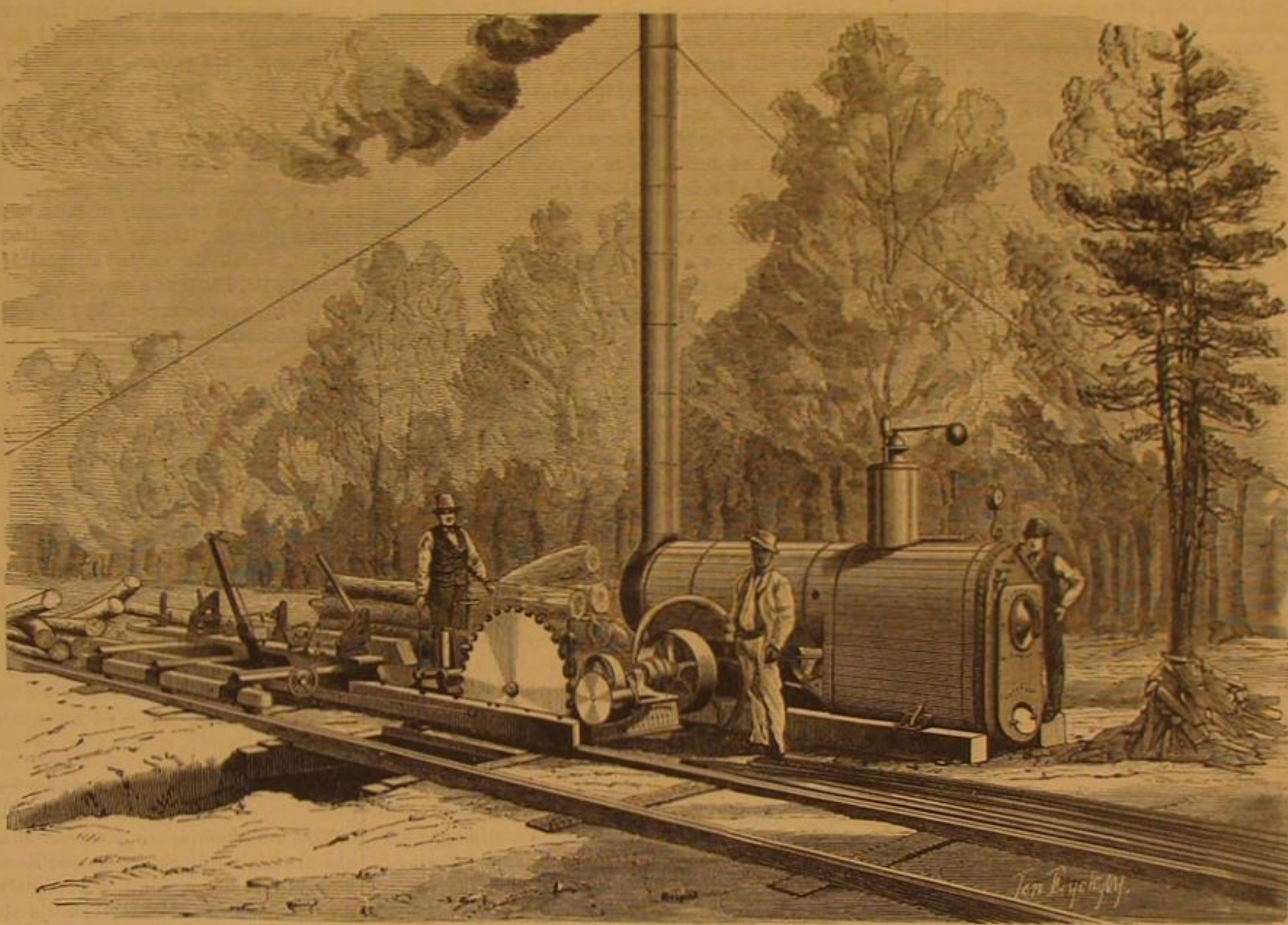
IMPROVED PORTABLE SAWMILL.

There is on exhibition at the Centennial a machine commonly known as the Canada sawmill, which has attracted much favorable notice both on account of the simplicity of its construction and the speed and accuracy with which it accomplishes its work. It was designed by the Waterous Engine Company, of Brantford, Ontario, Canada, expressly for use in the extensive lumber districts of the Dominion, to saw up the timber in the localities where it is felled, and thus to save the trouble and the expense of the carriage or rafting of the logs to distant points; and being portable, it may readily be moved from an exhausted part of a forest to a new situation. The machine is also excellently adapted for employment in shipyards, in most of which establishments in Nova Scotia and New Brunswick, we are informed, it has superseded whip sawing by hand.

In the annexed engravings, Fig. 1 represents the mill as it appeared at work while on exhibition at the Santiago (Chili) Exposition of 1875; and in Fig. 2 the portable boiler and engine are shown. The portable machine has a 20 horse power engine, which, together with its boiler, is of such weight and of such construction that both boiler and engine may easily be loaded on trucks, when changing the position of the mill, without any disconnection being necessary; so that the labor of a skillful machinist is not required to readjust the mechanism. The saw mandrel, feed, and gig work are compactly arranged in an iron frame, and can also be loaded and moved without being taken apart; so that, when resetting the mill, all that is necessary is to frame the foundation timbers previously used in the ground, set the mill on them, coupling the engine shaft and saw mandrel, lay the track, place the carriage on it, and the mill is then ready to start. The whole operation does not take more than from one to two days.

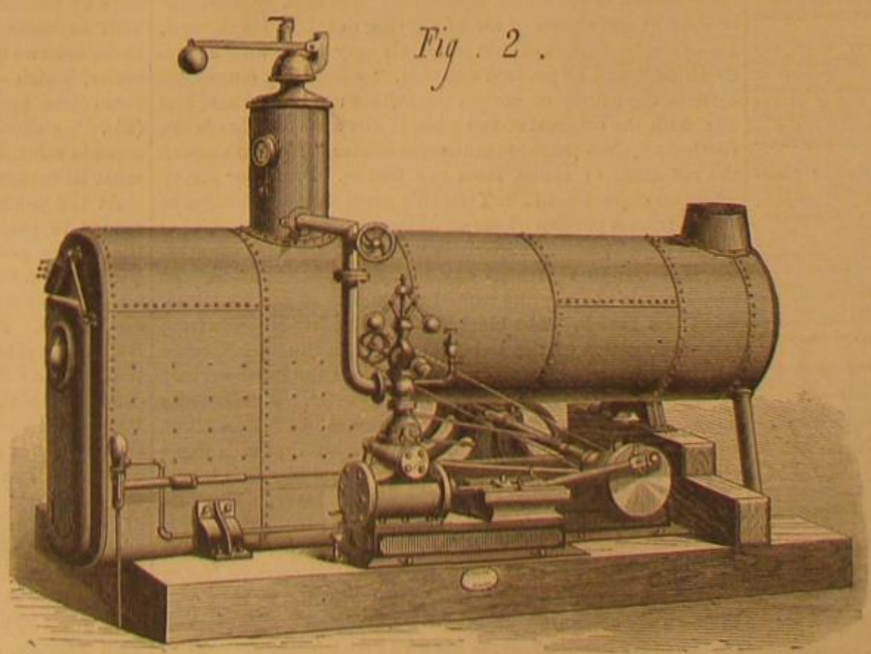


CANADIAN PORTABLE SAWMILL AT THE CENTENNIAL.

The boiler is supplied with sawdust grates, by means of which it is enabled to keep up a full supply of steam with no other fuel than pine sawdust and refuse edgings. It is also covered with hair felting and lagged with wood or sheet iron. Its form is clearly shown in Fig. 2. The plates are of the best English material, and the heads are Lowmoor iron. Each boiler is subjected to 120 lbs. cold water pressure before shipment. The 20 horse power engine drives a 56 inch saw, which will, it is claimed, cut from 6,000 to 10,000 feet of lumber per day, or 1,000 feet of one inch pine lumber in a single hour. The 25 horse power engine, which is usually employed in connection with a tubular stationary boiler, drives any size of saw up to 66 inches, and its capacity is said to be from 8,000 to 12,000 feet of lumber per day.

At the Chili Exposition, the 20 horse power mill, we are informed, sawed and edged 1,060 feet of lumber in 40 minutes, vanquishing all competitors and gaining a medal and diploma. It has received the first premiums at ten Canadian Provincial Exhibitions, besides a highly favorable report from the judges at the Centennial.

Fig. 2.



To FIX fugitive colors in linens, muslins, etc., soak the fabric for an hour in a pail of water containing a tablespoonful of turpentine

A Hint for Nervous Orators.

That distressing sensation known as stage fright, which often afflicts persons inexperienced in speaking before a large audience, can be removed by a few whiffs of ether. Dr. William Fuller, of Montreal, says that either this remedy or a minute dose of morphia will remove all the spasm of the cerebral vessels and violent palpitation of the heart, and obviate the confusion and forgetfulness with which the sufferer is usually seized, so that he does not have to wait for symptoms of reaction to set in to allow him to "get warmed up," as the saying goes Too large doses of either remedy, it should be remembered, produce the opposite condition of the vessels, quite as fatal to a successful result. An objection is that reliance on this means may lead to a dangerous habit.

Drainage of the Eye Ball.

Dr. D. Weeker has introduced another new operation in ophthalmic surgery. It consists of a system of drainage effected by the introduction of a piece of gold wire through the membranes of the eye, which is so arranged that the patient is in no way inconvenienced by its presence. This new method is applicable to all cases in which the drainage of a liquid from the eye would be indicated, such as hydrophthalmia, staphyloma, detachment of the retina, absolute glaucoma, etc. Thus far the results have been encouraging.—*British Medical Journal.*

Open Air the Best Remedy for Consumption.

The conclusion reached by late observers is in favor of the open air treatment of consumption. The following case, given in the *British Medical Journal*, is illustrative: "An officer of a regiment contracted phthisis when stationed in the south of England. He was under medical treatment some time, and had the usual sick leave, but, on his return to duty, got worse again in the same way. The next time he was invalided with the upper lobe of the right lung seriously involved, in the third stage, with cavities; and he was examined by the usual medical board, and finally he sold out of the service and regiment. Under medical advice he took to traveling about this country and the Continent, to riding on horseback instead of walking, and attending meetings of the hounds frequently.

"Two or three years then elapsed, during which his case was withdrawn from my observation; and I was then surprised to meet him one day in the summer at Lord's cricket ground, looking quite recovered."

This report, by Surgeon Major W. T. Black, leads him to formulate the proposition: "It is living in the open air in a fine climate that is really beneficial for consumption, and not the mere climate of itself.'

"If this is not new, it is at least too often forgotten," says the *Medical and Surgical Reporter*. "A friend of ours, a medical gentleman, who has suffered from phthisical symptoms, and has traveled largely, has lauded the climate of Northern Africa as best suited for open air life in winter. The recently published book of Dr. Arthur Leared, "Morocco and the Moors," informs us that at Tangier the accommodation is good and the cost of living decidedly cheap. The ordinary summer temperature ranges between 78° and 82° Fah. The mean temperature of winter is about 56° Fah."

Portland Cement on Woodwork.

Portland cement has many uses in the garden and elsewhere, not generally apparent. Some of them are enumerated by the *Garden* as follows: When made into a thin solution like whitewash, this cement gives woodwork all the appearance of having been painted and sanded. Piles of stone may be set together with common mortar, and then the whole washed over with this cement, making it look like one immense block of gray sandstone. For temporary use, a flour barrel may have the hoops nailed, so as not to fly apart, and the inside washed with a thin paste of Portland cement, and it will serve for a year or more to hold water. Boards nailed together and washed with it make good hot water tanks; and it is of use in so many ways that it may be regarded as one of those peculiar things in a garden which it is always good to have at hand.

A CUBIC inch of charcoal has not less than 100 square feet of surface in its pores.

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THE OCEAN ECHO—HENRY VS. TYNDALL AGAIN.

Even his arduous labors in connection with the Centennial Exposition, added to his other pursuits, have not been sufficient to cause the venerable leader of American scientists to relax his researches into his favorite acoustical problems during the past year; and he recently came before the National Academy of Sciences with a new series of discoveries and theories, which he modestly announced as a "few additional facts" related to the results of his previous investigations.

It will be remembered that, at the 1875 fall meeting of the above named association, Professor Henry read a paper on a similar subject—in fact, his attention has been enlisted in the same direction for many years—in which he changed the scientific duel between Professors Tyndall and Osborne Reynolds into a triangular controversy. While he contented himself with disagreeing with Reynolds in many points, he hurled such a host of convincing experiments against Tyndall's theories of "acoustic transparency" that those structures, which Reynolds had already badly undermined, had little substantial support left them, even in the minds of those perplexed physicists who watched this war of the giants from afar, and who scarcely ventured opinions of their own in view of the disagreement of so learned a triumvirate of doctors.

Now Professor Henry returns to the fray, and again proceeds to discomfit the results of the "scientific use of the imagination" of Dr. Tyndall, not by propounding adverse theories, but by the inexorable logic of actual experiment. How he does it will appear in the following brief explanation of the new discoveries, which chiefly relate to the "ocean echo." Loud sounds, Professor Henry says, are wanting in analogy to light, so far as concerns obeying its rule that the angle of incidence is equaled by the angle of reflection. Instead of being reflected from a parabolic mirror in parallel rays, sounds diverge in all directions. A whistle being located in the focus of a parabolic reflector, 12 feet in diameter, gave a sound which, at a distance of 4 miles, had diverged so that it reached the whole horizon, and was heard with equal intensity to the rear and in front of the reflector. The cause of this divergence is explained in two ways: first, we may suppose the crest of a sound wave to be abruptly terminated at either extremity, when the tendency of the compressed air which constitutes the wave will be to expand itself in all directions—laterally from the ends of the wave as well as directly in front. Second, another cause may probably be found in the retardation of the two ends of the wave as it proceeds from the mouth of the trumpet. This would occasion a curling of the ends of the wave, as well as an elongation of them as they proceed from the swelling aperture. In the tendency of the sound to spread is to be found an explanation of the action of the trumpet, which gives the sound beam a greater condensation along its axis, and thus checks its spreading. Thus a speaking trumpet may act as efficiently if lined with felt as if lined with metal.

Although the tendency of sound is to diverge in all directions from an axis, yet there are cases where "sound shadows" are produced. Professor Henry mentioned a case where a fog whistle was placed near the water level of an island on which was a conical elevation. Vessels approaching from the other side of the hill heard the sound distinctly at a distance of three miles; but when the distance was reduced to a mile, the sound was lost and not recovered at any smaller distance. Here the termination of the shadow was at the one mile point, at which the diverging beams of sound, passing over the crest of the island, bent down and reached the surface of the water.

These conclusions are applied to the elucidation of the ocean echo, which is a reverberation coming from the horizon, near the surface of the ocean, and from around a point in the prolongation of the axis of the trumpet. It will be remembered that last year, in a lecture before the Royal Institution, Professor Tyndall adduced a number of brilliant experiments to show that echoes may be caused by reflection of sound from clouds of air of varying density. He showed, for example, that invisible warm air may act as an "acoustic cloud," and he pointed out that, "when such clouds are close to the source of sound, the echoes are immediate, and mix with the original sound; but if the acoustic clouds are further off, then there are prolonged echoes." He also showed the reflection of sound from gas flames. Professor Henry offers no objection to Dr. Tyndall's proof that a reflection of sound from a portion of air of different density is possible; but he says Tyndall's experimental conditions are exaggerated, and fail to represent any real atmospheric state. To test Tyndall's theory, he turned the mouth of a trumpet toward the zenith. The blast was intense, but no echo from the prolongation of the axis, that is, from the zenith, came back, although it was audible all around the horizon, half of which was on land and half on water. A rain cloud passed over the trumpet, and even a few drops fell: still no sound from the zenith. Compare this with Tyndall's experiment, in which he showed that, while two hundred layers of muslin did not cut off sound, a single layer, when wet, did, the latter presenting continuity of the air. Certainly it might be supposed that the rain cloud would act in a somewhat similar manner to the wet fabric. Professor Henry repeated his experiments several times, failing in each case to find any substantial basis for Dr. Tyndall's assumption. On the other hand, applying his own conclusions, he considers the echo to be due to reflection from the perfectly smooth surface of the ocean. On account of the divergence of sound, portions of waves in every direction must have descended to the horizon; and as some of these must have reached the plane of the ocean in a path curving inward toward the source of sound, they would, when they reached the ear of the observer in the vicinity of the source, seem as if coming from a point in the horizon, and hence would give rise to the phenomenon of ocean echo. Rays of sound at different distances from the ear would be reflected from the surface of the ocean, and thus occasion the prolonged echo: a blast of 5 seconds in one experiment on this point gave an echo lasting 20 seconds. "This," says Professor Henry, as a final shot at the "acoustic cloud" theory, "could only be produced by ordinary reflection from a series of surfaces placed at different distances, an arrangement of the material of the atmosphere which (on the doctrine of probabilities) would not be of frequent occurrence."

SLADE SUSTAINED.

Speaking of the exposure of the Slade trick, in London a few weeks ago, we expressed the belief that it would not lessen in the least the confidence of spiritualists in Dr. Slade or his practices. Even if strong enough to secure his conviction in the courts as a common swindler, the evidence of Dr. Lankester and others could not and would not shake their assurance of his personal honesty and the genuineness of his mediumship, for the simple reason that their confidence was the result of delusion, not a sane mental condition determined by or amenable to evidence.

Whether we were right or not as to the cause, we certainly were right as to the fact, for which we have the testimony of the president of the (British) National Association of Spiritualists. At a special meeting of the association, in London, October 4, that gentleman said he would willingly speak of Dr. Slade, in compliment to whom the gathering had been announced, but that could hardly be done without being drawn into a discussion of the case before the courts, and respect for the law made such a discussion unadvisable at that time. "It may be permitted me, however," he continued, with a sublimity of faith and felicity of diction marvelous to see, "it may be permitted me, however, to state a fact, which we cannot conceal if would, that our confidence in Dr. Slade as a genuine medium is in no way affected by the inferences drawn by two gentlemen who were quite inexperienced in the difficulties of the subject, and which inferences were founded on observations likely to be unconsciously vitiated by apparently slight but really important foregone conclusions"!

Surely our venerable poet must have been in a satirical mood when he penned the familiar lines:

"Truth crushed to earth shall rise again;
Th' eternal years of God are hers;
But error wounded writhes in pain,
And dies amid his worshippers!"

Since the above was written Slade has been found guilty of trickery at his *séance* with Dr. Lankester, and sentenced to three months imprisonment with hard labor. From this decision, an appeal has been taken to a higher court, pending which he has been allowed to go out on bail. He was given the opportunity of performing his legerdemain in court, and of satisfying the judge of its spiritual character, but declined, not daring, apparently, to testify even in his own behalf.

THE LEVERRIER OF CHEMISTRY.

The correspondence between the hypothetical element eka-aluminum, imagined by the Russian chemist Mendeleef, and the real element gallium, recently discovered by M. Lecoq de Boisbaudran, is so remarkable that the attention of European scientists is now being closely devoted to its examination. In 1869, Mendeleef published a memoir, which attracted little notice at the time, but which announced as a law that "the properties of simple bodies, the constitution of their combinations, as well as the properties of the latter, are periodic functions of the atomic weights of the elements." Without entering into the details of the theories whence arose this conclusion, it will suffice to state that the author considers that this periodic law indicates the gaps which still exist in the system of known elements, and admits of predicting the properties of unknown elements, as well as those of their combinations. Thus, for example, there are two gaps in the groups D III and IV of the fifth series, which elements, yet to be discovered, M. Mendeleef some time ago named eka silicium (Es) and eka-aluminum (El). To show how this last mentioned hypothetical element is related to gallium, the characteristics of that metal must be reviewed.

At the present time, M. Lecoq de Boisbaudran has succeeded in preparing 7·5 grains. In a liquid state, gallium, the fusing point of which appears definitely to be 86·27° Fah., is of a fine silver whiteness; but on crystallizing, it takes a very marked bluish tint, and its brilliancy notably diminishes. By suitable cooling of the melted material, isolated crystals are obtained, in octahedral shape, and these M. de Boisbaudran is now measuring. As regards density, which is the important point to be noted, M. de Boisbaudran says: "In May, 1876, I attempted to measure the density of gallium by a specimen weighing 0·92 grain. I obtained 4·7 at 59° Fah. (and relatively to water at the same temperature). The mean of the densities of aluminum and of indium being 4·8 (to 5·1) the specific gravity provisorily found for gallium appeared to accord quite well with the theory placing that metal between indium and aluminum. The calculations established by M. Mendeleef, however, for a hypothetical body which appears to correspond with gallium, show the number 5·9. Gallium, crystallized under water, sometimes decrepitates on heating. Perhaps my first metal contained bubbles fill with air or water. To eliminate this possibility of error, I heated the metal highly and solidified it in a dry atmosphere. Then I obtained higher densities, varying from 5·5 to 6·2, the weight of the pieces tested being some tenths of a grain. Finally, I combined six specimens, aggregating 8·7 grains." The mean of two different experiments gave (1st) 0·5935; (2d) 0·5956. "It is hardly necessary to insist," adds the author, "upon the extreme importance which attaches to the confirmation of the views of M. Mendeleef concerning the density of the new element."

This, however, is by no means all. Seven years ago, M. Mendeleef said, eka aluminum will have an oxide of the form El_2O_3." The oxide of gallium is Ga_2O_3. "It will be almost fixed, and will melt at a very low temperature. This answers exactly to gallium, which melts at 86°. He said, further, that the future element, volatile and taking its place between indium and aluminium, would be discovered by spectral analysis, and so gallium was discovered.

We may agree with *La Nature*, whose editor, M. Tissandier, discussing this same subject, holds that Mendeleef's prediction abstracts nothing from De Boisbaudran's merit as the original discoverer. The French chemist attained his result in no fortuitous manner. He also foresaw the existence of gallium, and he isolated it only after ten years of persevering labor. He compared the spectra of different metals minutely, and thus was led to suspect the intermediate element between aluminum and indium.

The analogy between Mendeleef's discovery in chemistry and that of Leverrier in astronomy is most striking. Leverrier, from the perturbations of Uranus, deduced a hypothetical planet by purely theoretical considerations, treated it as if it were a real world, and then verified his calculations and theories by his magnificent discovery. Mendeleef likewise, by considerations as purely theoretical, conceived a hypothetical element. Had Adams, who discovered Uranus almost at the same time as Leverrier, worked from that astronomer's calculations, the analogy would be without a flaw, for he would then stand as De Boisbaudran now does toward Mendeleef. As it is, the discovery seems to open as wide an horizon in theoretical chemistry as did Leverrier's achievement in theoretical astronomy.

PANICS IN SCHOOL HOUSES.

It seems to us that remedial measures are needed to prevent the occurrence of the panics which, on the breaking out of a fire, real or imaginary, always occur in crowded schools, or at least to obviate the dangers incident to the headlong rush which takes place when the tumult overpowers the means of prevention. Several such scenes of confusion have lately been witnessed in this vicinity, and they are becoming sufficiently frequent to render parents unwilling to permit young and feeble children to attend the crowded public schools. A panic occurred the other day in a large school room, because a steam pipe, leaking, discharged into the apartment a cloud of steam, which the children supposed was smoke from a fire. Another was just avoided through the scholars being at recess, when a genuine fire broke out near the recitation rooms, and on one of the stairways which formed a means of egress.

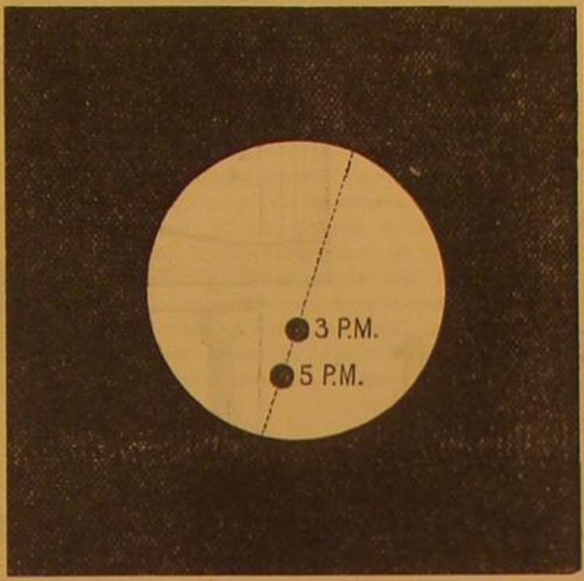
The prevention of disastrous confusion demands the greatest care, especially from those who construct school buildings and those who are responsible for their management. That such care is not exercised, we are persuaded from the frequency with which panics occur. Had the steam pipes been in proper order, or inflammable materials not existed in the school houses, neither of the above examples would have happened; and so, in every instance, some provoking cause can generally be found, which is attributable to a lack of proper vigilance or the absence of proper precautions. School houses should be fireproof and contain no material likely to feed flames. Even the probability of spontaneous combustion should be considered, and no dry or pulverulent material should be allowed to accumulate upon or around the steam heating apparatus. So carefully should risks be avoided that, while considering plans for new structures, or the introduction of new appliances into old buildings, the question whether there is anything in the schemes or projects proposed, which by any possibility might determine conditions sufficient to cause a panic, should be fully weighed. The case is one in which the ounce of prevention is worth a great many pounds of cure, although in the latter respect much can be done in providing ample modes of exit. If some rigid system of inspection of all school buildings, to be made by men thoroughly conversant with all the causes of schoolhouse panics—the principal of which, of course, is fire—were enforced, we probably should hear much less of children killed and injured through the efforts of a frightened crowd to escape.

VULCAN AGAIN.

Still another correspondent, as the subjoined letter shows, informs us that he saw Vulcan, or something on the sun which may answer to the description of that fugitive planet. This time the date is October 24, which is within Leverrier's first predicted period when observations should be made; and singularly enough the hour, 3 P. M., coincides with that of the reported observations of our other correspondents. The motion of the body, according to Mr. Wright, is different from that hitherto reported, as hitherto the spot has appeared moving upon the sun's disk, while now it is traveling off. The observation, in any event, is especially interesting, because it is the only one made since Leverrier's announcements in which anything resembling Vulcan has been seen; and moreover, it is also the only one of late date where the observer was not "taken by surprise," and where he adopted the best measures possible under the circumstances to verify the discovery. The following is the report:

To the Editor of the Scientific American:

I was reading last night in the SCIENTIFIC AMERICAN about the transit of Vulcan, and was so interested that I decided to make search myself during these clear, unclouded days. So this afternoon at 3 o'clock I got out my tube (4 inch lens); and at the very first focus the transit stood before me just as distinctly as it is printed in your paper (page 257). I was so astonished and delighted that I had to look and look again to satisfy my wondering eyes. Then I called my family, and they all saw it as plainly as I had done. Having satisfied myself by a half hour's observation that it had motion, I at once telegraphed to Professor Davidson (of the U.S. coast survey) at San Francisco: "Transit of Vulcan this afternoon; look for it." Then I went to the photograph rooms and used every effort to get a negative of it; but as we had no appliances, no facilities, and no knowledge how to take such a negative, it is not surprising that the one plate exposed is not of much value. The transit, however, was seen by four persons; others I did not summon, as I was more anxious to get a photograph. Had it been earlier in the day, I would have telegraphed to some eastern observers, but at the time I saw it first (3 P. M.) the sun was already set to eastern people; but I did the best I could by telegraphing to San Francisco, and then trying to get a photograph.



The apparent path of the planet, as near as my observations show, for the two hours' time before sunset, was as indicated on this diagram; and the time occupied in its transit I judge to be from about sunrise till 9 in the evening, about fifteen hours. In this diagram, I have drawn Vulcan's appearance too large: the relative size is perfectly shown in your diagram, page 257, this current month. W. G. WRIGHT.

San Bernardino, Cal., October 24, 1876.

If we might pin our faith to M. Leverrier's recent utterances, and assume, as we stated last week, that the supposed planet rotates about the sun once in 33 days, an even number of such periods from July 23, the date of other reported observations, would bring us to October 30, or within a week of Mr. Wright's observation. But M. Leverrier's views on the subject appear at present to be in a transition state, and our French mails each week bring us new statements from him, which of late have invariably failed to accord; in fact they often wholly differ from those enunciated seven days before. The reader will therefore understand that the data we now give, as well as those which we have presented, represent merely stages of progress in M Leverrier's investigation, through which we are endeavoring to follow him. The latest dictum of the eminent astronomer is more logical than some previous announcements, but at the same time seems to contradict flatly his previous results. In lieu of Vulcan swinging in a regular orbit in equal periods about the sun, we are now told that its orbit is highly eccentric, and that the planet behaves like Venus, making two transits within a few years, and then not repeating the passage for a century. This, of course, puts a stop to any such off-hand calculation of future transits as is above referred to.

M. Leverrier's reasoning whereby he reaches this conclusion is very interesting. He starts with the idea of finding a formula which will enable him to predict the Vulcanian transit, and to do this he makes use of Mercury, the theory of the motions of which planet, as is well known, is complete. Taking five good observations of Mercurial transits, dated 1780, 1802, 1832, and 1845, he determines this expression for the Mercurial orbit: $V = 56·04° + 4·092307° j - 7·66° \sin. v - 9·18° \cos. v$, in which j is counted from 1875. From this he calculated the next Mercurial transit, which he found would fall on November 9, 1848. Now this is exactly the date when a transit of Mercury did occur, and it was observed by Hind in London. In other words, had Mercury never before been seen, it would then have been discovered through the calculations.

M. Leverrier applies this method to Vulcan; and assuming the data of previous observers to be correct, he reaches the formula $V = 139·94° + 216·18° k + (10·901252° - 1·972472° k) j$, in which k is unknown, but the values of which are necessarily whole numbers. It is to be noted first that, if the solutions differ in the majority of points on the orbit, they coincide at the node, and this circumstance renders the problem much simpler. Besides, the variation of which k is capable is confined within very narrow limits.

With $k = 0$, the distance to the sun is 0·201, or one fifth of the earth's distance. The elongation is then 10°, that is to say, Vulcan is always so near to the photosphere that it is easy to understand why the planet is so rarely visible. With $k = 1$ almost the same results are obtained. The distance is not more than 0·181, and the rarity of observations is still better justified. But if $k = 2$, the rotation of the star must take place in 24 days, or in a less period than that in which the sun revolves on its axis; and consequently this solution is inadmissible, unless Laplace's cosmogonic hypothesis is rejected. Inversely, if $k = 1$ (or -1) in the above equation, the elongation becomes so great that for this reason the planet could not often be observed.

Now there has always been noted, in the transits of a single planet, periods of frequence and rarity. Venus, as we before stated, crosses twice in ten years, and then a century elapses before another transit occurs. The same is true of Mercury, a [illegible]. Leverrier says, also of Vulcan. The period of the latter [illegible], he states, is 7½ years, and there should be a transit on March 22, 1877, and not another until 1883. He advises that even the passage next year is not certain, the calculations showing that the trajectory of the planet will be sensibly tangent to the sun's edge; and besides, they do not determine its position with accuracy. But he counsels careful observations on the day noted.

Meanwhile there will be a chance for spectroscopists, as passages will occur frequently in the coronal region. These M. Janssen has already begun to search for.

IRREGULARITY OF THE EARTH'S MOTION.

Professor Simon Newcomb, of the Washington Observatory, is to be credited with a new astronomical discovery, which bids fair to be of some importance. He has found that our planet, instead of rotating regularly about the sun, is pursuing an apparently irregular motion, sometimes running ahead of, sometimes falling behind, the time based upon its own movement at any given period. The consequence is that the motion of the earth becomes no longer an absolutely exact standard for time measurement; and thus our reliance on our globe, already impaired since it has been demonstrated that there is no such thing as *terra firma*, and that its surface is constantly changing, is again weakened, and in a new direction. It is safe to believe that, now the discovery is in the hands of the astronomers, we may look for remarkable deductions.

Professor Proctor, who has recently been discussing it, says that for about half a century there has been a doubt among astronomers as to the steadiness of the earth, and that Sir William Herschel suggested the possibility that, if a careful comparison were instituted between the turning motion of the earth and that of other planets, minute changes might be recognized. Accordingly he undertook the study of Mars, and measured the Martial day to a tenth of a second in a day; but this was of no use in testing the errors of our terrestrial time piece, where the same errors have to be measured by hundredths of a second in a year. Besides in Herschel's time the doubt on the earth's motion had been raised by Halley's recognition of the moon's apparent hastening; and this suggested little, because the lunar movements had never been closely analyzed, and the lunar hastening, as it was, indicated too small a change for Herschel to measure by his standards. Still this vague doubt was deemed of sufficient importance to cause Laplace to investigate it; and he showed that, among the various circumstances which affect the moon, there is one whose effect, at present and for many centuries to come, will hasten her motion. Then calculating the amount of such hastening, he concluded that it exactly corresponded with the hastening actually observed. "Perhaps there is not, in the whole history of Science," says Professor Proctor, "a more remarkable circumstance than this seemingly exact solution of a most difficult problem, where in reality the solution was incorrect." There was no forced agreement of figures; the work was placed in all its detail before the scientific world; mathematicians and astronomers recomputed it, and all agreed in its accuracy.

About a quarter of a century after Laplace's death, Adams (the co-discoverer, with Leverrier, of Neptune) re-examined the reasoning and found a flaw. Laplace judged a certain effect might be neglected. Adams thought not, and tested the matter; and then it appeared that it exercised so important an influence that, when due correction was made in Laplace's work, only one half the hastening was accounted for. Then arose a storm in the astronomical world. Leverrier, with all his acumen, failed at first to perceive the nature of the correction, and declared Adams to be mistaken. Pontécoulant sneered at it as "analytical legerdemain;" but the English mathematicians first accepted Adams' result, and then, after Delaunay had verified it, the continental astronomers followed. Delaunay not only admitted a retardation of the earth's motion, but pointed out where and how the same might be affected, namely, by the friction of the great tidal wave, which travels round in a direction opposed to the earth's rotation. This view has been generally accepted; and it can be shown that, if a clock could be made to go at a rate corresponding precisely to the earth's rotation, as indicated now, for 100 years, at the end of that time the earth would be found to have lost 22 seconds.

Now comes in Newcomb's discovery to show that the earth (judging from the moon's movements) undergoes irregular changes. It lost seven seconds between 1850 and 1862, and then, turning too fast between 1862 and 1874, gained eight seconds. Meanwhile smaller changes, some in one direction, others in the other, have taken place, generally lasting about four weeks at a time.

Two theories are suggested to account for these movements, either that the earth's motion is nominally irregular, or that some unseen body passes near enough to the moon to disturb her motion around the earth. Professor Newcomb adheres to the first hypothesis.

UP to the hour of going to press, the list of patents issued during the week ending October 17, and bearing that date, had not arrived from Washington.

SHELL lime, which contains considerable phosphorus, is superior to stone lime for agricultural purposes.

IMPROVED SHOE-SCOLLOPING MACHINE.

In the manufacture of ladies' and childrens' fine shoes, it is now customary to scollop the edges of the vamps, quarters, and button laps. This work, as ordinarily produced by hand, by dies, is irregular in appearance, and not uniform through any number of pieces; while, as each part has to be scolloped in turn, the labor involves considerable expenditure of time. By means of the improved process, performed by the aid of the new machine herewith illustrated, the work can be done with ease and rapidity by a boy or girl; and the single tool used answers equally well for all sizes, from the smallest infant's shoe upward. The invention also admits of the use of cheap paper or cardboard patterns, instead of those of galvanized iron or zinc commonly employed.

Fig. 1 is a plain view of the machine, and Fig. 2 an elevation. A is a massive circular cutting block, in the lower part of which a hub, B, is let in, and tapped to receive the vertical screw pivot, C, which rests on the circular bed plate. Said plate is supported on legs, as shown On each side of the block are slotted bars, D, which, by set screws passing through the slots, are movably secured to the standards, E, Fig. 2. Projecting from each end of these bars are pivoted arms, F, which at their extremities carry the vertical three-armed guide pieces, G. H is a bar, bent, as shown, at right angles, its horizontal part having longitudinal projections, which enter a guide socket beneath the bed plate; so that by drawing said horizontal part out or pushing it inward, securing it in either case by the set screw, the vertical arm may be adjusted farther from or nearer to the cutting block, A. On the vertical arm, H, is pivoted a presser, I, which is held downward by the leaf spring shown. To an eye in the outer end of said presser is attached a cord connecting with a foot treadle, J, so that when the latter is forced downward the presser is lifted against the action of the spring. Also pivoted on arm H, is a bar, K, at the extremity of which and over the cutting bar is pivoted a curved adjustable slotted bar, L. To the rear of bar, H, is pivoted a cam lever, M, on the cam of which are shallow notches, which engage against the end of bar, K, and thus hold the same when its opposite extremity is pressed by the action of the cam against the cutting block.

Fig. 1

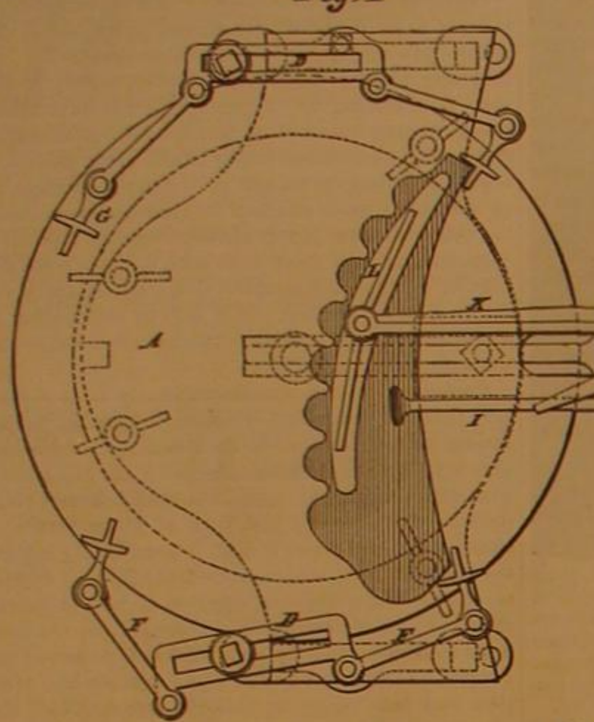


Fig. 2

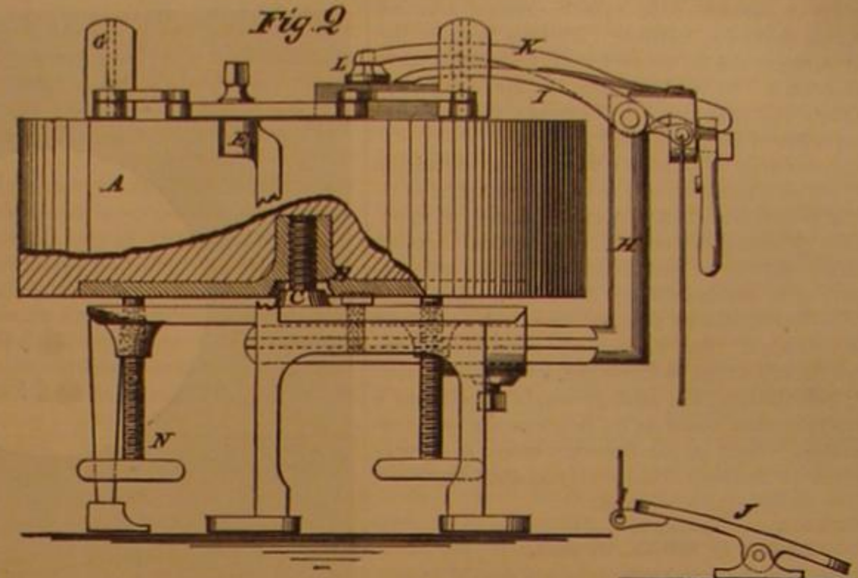
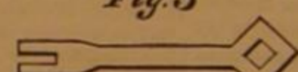


Fig. 3



MANLEY'S SHOE-SCOLLOPING MACHINE.

Sufficient of the mechanism has now been described to enable its working to be understood. In Fig. 2 a button lap is represented resting on the block; several of such portions are intended to be adjusted and cut at once. To this end the bar, M, is turned back out of the way, and the foot, pressing on the treadle' raises the presser, I, as each lap is in turn adjusted in place upon the one beneath it. The presser, it will be observed, in so acting, leaves the hands free to place the pieces as desired. When a sufficient number are adjusted, the pattern is laid on top, and the bar, K, is carried down, jammed, and locked by the lever, O, as described. Then the scollops are cut by a proper tool placed so as to follow the scollops of the pattern.

Fig. 4

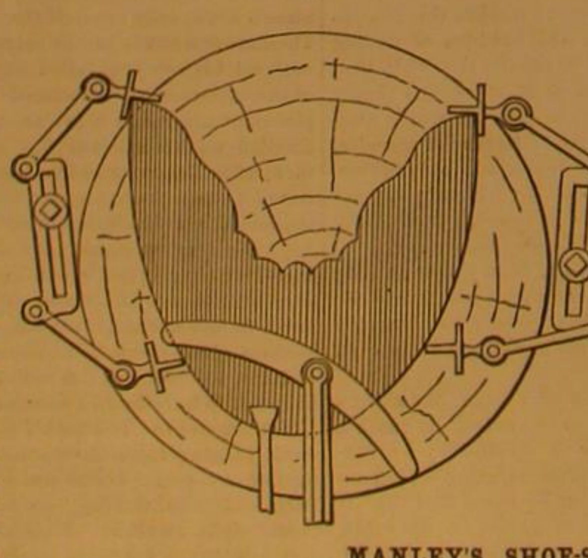
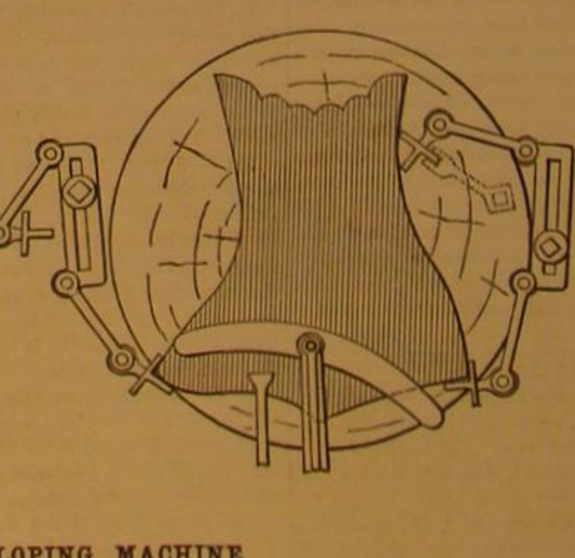


Fig. 5



MANLEY'S SHOE-SCOLLOPING MACHINE.

In course of time the surface of the cutting block becomes injured; but its durability is greatly increased by the fact that it can be turned on its pivot so as constantly to expose fresh surface, and through the adjustability of the parts which hold the pieces, to be cut as already described. When, however, the surface becomes too badly scarred, a thin slice is sawn off, and the block turned upward on its screw pivot, until its hight is such that it fits against guides, etc., as before. In order to steady it, the four set screws are provided. These pass up through the metal base plate and are readily adjusted from beneath.

The object of the set screws which confine the slotted bars, D, is to allow of the adjustment of the guides to suit the different pieces to be scolloped. Thus, in Fig. 2 a button lap is being operated upon, and but two guides are used to hold the corners. In Fig. 4 a vamp is in place; and here all four guides are employed, while the quarter in Fig. 5 requires but three guides. Of course when the guides are once adjusted, they enable a series of objects of like size to be laid on the block, always exactly in the same place Another point to be noted is that the set screws of the bars, D, may be removed by the wrench, Fig. 3, and the bars reversed (as will be seen by comparing the different positions of said bars in the various figures). This admits of accurate and easy adjustments which would be impossible were the bars immovable.

Patent pending through the Scientific American Patent Agency. For further particulars address the inventor, Mr. William Manley, 111¼ North Water street, Rochester, N. Y.

Nothing to Do.

Under the above heading, Anthony's *Photographic Bulletin* counsels studio operators to put their places in order during slack times. The editor's hints are equally appropriate to other professions.

Necessarily there are no idle moments in the photographic studio—no need of yawning and lounging about for want of useful occupation. In every department there is work enough for willing hands to do, rain or shine; and if the "head of the house" is *level*, he will see to it that his subordinates are provided with useful if not at all times particularly agreeable occupation. To say nothing of the requirements of order and neatness in the several work rooms, as well as the reception and sales rooms, there are always little matters of repairing and adjusting, which the operator, closet hand, and printer in hurried moments deferred till "a more convenient season," which season is now, when no orders are pressing, and no sitters in waiting.

Your bath needs cleansing and renewing; your shields are loose-jointed and leaking light; your chemicals need filtration; your camera and lenses require readjustment; your posing chairs are shaky, discolored, and sadly in need of renovation for decency's sake; and numerous other little matters, apparently of trifling consequence, would be all the better for a little, or, if you please, a good deal of, timely attention.

And then the printer's quarters: Is everything in place and there a place for everything—we mean, of course, everything needful? Are the printing frames in working order, the negatives carefully classified—accepted, doubtful, and rejected—and conveniently placed for the duty that awaits them? Are the silver clippings and solutions prudently bagged and bottled, and have you done all that an ingenious and enquiring turn of mind would suggest to make this branch of the photographer's savings' bank a paying success? Finally, have you straightened up things about the rooms with a view to safety as well as neatness, so that the insurance examiner, calling unannounced, would not write you specially hazardous, and charge your employer accordingly?

And now, Miss Blank, of the reception room: are you waiting for a customer, and while waiting have you taken up your embroidery or the last novel, or, what is more likely, a position of rest on your elbows with hands supporting a head not able to comprehend the fitness of things in the duties assigned you? If unable to wield the broom and dust brush, you have, of course, had the service performed, and in the meantime you have brightened up the showcase, arranged in tasty order the specimens therein and thereabouts, and you have not forgotten the disorder in which you or some one else left the cabinet of drawers the other day in looking for a needed mat, passepartout, or frame; and you have looked into the toilet or dressing room, and seen that the mirror reflected the image of a neat and tidy attendant; and then you have carefully looked over the promised work and appointments to know of yourself that they are not to result in disappointment when the specified time arrives; and finally you have carefully surveyed the field over which you hold dominion, and find it not deficient in any of those little attractions and matters of taste which your thoughtful brain and industrious hands could supply. Then you, and the operator, the closet hand, and the printer, are always busy and usefully occupied, and the proprietor, if he is observant and appreciative, as he should be, is happy in the possession of such help.

Swimmer's Cramp.

The loss of body heat in water is now held to be intimately associated with the cramp which so often seizes even able swimmers. Here there is not only a general powerlessness induced, but the spasm of the muscles connected with respiration diminishes the capacity of the thorax, and the cramp-stricken swimmer often disappears immediately without warning, never to appear alive. The buoyancy conferred by the chest being full of air is largely reduced by this diminished thoracic space, and the body at once goes under water. No skill in the art of swimming will secure any one from this risk; and when the water is cool it is well that the swimmers keep near the shore, or at least near each other, so that aid can be readily rendered if required.—*Sanitary Record.*

IF, during a frost, the moles throw up fresh earth, within 48 hours the frost will be gone.

CURIOSITIES OF THE CENTENNIAL.—I.

We have collected a number of the most curious and interesting objects, to be seen at the Centennial Exhibition, in the series of sketches herewith given. These articles, as well as those which will follow in future issues, are mostly unique either in value, handiwork, or historical interest, or as representing some unusual phenomenon or occurrence: and hence are, we think, the features likely to remain uppermost in the mind of the visitor, while the rest of the display may be remembered in its immense entirety. The engraving inscribed

SWEDISH BOILER

represents a steam generator of Bessemer steel, which in itself illustrates the great strength of its material in withstanding effects which might, in an ordinary boiler, easily have determined an explosion. The generator was constructed at the Göteburg Engine Works, in the summer of 1869, and, with a 10 horse power engine, was placed in a small steamer. After a year the vessel returned for repairs. On examining the boiler, it was found that the crown sheet had evidently, through lack of water above it, been rendered red hot, possibly repeatedly. The pressure above had forced the plates in, as shown in the two views given, without injuring them or causing the slightest rupture, thus affording proof of the great strength of construction obtained by flanging the edges of the flue joints as well as of the excellence of the material. The plates were rolled from Fagersta (Sweden) Bessemer ingots. The diameter of the box is 2 feet 3 inches, length about 5 feet. The plates are ⅜ inch in thickness, and the flanges 2 inches in width. There are four depressi ns, the deepest of which is 6 inches, and ½ inches by 1 foot in area. The outline diagram given shows the general construction of the boiler. We also give a sketch of one of the Swedish iron exhibits, a four-stranded rope made of ¾ inch round iron and tied into a complicated knot while cold. No fracture is visible. This is but one of many similar objects displayed to show the excellence of Swedish iron. The famous

$72,000 SILVER INGOT,

exhibited in the Mexican section, looks like a huge cake, smooth and rounded beneath and having an irregular surface above. It was produced from 272 tuns of argentiferous lead, and was cupelled in a German cupelling furnace. It weighs 4,002 lbs., and thus averages 235·4 Mexican ounces to the tun of ore. The cost of production was $1.76 per tun. Its diameter is about 6 feet, and thickness at thickest part nearly 5 inches.

THE BRAZILIAN COTTON PAVILION

and the Rhine wine exhibit, both in Agricultural Hall, are remarkable for tasteful and striking design. The cotton pavilion is a large roofless enclosure having numerous gothic arches. The frame is of light wood, but entirely hidden by masses of pure white cotton which cover every portion. Balls of cotton on stems, to represent flowers, project from the angles, and inside the arches long fragments of the staple hang down in a graceful fringe. At a little distance the structure looks as if made of snow. Inside, arranged upon a pyramidal stand, are glasses filled with samples of fine cotton, and outside are cotton bales and similar packages, tastefully disposed. The Rhine wine exhibit is notable for the four enormous bottles which stand on pedestals at each corner of the platform. They are accurate imitations of the bottle peculiar to the variety of wine displayed, only on a colossal scale. Smaller bottles, perhaps 3 feet in hight (the large ones measure about 10 feet) are placed in huge vases and surrounded by imitation ice. Vines are trailed over the pedestals, and with painted decorations render the exhibit one of the most noticeable in the entire building. Another German exhibitor, a scythe manufacturer, disposes his productions in the form of a tree, so artistically that at first sight the object looks like a leafless pine. The scythes are turned backs up, and placed radially about the trunk. An eagle perched on the apex adds to the illusion.

To agricultural visitors there seems to be no object in the entire Exposition which possesses a greater interest than

DANIEL WEBSTER'S BIG PLOW.

The crowds around this venerable machine are immense; and if it were not for the close watch of the police, the relic hunters would probably carry it off piecemeal. It is a huge affair, 13 feet long, its beam measuring 9 feet 1 inch and its handle 6 feet four inches. The share is 16 inches, and its mold board 20 inches, in width. It was made by the great Webster of colossal brain himself, in 1837; and although rudely constructed and bearing the marks of age in numerous cracks and weather stains, it looks capable of good service yet. That it once did great work we have the famous statesman's own word. In one of his speeches, he says: "When I have hold of the handles of my big plow, with four yoke of oxen to pull it through, and hear the roots crack and see the stumps go under the furrows and out of sight, and observe the clean mellowed surface of the plowed land, I feel more enthusiasm over my achievement than comes from my encounters from public life in Washington." This extract is posted up beside the plow, and we suppose it may be found in a great many more note books than in the 50,000 copies of the present issue of the SCIENTIFIC AMERICAN. We watched one aged and enthusiastic granger study it till he knew it by heart, and then depart, repeating it over to himself, in tones and with gestures doubtless born

SOME REMARKABLE EXHIBITS AT THE CENTENNIAL of a vivid reminiscence of the "Great Expounder's" matchless oratory.

AN INGENIOUS MECHANICAL DEVICE,

whereby the reciprocating of a piston is transformed into rotary motion, and the piston at the same time oscillated on its axis, exists in the Russian valveless engine. As represented in our sketch, there is an arm attached rigidly to the piston rod, and having on its end a ball which enters a socket near the periphery of a disk. The latter answers for a flywheel, and is rotated by the arm as the piston rod reciprocates, while the rod itself is vibrated. The effect of oscillating the piston is to open and close the steam valve passages suitably arranged therein.

We have hitherto labored under the idea that in ingenious combinations of furniture our American inventors excelled the rest of mankind. But now we doubt it. There is an exhibitor from the Argentine Republic from whom our inventors may take lessons. He contrives to stow more utterly diverse articles into a smaller space than any one we ever saw; his furniture is at once a puzzle and succession of surprises. No drawing would do justice to the principal object which he displays. It is a dressing case which contains everything in the housekeeping line, from a coal cellar up. There are places for utensils, for blacking boxes, for cigars, hair brushes, garments, gas stoves, provisions; and the rest a New York *Herald* exploring expedition might profitably be fitted out to discover. If there is a cradle and baby tender also combined, and we dare say there is, the young housekeeper needs nothing more to complete her *ménage*. For people who have no fixed abode, but who "live in trunks," this South American inventor provides a less complicated but none the less ingenious combination, which is depicted in our sketch. To begin with, there is a trunk about as large as the average "Saratoga," presenting nothing remarkable in aspect except an exterior strength calculated to defy the most persistent baggage smasher. You seize the top, throw it over sideways in two portions, lift up and open out the back part, and behold the trunk is a comfortable lounge. Where are the garments? In the drawers under the seat, which the fall of a false front piece reveals. Is a table needed? A flap hung to the back is raised and firmly supported by props. One arm may be developed into a writing case with all the appurtenances, the other into a dressing box containing all the toilet articles. The empty spaces in the lid are to be utilized. Step around to the rear, pull on a couple of knobs, and there are two small tables set with plates, knives, forks, tumblers, napkins, and all the *et ceteras*. That trunk is an exposition by itself.

THE CALIFORNIA MAMMOTH GRAPE VINE

is exhibited in Agricultural Hall, and is probably the largest vine in the world. It has produced yearly 12,000 pounds of the variety known in California as the Mission grape. It was planted by Doña Maria Marcelina de Dominguez, according to the custom of the country, at the birth of a child, some sixty years ago. For several years it has shown signs of decay, and was dug up, sectionized, and boxed for removal to the Exposition. There the sections are bolted together, and the vine is set up as nearly as possible in its natural position. It is, of course, very irregular in shape, so that no definite dimensions can be given. The size of the trunk can, however, be estimated from that of the figure represented beside it.

Correspondence.

Boiler Explosions.

To the Editor of the Scientific American:

In the last number of the SCIENTIFIC AMERICAN I read your notice of a disastrous boiler explosion at Pittsburgh, Pa., in which you state that "no cause is yet assigned for the casualty," and that "the boilers were inspected some five weeks ago, and were then in good condition." There has been much argument on the subject of boiler explosions; and from an everyday experience of nearly forty years in the construction and management of steam boilers of various kinds, I will venture to give you my opinion on the subject, although I shall differ from many.

In the first place, I think there is one, and only one, cause of boiler explosions, and that is the want of a sufficient quantity of water. But a boiler may be burst from many causes. You will see here that I draw a distinction between the explosion and the bursting of a boiler. An explosion is an expansion with great force, followed by a violent report, and a burst is simply a liberation from confinement, without the great force and violent report of the explosion. Bursting may result from various causes, such as a weak or defective boiler, an over pressure of steam, or water, or air, as the case may be. A boiler may be made defective in several ways. First, by letting dirt and sediment collect on the bottom of the boiler, which is directly over the fire. Boilers can be and are very frequently burnt entirely through in this way. Second, by using inferior qualities of iron in the construction. Third, by poor riveting. Fourth, by injury in testing, by subjecting the boiler to more pressure than the iron is capable of bearing. Fifth, by freezing. Sixth, by the present ruinous practice of blowing the water out of the boiler under a pressure of steam, and while the fire box or bridge wall is still hot. The consequences of this practice are cracked sheets, broken rivets, grooving, etc. Moreover the dirt and sediment dry and adhere firmly to the iron, and form a crust or scale; while if the water was drawn off cold, the sediment would be soft, and the most of it would be drawn off with the water, or at least could be washed off.

A boiler may be burst either by steam pressure or hydrostatic pressure, and the destruction of property be the same; but of course life would be endangered by scalding water and steam. The bursting of a boiler makes little or no report, no more than the opening of a safety valve or a blowing-off valve. But a boiler is seldom allowed to burst, as timely notice is usually given by the leakage of steam and water from the defective part. Not so with an explosion. This agent of destruction never seeks the weak places of a boiler; and the strength and thickness of a boiler has nothing whatever to do with its explosion. In fact the stronger a boiler, the more terrific the explosion, and the more disastrous will be the effects. And as far as boiler inspectors are concerned, they can pronounce a boiler good or bad, and determine its liability to burst, but that can do no good in preventing its explosion. That depends wholly on those having it in charge.

Boiler manufacturers are often and unjustly blamed for the explosion of a boiler which, I repeat, can only occur from the want of a sufficient quantity of water, caused by the carelessness or inexperience of those in charge of it. If employers were more careful to secure competent engineers, there would be fewer explosions. There need be none.

L. B. DAVIES.

[For the Scientific American.]

THE MERITS AND DEMERITS OF LINNÆUS.

To the great Swedish naturalist Linnæus, who was born in the year 1707, belongs the honor of having first originated a system of classification of the vegetable and animal kingdoms, which system (although Linnæus himself remained perfectly orthodox, believing in the theory of special creations) contained in itself the germ of the evolution doctrine, now grown to such mighty proportions. In regard to the account of the creation given in the book of Genesis, we must (with Haeckel) acknowledge that it reveals two grand fundamental ideas, namely, differentiation and progressive development of the matter "created" "in the beginning." Together these form a grand conception, perhaps, far more important to the truth of the narrative than the now ascertained error of considering this little earth as the center of the Universe, around which sun and stars revolve. This error was confuted by Copernicus, Galileo, and their successors. Another important change in the popular ideas of creation, namely with regard to the position of man in the whole scheme, has been effected by Lamarck, Darwin, and others. It is strange that theologians should so frequently, as they do, content themselves with asserting the literal accuracy of so ancient a book as the Bible, which has suffered severely by the course of tradition and the vagaries of translators, in place of confining themselves to the grand moral lessons and the pure religious principles it inculcates. The Bible is not a text book of natural science, nor has it ever pretended to be one.

The great progressive step made by Linnæus was as simple as it was rich in results. It was the designation of each plant and animal by two names. The first, the genus, was given to each family of plants or animals; while the second, the species, gave greater definition and more individuality to each single plant or animal. Thus, for instance, he included all animals resembling the tiger, whether large or small, under the genus *felis*, and he used the name for the whole class; and he added a second name for the species to which the animal belonged. Thus, he called the common tiger *felis tigris*, the lion *felis leo*, the panther *felis pardus*, the jaguar *felis onca*, the wildcat *felis catus*, and the house cat *felis domestica*. This method was perhaps suggested to him by the custom in society of having family names and baptismal names, by which members of the same family may be distinguished. Before the time of Linnæus, the different names of the individual plants and animals formed a perfect chaos; but the dual nomenclature not only necessitated a classification, but became its basis. The two names soon proved the value of the system, as by them attention was drawn to the similarity and relationship between the various plants or animals. Linnæus in fact attempted to complete the whole system, and divided, for instance, the whole vegetable kingdom into 24 classes, which he subdivided into orders, these into genera, and these again into species. He divided the animal kingdom into 6 classes, which were again subdivided into many orders, genera, and species. Notwithstanding that his classification has been modified, and has been based on facts since ascertained to be more fundamental than those on which he grounded his theory, the honor of the reform belongs to him: although he was often in doubt, especially whether some particular animal had to be considered as a separate species, or only as a variety of the same species. He even went so far as to admit that hybrids may constitute the origin of new species, and even that a great number of new species had originated by the interbreeding of other species. This opinion was very remarkable as that of a man who had already accepted the theory of the miraculous creation of every species; and it would have been in direct contradiction to his creed, were it not that he had claimed as an exception to the rule that some species were originated by hybridism or incidental changes: and all that Lamarck and Darwin did was to extend Linnæus' exceptional theory to the origin to all species whatsoever.

In regard to the origin of the distinct species, Linnæus, as before remarked, believed in special acts of miraculous creation, and adhered strictly to the Mosaic account, according to which plants and animals were created by God, "each after its own kind." Linnæus expanded the idea, and went into details, expressing the belief that, originally, either a single individual or a pair of each animal or plant had been created. He believed that "man and wife created He them" of every species which exists in two sexes; however, in those cases where every individual is possessed of both sexual organs, as is the case with many kinds of snails, worms, parasites, and the majority of plants, Linnæus believed that God created only one individual, as this was sufficient. Linnæus further believed that, in the deluge, all the then existing organisms were drowned, except the few individuals of the various species which were saved in Noah's ark, and afterwards put ashore on Mount Ararat. The geographical difficulty of widely differing animals and plants living together when put ashore, he explained by the fact that Ararat, in Armenia, is situated in a warm climate; and being more than 16,000 feet high, it unites in itself all the conditions for affording diversity of climate to suit animals of different zones. The animals accustomed to the climate of the polar regions, such as polar bears, could therefore at once ascend to the cold snow-covered summits; those accustomed to a warm climate could go to the foot; while the inhabitants of the temperate region could remain where they were, half way up. From this mountain, he asserted, the animals distributed themselves afterward again over the whole earth.

Haeckel makes a serious objection to the possibility of existence of a single pair of animals of each kind at the same time. He says that, for the first few days after the creation or after the deluge, the carnivorous animals would have eaten all the herbivorous cattle, the lions and tigers would have eaten the single pairs of sheep and goats in existence; while the herbivorous animals would have eaten as once all the single plants before there was a chance of propagation. Certain it is that the balance in the economy of Nature, such as we see it now, could never have existed if only one single pair of each species had been created at the same time. It is seen, then, that the hypothesis of Linnæus is scarcely worth a serious discussion; and when we consider that he had a clear head and excellent reasoning powers, it is indeed very doubtful if he could believe in it himself.

This hypothesis prevailed, however, for about a century without being disputed; and this was perhaps partially due to the merits of Linnæus as a naturalist, and the great renown he had earned by his systematic description of the works of Nature. This, added to the prevailing idea of considering the Bible to be intended to teach the sciences, retarded the acceptance of sound and correct ideas concerning the institution of the Universe.

In closing this review of the merits and errors of Linnæus, we cannot abstain from expressing our surprise that Professor Huxley, in his recent lectures in this city, selected Milton in place of Linnæus as the defender of the six day miraculous creation. Milton should be considered by every one as drawing on his imagination, and availing himself of poetical license to the fullest extent. He was no scientist, but a poet; and he should on this account not be held responsible for his *quasi* scientific opinions. But Linnæus was a scientist, and his opinions, hypotheses, and theories fall within the pale of scientific criticism: and he was especially scientifically definite in all he said and wrote. If Professor Huxley selected the poet because everybody knows Milton and his works, we may suggest that some information about the great naturalist Linnæus and his services to Science would have served the purpose, of bringing out the truth of the evolution theory, far better than the beautiful poetical dreams of "Paradise Lost."

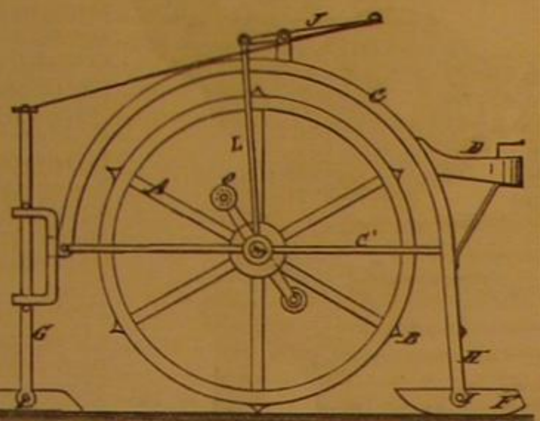
P. H. VANDER WEYDE.

The Thirty-Eight Ton Gun.

For some little time past a substantial target has been in course of erection on the experimental grounds at Shoeburyness, England. The object of this structure was to ascertain the measure of power of the 38-ton 12½-inch gun at the muzzle. This object was satisfactorily accomplished on Wednesday afternoon in the presence of a large number of officials connected with the War Department, besides officers of both branches of the service. The target was composed of three plates of John Brown and Company's make, each plate being 10 feet wide, 8 feet high, and 6½ inches thick. Between the plates were 5 inches of teak packing, bringing the total thickness of the target to 20½ inches. The plates were bolted together in couples, the first to the second and the second to the third, with sixteen 3 inch Palliser bolts. The target was supported in the rear by horizontal and vertical bracing formed of 14 inch square timbers with raking struts abutting upon piles of the same scantling, the latter being stayed against an old target. At the side of the target were placed some old 6 inch armor plates on end strutted with timber, and on the top were some old 8 inch plates tied back to the target with old railway bars. A trial shot was first fired at an old 10 inch armor plate with a charge of 130 lbs. of 1·5 inch cube powder and an 800 lbs. Palliser shell made up to weight with sand. The shell struck the plate with a velocity of 1,436 feet per second, punched a clean hole through it, snapped short a 14 inch pile a couple of feet behind it, and broke up against an old target. The round against the new target was fired with a similar charge to the foregoing, the range being, as before, 70 yards. The shot, which had a striking velocity of 1,421 feet per second, punched a clean hole 13 inches by 12½ inches in the front plates, and passed through the middle into the rear plate, where it broke up. The base of the shot with a portion of the walls was left in the hole, but the point, with 9 inches of solid metal, struck against the rear target some 10 feet off, and rebounded to a distance of 20 feet to the right proper of the target. The rear plate was considerably buckled, but the iron around the shot hole was not cracked or started, the metal showing a fibrous fracture bespeaking its high quality. The timbers were considerably started, a pile next the target in the rear to the left proper being sheared clean off. In fact the proper side of the target was thrown back about 7 inches, and, of course, it generally suffered severely. The results as regard penetration were such as had been anticipated by the Heavy Gun Committee, so that practice here has satisfactorily confirmed theory, and has afforded data of considerable value to the authorities.—*Engineering.*

NEW ICE VELOCIPEDE.

In the annexed illustration is represented a novel ice velocipede, invented by Messrs. Juan Arnao and Juan Arnao, Jr., of Brooklyn, N. Y., and patented through the Scientific American Patent Agency. A represents a drive wheel, having points, B, on its periphery, and arranged on a shaft that



is journaled in two longitudinal springs. C is the frame, and D a seat located on its rear so that the rider may conveniently operate the foot cranks, O. H are rear bifurcations of the frame, to whose lower ends are pivoted the runners, F; while G is an independent standard, swiveled in the front of the frame, and connected, by cross pieces and cords, with the front end of a lever, J. This enables the rider to guide his velocipede with great facility. The lever, J, is pivoted to a stud on top of the frame, so as to bring its power end near the driver, and is connected at the other end, by pivoted rods, L, with the drive shaft. By this arrangement the driver can readily lift the wheel from the ground at any time, and the runners are enabled to pass over small obstructions on the ice.

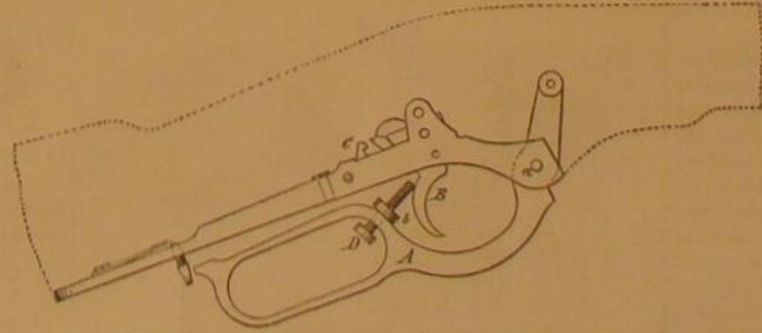
A Solar Distillery.

M. Mouchot, whose steam boiler, heated by the sun's rays concentrated by a concave mirror, we described not long ago, recently exhibited to the French Academy of Sciences a new apparatus whereby by solar heat he distilled excellent brandy. The mirror was but 19·5 inches in diameter. A little over a quart of wine was placed in the boiler, and brought to boiling for 15 minutes by the concentrated rays. The alcoholic vapor entered a tube placed in the center of the boiler, traversed the supporting foot of the mirror, and descended into a room, where it condensed. The liquor was of remarkably good flavor, free from the disagreeable taste of alcohol peculiar to that obtained from wine in the usual way, and savoring strongly of the best cherry brandy.

M. Mouchot afterward placed flowers and odoriferous leaves in his boiler, and made a variety of perfumes and essences. Finally leading the steam into a cooking apparatus, he prepared an entiredinner by the agency of the sun's heat.

NEW METHOD OF SETTING HAIR TRIGGERS OF RIFLES.

This is a timely invention, which will interest riflemen and the many amateurs who are engaged in the laudable effort of attempting to rival the famous scores mde by the international teams at Creedmoor recently. The usual manner of setting the set trigger is to throw the trigger, B, in the engraving, forward with the thumb. This operation requires both time and some exertion, and the present device is intended to obviate the difficulties. Referring to the engraving, which is a side elevation, A is a finger lever, which is pivoted to the lock at *a*, in the usual manner. B is the trigger, and C the set trigger D is a milled head screw, which runs through the finger lever to a point near the trigger, and is capable of moving the trigger sufficiently to set the set trigger, C, when the finger lever, A, is moved either away from or toward the rifle stock. *b* is a jam nut placed on the screw, D, that bears on the finger lever, A, to prevent the screw from turning when once adjusted. The rifle can then be discharged with greater rapidity and with less exertion.



LEONARD'S METHOD OF SETTING HAIR TRIGGERS OF RIFLES.

The device was patented through the Scientific American Patent Agency, September 5, 1876, by Mr. George O. Leonard, of Red Bluff, Cal.

What a Patent Agent Ought to Be.

A patent agent ought to be careful and honest, because he is the repository of his clients' secrets. No class of property is more highly valued by its possessors than that which derives its origin from invention. No matter how trifling the idea may be, the person who conceives it is apt to place a much higher estimate upon its value than others, and he is therefore jealous of its possession. This jealousy is excusable, however, on account of the fragile nature of the tenure by which he holds possession, and because his title cannot be permanently established until the patent is actually allowed and issued. An improper exposure or unwise placing of confidence in a third party by the inventor or his confidents is liable to, and often has, cost the inventor not only time and money to obtain his rights, but has entailed the entire loss of his invention.

It is therefore necessary that the patent agent should not only have the confidence of the inventor, but that he should carefully guard the interest of his client and see that no injudicious exposure or explanation is made that parties liable to create trouble can get hold of. The utmost confidence ought to be maintained between an inventor and his attorney or agent.

A patent agent ought to be patient. Inventors are proverbially tedious. They like to talk about their inventions especially to the person whom they have employed to prepare their patent papers and attend to prosecuting their applications. This is also excusable, because it relieves the mental pressure. It is the inventor's safety valve. Fear of exposing his secret to others compels him to keep it locked up in his brain; and there it lies, unfolding itself, expanding in value and importance and permeating every tissue of the human anatomy until the accumulated pressure is relieved by a distribution of the burden with a confidant, and the patent agent is usually that confidant.

The agent should patiently listen, for the talk of an inventor is valuable to him. It gives him the inventor's peculiar ideas; and if he is a student of human nature, it enables him to frame the case so that the inventor will be satisfied with it in every particular.

The patent agent should be accommodating. Inventors are often whimsical; the very nature of their undertaking is apt to lead them to peculiar theories and incorrect conclusions, although the general result of their theories and conclusions may be correct. These theories the agent must not combat, unless they are vital and enter into the essence of the case. He had better let their possessor retain them than incur his distrust and possible enmity by opposing them. The inventor will find his errors when he comes to enter upon the actual and practical field of operation.

The patent agent must be familiar with the law of patents; otherwise how can he guard the vulnerable points of the invention? Every specification must be prepared with a view to its having to pass at some time or other through the ordeal of a judicial examination, and a judgment as to its validity and scope; and unless the person who prepares the specification fulfills the legal requirements, and in a legal manner sets forth the description and claims, the patent will not stand.

No general knowledge which he may possess will make up for the want of legal knowledge; this want is the one thing that may defeat the end sought, and the knowledge must be properly possessed and properly employed.

The patent agent must be a mechanic, theoretical, at least. In this particular, a patent agent must be qualified by nature, and not by education, although education is necessary to enable him to dress his mechanical points in proper language and render his points plain, certain, and intelligible. Technical knowledge of each particular art, trade, or profession is not required, but a general knowledge of the various steps and requirements is necessary. A person who possesses the inventive faculty, if otherwise qualified, makes the best patent solicitor; he can then see each invention through the same medium and in the same light that the inventor himself sees it; he can pick out and embody the small mechanical points that form the real safeguards of a patent, and thus more absolutely prepare the case for the scrutiny of judicial investigation and the criticism of mechanical experts.

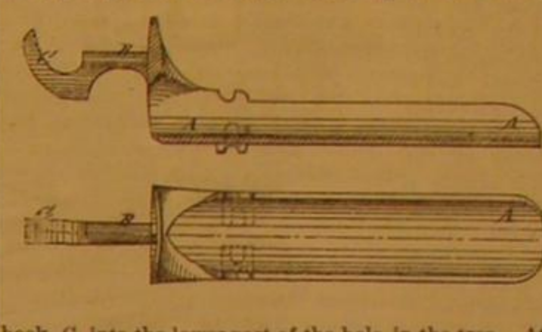
Few men possess all of these qualities, therefore we might say that few men are competent to serve as patent solicitors. The want of proper qualifications in patent agents is the cause of so many worthless patents being issued from the Patent Office. The inventor must absolutely depend upon the preparation of his case for his security and defense, and it therefore behooves him to examine into the character and qualifications of the person in whose hands he places his invention and secret.

The safest and best guide for inventors who require the services of a patent agent is to choose those who have been long in the business and who have acquired a settled reputation for integrity and capacity. Mushroom patent agents exist everywhere. They employ the most specious means to entrap the uninformed inventor, but their services are an actual damage nine times out of ten. It is a hundredfold cheaper to pay a competent attorney or agent a fair fee than to accept the services of such men for nothing.—*Mining and Scientific Press.*

TO PURIFY glycerin, add 10 lbs. iron filings to every 100 lbs. glycerin. In a few weeks all impurities will lay at the bottom.

IMPROVED SAP SPOUT.

Mr. Hiram A. Lawrence, of West Shefford, Quebec, Canada, has patented through the Scientific American Patent Agency, September 12, 1876, an improved sap spout, which may be applied to the tree without pounding, and, consequently, without injuring the bark: which will prevent leakage, cannot be forced out by the sap freezing in the hole, and which cannot be drawn out or loosened by suspending a bucket from it. The body of the spout, which is of iron, is made in the form of a half tube. At the base the sides of the spout are extended up to meet above the cavity, as shown in the engraving. The hole in the tree is made of such a size that the stem, B C, can be inserted in it by raising the outer end of the spout. When the stem has been pushed so far into the hole that the upper part of the base of the spout strikes against the bark of the tree, the outer end of the spout, A, is then pressed downward. This forces the transverse edge of the end of the hook, C, into the upper part and the longitudinal edge of the base of the



hook, C, into the lower part of the hole in the tree. At the same time, the edge upon the base is forced into the bark of the tree around the lower part and sides of the hole, so that there can be no leakage.

Solvent for Rubber.

This new solvent consists of a mixture of methylated ether and petroleum spirit—the common benzolene used for burning in sponge lamps. This forms the most rapid and, perhaps, the best solvent we have tried; the mixture is as much superior in power to either of its constituents singly as the ether-alcohol is to plain ether in its action on pyroxylin. We make a very thick solution by dissolving sixty grains of good india rubber in two ounces of benzoline and one ounce of sulphuric ether. If the india rubber be cut up fine and the mixture shaken occasionally, the solution will be complete in two or three hours, when it may be diluted to any required strength with benzoline alone. The india rubber should be as light colored as possible, and all the outer oxidized portions must be cut away. Shred the clean india rubber with a pair of scissors, and throw it at once into the solvent.—*British Journal of Photography.*

Wood Pulp.

Many substitutes for cotton wool have been proposed for the making of pyroxylin, such as linen rags, sawdust, flax, paper, etc., the last-named material alone being the only one used practically, though it is by no means certain that sawdust might not supply a good pyroxylin with organic reactions for special purposes. But the most promising material of all is offered in cellulose prepared from wood, which is now made for the paper manufacturers in very large quantities. The mechanical wood tissue obtained by grinding wood does not answer their purpose at all; but the cellulose prepared by chemical means is a substance whose qualities render it suitable for the manufacture of the highest quality of paper. So far back as 1868, a company made paper from this material alone, without the addition of rags. Three years afterwards five large mills were started (by an English company) in Sweden; and in Germany, at the present time, there are six factories in which the same process is carried out. It is somewhat as follows: The wood of pine and fir trees (oak is of no use whatever) is cut into small pieces a little less than an inch long by half an inch wide and a third of an inch thick, which are then comminuted by passing them into a machine very like a large coffee mill. It is then boiled, under a pressure of ten atmospheres, in a solution of caustic soda for about four hours. The residue is well washed, bleached, pressed, and lastly dried and cut up into sizes suitable for packing. It is also sent out unbleached, in which form it is used for a variety of purposes, besides making brown paper. This is the form we should be inclined to think would be most suitable for the manufacture of pyroxylin. The greatest demand hitherto has been in Germany and Austria, the former country producing, it is estimated, 250,000 tuns of paper a year, and Austria about 100,000 tuns. If only one fifth part of this be made with cellulose, that would mean 70,000 tuns of this material, which would require 280,000 tuns of wood for its production.

REMOVING SUBSTANCES FROM THE EAR.—Take a horsehair, about six inches long, and double it so as to make a loop at one end. Introduce this loop as deeply as possible into the auditory canal, and twist it gent y around. After one or two turns, according to the originator of the plan, the foreign body is drawn out with the loop. The method is ingenious, and at all events causes little pain, and can do no harm.—*Medical Record.*

THE Amazon river drains 2,500,000 square miles of land, and is navigable for 2,200 miles from its mouth.

IMPROVED TWIST DRILL AND TOOL-GRINDING MACHINE.

Great difficulty has always been encountered in grinding threading tools to an accurate angle and center. The same is true of drills, and, in fact, of any tools whose edges are made up of straight lines, in which symmetry of shape is a necessity, in order that they may produce true and correct work. Makers of taps, among others, meeting this difficulty, have been obliged to try many devices to obviate it, and often, to obtain uniformity, employ rotary cutters or other and hitherto ineffectual substitutes; but as a rule most machinists rely on their manipulative skill and accuracy of eye to grind their implements to exact shape.

The new machine, which is illustrated herewith, is another instance of that tendency, which is everywhere manifest, to substitute the absolute certainty of mechanism for the doubtful results depending on the judgment; and it is so constructed that the correct grinding of the tool is simply a matter of easy adjustment. Tools may be ground to any given angle, from zero to ninety degrees; any desired clearance may be given to them, and the grinding is done in an improved manner by using a wheel which has an annular recess in each of its sides. This allows the edge of the implement to pass entirely across the grinding face on the side of the wheel, and thus be made perfectly straight and flat, instead of concave, as must be the case when the periphery of the wheel constitutes the abrading surface.

Fig. 1.

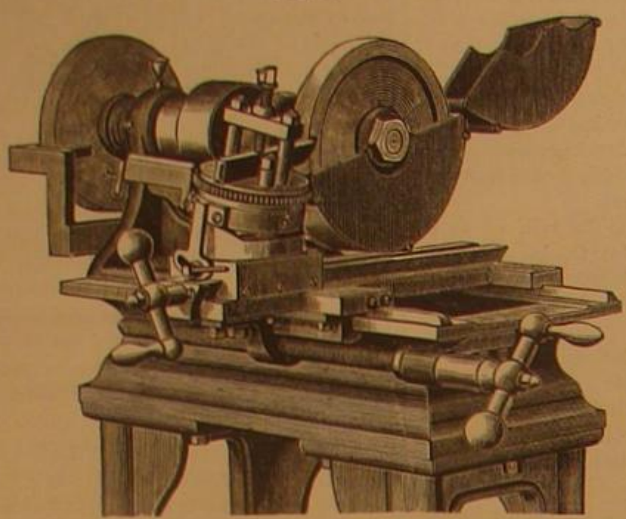
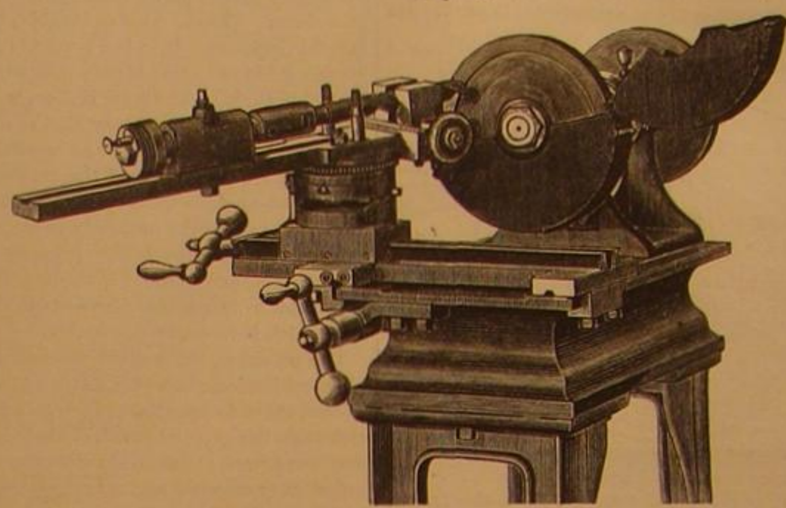


Fig. 2.



FAY'S TWIST DRILL AND TOOL-GRINDING MACHINE.

Fig. 1 represents the machine in use, grinding tools. The tool is fastened to the top of a circular graduated and pivoted tool block, and held the same as when in use in the lathe or planer, being adjusted by the index on the edge of the block to any desired angle and clearance with the grinding face of the wheel; and when brought in contact with and passed across the wheel by means of feed screws, the edge is made perfect. Then (without unfastening the tool) passing it to the other side of the wheel by means of the feed screws, the operation is repeated. This machine has a steel spindle, with adjustable taper bearings, of gun metal. A wheel for general use can be mounted on the other end of the spindle as shown. The machine is furnished with patent corundum wheels, which are made specially for tool grinding, and which will do the work rapidly and effectually without drawing the temper. Fig. 2 shows a drill-grinding attachment, by means of which twist drills or flat drills may be ground with accuracy. The shank of the drill is held in a socket, the same as when in use. The point is held in jaws adjusted with right and left hand screw. By means of the graduated and pivoted tool block, the point of the drill may be placed at any angle and clearance with the grinding face of the wheel and ground the same as a tool, using only one side of the wheel. After grinding one lip, it is turned exactly half round by means of an index on the end of the spindle holding the drill, and the other lip is ground. Then, by passing the point just inside the grinding face and drawing out the index pin, and turning the spindle forward, clearance is given to the back corner without making the edge too thin, and the drill is put in the best condition for use. Twist or flat drills, of any length or size up to two inches, can be ground on the machine.

This machine has been patented by John P. Fay, of Worcester, Mass., and when exhibited at the American Institute Fair of 1874 received their silver medal and commendatory report, as "the first completely successful machine for the purpose." It has also received the same notice at the Centennial Exposition, where it has been on exhibition. It is being rapidly introduced in some of the largest and best shops in the country. For further particulars, address the makers, the Wood and Light Machine Company, Worcester, Mass.

IMPROVED COMBINATION DESK AND BOOK CASE.

We live in an age of condensation, and combination furniture accords with the spirit of the times. Hence inventors of the same find a ready sale for their productions, and make money. At the present Fair of the American Institute, there is a table which transforms itself into a bed, a bed which turns into a bureau, a combined washstand, wardrobe, and dressing case, a mixed blacking box and shaving case, sofa beds uncounted, and so on through a long category of articles, which are always surrounded by a curious crowd. The exhibitors tell us that such inventions pay excellently, and point to the fact that large numbers of regular furniture dealers are now keeping the newest combined appliances in stock, in response to popular demand. On Broadway there are two or three stores, in the large windows of which active individuals constantly display iron chairs, which can be adjusted to form lounges or to suit any position of the body. The throng of gazers renders the sidewalk almost impassable; and if we may judge from the rapid extension of the proprietor's business from one store to several, scattered about the city, his device also has paid. The invention illustrated in Figs. 1 and 2 of the annexed engravings offers a still more striking instance. It is a combined writing desk and book case, adapted to the uses of offices, libraries, hotels, etc., and was patented September 7, 1875. The inventor has exhibited it at local fairs and has displayed it at the Centennial in a very prominent locality. The result is that a number of clerks are employed to show the article, explain its operation, and to fill orders. The desk is an excellent article of furniture, handsomely designed, as our engravings show, and combining improvements in the shape of an ingenious inkstand and paper file, which are the subjects of separate patents, and which are illustrated more fully in Figs. 3 and 4. All were devised by the same inventor, who "didn't know he was inventing," but merely wanted some conveniences of the kind to answer his own requirements, and exercised his ingenuity to make them.

Fig. 1.

This suggests the idea that a process of self examination by every one, to determine whether or not he is an inventor, might result to the profit of a great many people. The probabilities are strongly in favor of any original idea, which will prove lucrative, as in this case, however trivial the invention may seem at first. But to return to the desk

Fig. 2

It is constructed double or single. In the one case it has desk, book shelf, and other conveniences below enumerated, on both sides, and is intended to stand in the center of the room, occupying an area of only 6 x 2 feet; in the other, the conveniences are on one side, occupying even less space, and it may be placed against a wall of the room. The floor space occupied is then but 15 inches in depth.

In Fig. 1 the desk is represented opened, in Fig. 2 closed. The various portions will be understood from Fig. 1. At A are hinged frames, whereon are mounted brackets to receive paper files of the pattern shown in Fig. 4. These files consist of a bent tin back, in which are a number of wires, the ends slipping into sockets at one extremity, and being secured by a locking hinged cap at the other. Newspapers are held by passing the wires through them and then fastening the latter in place, as already described. In the book case, B, a secretary, C, is provided. The folding desk, D, is hinged and supported as shown, and provided with a swinging inkstand, which always remains perpendicular without regard to the position of the leaf. The inkstand is hung on gimbals, and is protected by a cap when the leaf is closed. A similar arrangement of swinging ink wells, designed for use on shipboard, is represented in Fig. 3. In order to afford greater writing facilities, sliding desks, which may be drawn out when desired, are provided at E, and beneath, at F, there is a case of drawers. Into the receptacle at G, waste paper may be placed, and at H, attached to the doors, there are boxes for letters and newspapers for the mail, and in rear, in the body of the desk, are alphabetic pigeon holes for filing printed documents, etc. A set of ingeniously contrived secret drawers are provided, the location of which we leave the reader to determine if he can.

Fig. 3

Fig. 4

The desk received a medal at the American Institute Fair of 1875, and the Centennial judges have awarded it an excellent report. Further particulars may be had by addressing the inventor and manufacturer, E. W. Stiles, 1,020 Arch street, Philadelphia, Pa.

Sulphur Tamping.

Sulphur tamping for iron in stonework ought never to have been substituted for lead tamping, since the presence of the least moisture between the surfaces of the iron and sulphur sets up chemical action, and, in a few years, the sulphur has been converted into a true hydrated sulphide of iron. During this conversion, the tamping swells greatly, and is either forced out of its place, and consequently its utility destroyed, or else it cracks the stone in lines radiating from the tamping, if this is used in a single spot; or, if there is a row of holes so tamped, the stone will be cracked longitudinally. To be sure, it may take fifteen or twenty years to actually break the stone apart; but in that time granite stones measuring eighteen inches by eighteen inches by nine inches have been so broken.

A CORRESPONDENT, writing from Japan, says that one of the practical results of Japanese traffic with this country is the extensive introduction into Japan of kerosene lamps and gas works, which the natives are commencing to manufacture themselves.

A MUSEUM OF BRITISH BIRDS.

Brighton, the Londoner's favorite seaside resort, has not only the largest and most complete aquarium which has yet been built, but also many other galleries of art, science and literature. Among these is a museum containing specimens of nearly all the birds native to the British Isles. The collection is the property of Mr. Booth; and the labor and expenditure must have been very large before so complete a collection was obtained. We select from the London *Graphic* four admirable engravings of subjects selected from Mr. Booth's Museum, the first of which shows a pair of those wonderfully wild and shy birds the herons, the European variety of which has furnished from time immemorial the game of the falconer. It will be seen that the neck is long and flexible, and the bill large, strong, and pointed; so that when the bird stands in a swamp or pool (as its habit is), with the long neck drawn down between the shoulders, the bill can instantly be darted forth and the passing reptiles or fish seized and swallowed.

The European heron (*ardea cinerea*) is of a bluish ash color, with a black crest on the hind head, the fore part of the neck being white with black dots. Its size and strength make it a noble quarry for the trained hawk, whose employment for sport is still practised in some parts of England. The falconer carries a square wooden frame suspended around him by straps over his shoulders. On this frame are perched the hawks, their heads being covered completely with leathern hoods, the caps of which, covering the eyes, can be raised. When a heron appears in sight, on the wing, the falconer raises the cap from a hawk, who is instantly on the alert, turning his brilliant eyes in every direction in search of a victim; the falconer then takes the bird on his hand and lets him go. The hawk flies with lightning speed toward the heron; and a struggle between the courage and skill of the one and the weight and strength of the other takes place, ending sooner or later in the death of the heron.

The peregrine falcons, shown in our second engraving, have been much used for the sport of hawking, as they are capable of being tamed without losing any of their power and courage; and when the battle is ended, they return to the falconer to receive the prize of victory. They are exceedingly handsome birds, the eyes being large and keen; the plumage is very compact, the head and neck in the adult male being grayish black tinged with blue, the rest of the upper parts being of a dark bluish gray with indistinct brown bars; the throat and front of the neck are white, and a broad triangular mark of blackish blue extends downward on the white of the cheeks from the corners of the mouth. The American bird most resembling the peregrine falcon is the duck hawk (*falco anatum*, Bonaparte).

The three owls shown in our third illustration are of the barn variety common in England. The tribe is known to science as *strix flammea* (Linnæus); it is somewhat smaller than the American barn owl, and is lighter colored, the breast being white. The singular look of wisdom of the whole owl family is well shown in the deep set eyes and the solemn, taciturn expression of countenance in this variety; and their zealous hunting after mice and small birds makes them useful in the barn and granary.

Our fourth engraving shows a family of kestrels, birds to which our sparrowhawks are very similar. The kestrel is about 14 inches long, with an extent of wing of 28 inches; the general color in the male is light grayish blue, the back and wing coverts being pale red with triangular dark spots. In the female, the upper parts are light red, with transverse dark bars and spots; the young of both sexes resemble the female. The kestrel hovers at a hight of about 40 feet above the ground, and pounces suddenly on small birds, mice, or reptiles, the numbers of field mice which it destroys being enormous. When not in search of prey it flies high, and is silent; in the breeding season, however, it becomes vociferous.

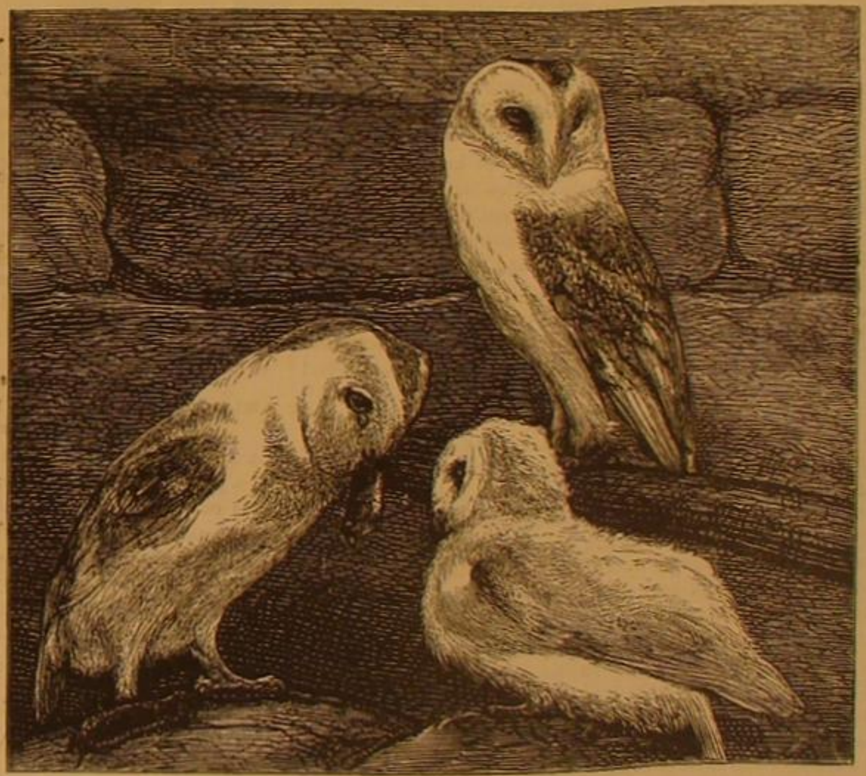
Alcoholic Solution of Shellac.

The production of a clear solution of shellac has been the subject of numerous experiments, but hitherto none has turned out satisfactorily except slow filtration. As is known, by digestion of one part of shellac with six or seven parts 70 per cent of alcohol, a solution is obtained which, when warm, is almost clear, but upon cooling becomes turbid, and is only partially clear after standing a week. The plan of pouring sufficient alcohol over coarsely powdered shellac to form a thin paste yields, upon the addition of more alcohol after the lapse of eight or ten hours, a liquor that does not deposit any more, but which is not clear. Another method suggested, of boiling the alcoholic shellac solution with animal charcoal, gives a clearer liquid, but there is always loss through absorption by the animal charcoal.

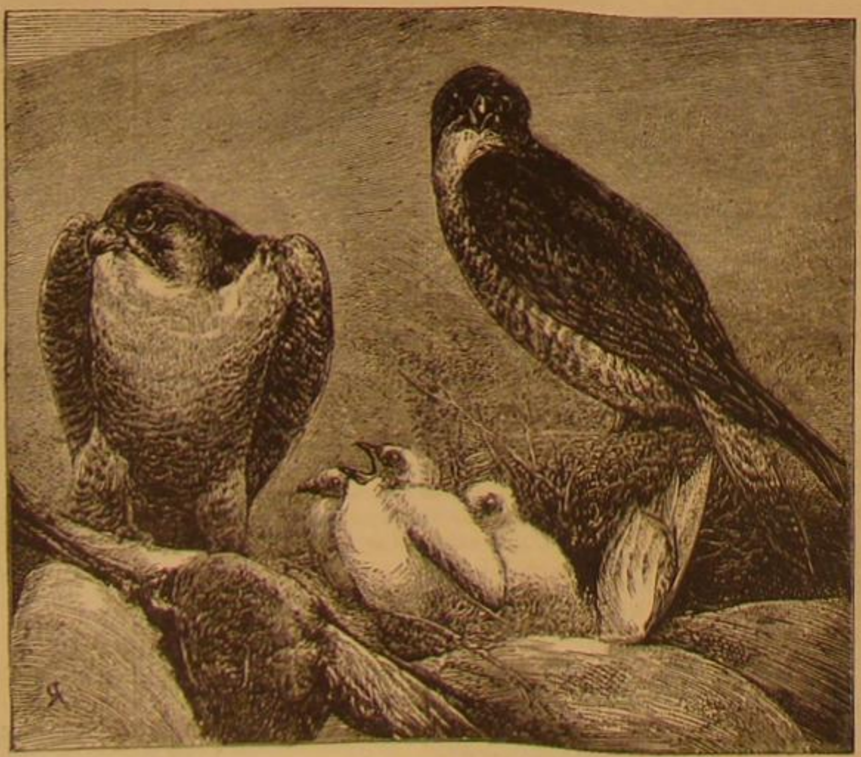
The object sought by the author was to obtain a clear alcoholic solution in a short time without much loss. Previous communications upon the substance occurring in shellac to the extent of five per cent, which renders its alcoholic solutions turbid, and is described by some authors as wax, and by others as a fat acid, suggested an attempt to effect its removal before dissolving the shellac. The shellac, therefore, was boiled with water, from one to five per cent of soda or ammonia being added, but without satisfactory result; a somewhat larger addition of the alkali caused the solution of the shellac. The author next prepared a solution with one part of shellac and six parts of 90 per cent alcohol at the ordinary temperature, which was effected with frequent shaking in ten or twelve hours. To this he added carbonate of magnesia to about half the weight of the shellac used, and heated the mixture to 140° Fah. The solution so obtained cleared more rapidly than a solution to which magnesia had not been added, and filtered in less time; but it did not supply what was sought. When powdered chalk was substituted for magnesia, the solution, after standing some hours, became three fourths clear, while the lower turbid portion could be rapidly filtered. It only required a little alcohol to wash the filter, and a clear alcoholic solution of shellac was obtained. Further experiments—for instance with sulphate of baryta—did not give a better result. When such a solution is made on a large scale, it would be best filtered through felt.

Notwithstanding that the object of the author had thus been attained, one or two other experiments were tried. To three parts of the above mentioned shellac solution, one part of petroleum ether was added, and the mixture was

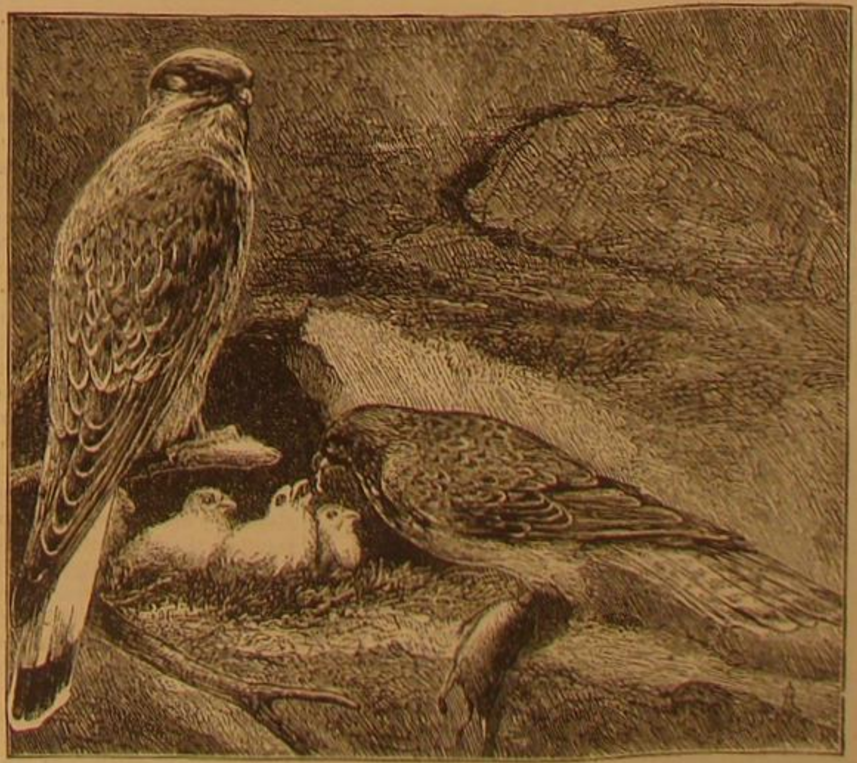
HERONS NESTING



A FAMILY OF BARN OWLS



PEREGRINE FALCONS AND YOUNG.



KESTRELS AND YOUNG.

vigorously shaken. After standing a few moments, the liquid separated in two layers; the upper light-colored layer was the petroleum ether with the wax dissolved in it, the lower yellow brown layer was a clear solution of shellac with only a little petroleum ether adhering. Upon allowing the petroleum heat to evaporate spontaneously, the wax that had been dissolved out of the shellac was obtained as a white residuum. By using alcohol at 95 per cent to dissolve the shellac, and then adding petroleum ether, a perfectly clear solution was obtained that only separated into two layers after water was added. Consequently an alcohol weaker than 90 per cent should be used.

The shellac solution obtained by means of petroleum ether, however, has the advantage that the shellac is left, after evaporation, in a coarser form, and easily separates: this may be obviated by adding one to three per cent of Venice turpentine.—*A. Peltz.*

[For the Scientific American.]

THE GAS MICROSCOPE.

BY HENRY MORTON, PH. D.

The projection of images from microscopic objects directly upon the screen with the gas microscope has always been a thing much desired by all those who have made use of the magic lantern as a means of demonstration; but the difficulties attending this experiment have been found much more serious than was anticipated beforehand. This is especially the case to one who has been accustomed to use the solar microscope, in which the advantage offered by the parallelism of the solar rays is of no great value. On account of the smallness of the object illuminated, as compared with the errors of focalizing or concentration in the cone of rays coming from the condenser, all the advantages in the use of a lens in a magic lantern, as compared with its use in a camera or the like, disappear, and the lens of the microscopic attachment is left to its own resources*, without any of that aid from the condensers which they afford so effectively to the objective of the magic lantern in its best form of construction.

Among the errors, which thus become conspicuous, the most manifest and vitally important is the want of flatness of field. By reason of this, while the center of the image is well defined, the edges are indistinct and unsatisfactory. To obtain lenses free from this defect has been the continuous effort of some of our ablest opticians for the last ten years; but the success so far has been very limited, and indeed it would seem as if the problem was one for whose solution we could hardly hope, for it must be remembered that lenses whose flatness of field in the table microscope leaves nothing to be desired in that direction, are entirely unsatisfactory when used in the gas microscope.

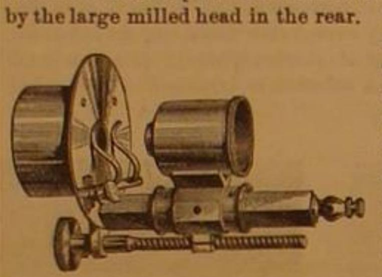
One of the most influential causes of this we shall notice presently; but we will here only remark that, as the result of a larger experience, we have become convinced that one must be contented with a moderate amount of success in this direction, and not expect what is, at present at all events, impossible.

The second great defect that we encounter in the use of the microscopic lens for projection is the irregularity of distribution of light upon the screen. By reason of this we may have a field of light, with a small bright area at the center, rapidly fading off into darkness, with no well defined margin. The causes of this are, among others, the confusion or want of accurate concentration of the cone of rays from the condensers, and the smallness of the objective, causing it to cut off oblique or marginal rays, more or less according to their obliquity. To remedy this difficulty we can work in two directions. In the first place we may improve the spherical correction of the condensers or the concentrated character of the source of light. The first of these improvements, as we have shown in another place†, has already been carried to its practical limit in the best sort of condensers, and the second involves the use of the electric light or of sunlight.

In the second place, any increase in the diameter of the microscopic lenses, without a corresponding increase in their actual length, insures a great gain as regards the equal illumination of the field. With this view alone, therefore, a simple uncorrected or single corrected microscopic lens, such as accompanies the regular gas or solar attachment made for the last 50 years and still made by Duboscq and other French manufacturers, would be the best form, and, as regards the equal distribution of light on the screen, this is true; but when such lenses are thus used, and are of sufficient size to secure this result, their errors of spherical aberration and want of flatness become unendurable. We are then fenced in on either side by the necessity of a large and short lens to secure an equal illumination, and the difficulty in securing flatness or correction under these conditions. The most successful compromise which we have yet found in this connection is the gas microscope objective of 1¼ focus inch by Mr. J. Zentmayer, the well known manufacturer of microscopic stands and lenses. With one of these a well defined object, such as a lady bug, mosquito, or the like, may be thrown on the screen with a clear image, pretty well defined up to the margin, and a field of light so brilliant and regular that it is hardly distinguishable from that of an ordinary magic lantern projecting a colored glass slide of the same object. Of course with such a power very minute objects must be rejected; but by a judicious selection, a large series of interesting ones can be secured, such as the lady bug or mosquito already mentioned, the ant lion, field spider, and various water insects, or larvæ of mosquitos and the different sorts of flies, also wood sections, and even objects so small as the eye of a dragon fly; but above all with this power may be most successfully shown what are by far the most popular illustrations with the gas microscope, such living specimens as the various larvæ above mentioned, and such other things as are to be found in stagnant water. For these the very simple and effective form of live slide devised by Mr. S. Holman, Actuary of the Franklin Institute, Philadelphia, is invaluable. It consists of an ordinary microscopic glass slip, of greater thickness and size than usual, with a spherical cavity about ⅝ of an inch across and $\frac{1}{16}$ of an inch deep, ground and polished in the middle of one face. This, when in use, is closed by a thin glass cover, which is kept in place by adhesion and atmospheric pressure, the cavity beneath it being filled with water containing the insect or other object. If it is desired to use higher powers, we must be contented with a limited selection of objects, choosing such as are strongly defined and well colored. Diatoms, blood disks, or other objects which are delicately tinted or colorless, are quite unfit for such use. A strongly colored eye of a fly or sting of a wasp, or other parts of insects, such as a claw of a spider, answer well.

In this case I have obtained the best results with Zentmayer's $\frac{1}{10}$ objective, using an extra condenser consisting of a plano-convex lens of about 3 inches focus and 1½ inch diameter, placed about an inch back of the object. This greatly increases the illumination of the field.

In using the gas microscope much depends upon the efficiency and convenience of the support for lenses and the stage, or what is known commonly as the gas microscope attachment. After many experiments and the frequent alteration of other forms, I have settled upon that represented in the accompanying woodcut as the most desirable. The portion holding the lens slides on a square bar receiving motion from the steep-threaded screw beneath, which is turned by the large milled head in the rear. This gives a very easy, smooth, and steady motion, abundantly delicate and yet admitting of rapid adjustment. The stage is perfectly flat and unobstructed; and two very elastic spring clips, whose tension can also be adjusted by a screw at the side, enable objects of almost any size or thickness to be held in position.



Within the large ring, terminating the apparatus toward the left, and which serves to attach it to the lantern, is a smaller ring which carries the extra condenser when required. This form of microscopic attachment is manufactured by Messrs. George Wale & Co., Hoboken, N. J., who are instrument makers to the Stevens Institute of Technology, of that place.

*On the subject here referred to, see SCIENTIFIC AMERICAN, 1873, volume XXIX, page 163.

†SCIENTIFIC AMERICAN, 1873, page 163, volume XXIX.

Minute Time Intervals Measured by Frictional Electricity.

An invention which will enable us to estimate the velocity of a projectile during its passage through the bore of a gun is one which the great advances which have been and are constantly being made in the science of gunnery has long rendered desirable. To meet this requirement, Dr. William Siemens recently renewed investigations into the subject, undertaken as early as 1847, and his studies have resulted in probably the most delicate and accurate chronoscope ever devised. To understand the nature of the novel principle introduced by Dr. Siemens, it is necessary to review briefly the previous labors of others in the same direction.

The first attempts date from 1837, and were made by Pouillet, who measured the time employed by a projectile to traverse a given path by estimating the intensity of the electric current provoked by the pulsations of a magnetized needle. Wheatstone, in 1840, Konstantinoff and Breguet, in 1842-3, and later De Brettes and others, sought an analogous solution of the problem in the use of magneto-electric registering apparatus, to which the names chronograph and chronoscope were given. Among these was included a device invented in 1845 by Leonhardt, which consisted in a clockwork movement, the index of which was moved by an electric current.

All these attempts, Dr. Siemens thinks, failed because the electric current marks intervals of time, not directly, but through the medium of magnetic or mechanical apparatus. He proposed, in the beginning, to use frictional electricity; but as at the time of his proposition experiments in that species of electricity were little investigated, the methods in vogue were continued. Subsequently these have been greatly improved; but recourse has always been had to the intermediary apparatus. This is the case in the Nobel and Boulenger machines, in which small errors in construction lead to greater ones in the indications. Recently Dr. Siemens has perfected and successfully tested his frictional electricity apparatus, which is constructed as follows. We translate the description from the *Revue Industrielle.*

A very light and highly polished steel cylinder is rapidly rotated by means of gearing, provided with a very sensitive regulator, and capable of being instantly arrested in its movement at will. The mechanism is so regulated that the cylinder makes exactly 100 revolutions per second. The completion of each hundred turns is suitably indicated so as to correspond with the beat of a seconds pendulum. Near the polished surface of the cylinder is fixed a conducting needle connected with the exterior armatures of an insulated battery of Leyden jars. The interior armature of each jar is in contact with a wire, insulated by rubber or gutta percha, which enters the bore of the gun through a hole made for the purpose. The battery is provided with a commutator, which allows of the jars being simultaneously charged by a Ruhmkorff apparatus.

When the gun is fired, the projectile successively destroys the insulating envelope of the wires which end in the bore; the exterior armatures of the jars are then put in communication with the gun, and hence with the earth. As the rotating cylinder is itself in connection with the earth, the jars instantaneously discharge through the needle and mark dots on the cylinder with great depth and distinctness.

The intervals between these points is measured with a micrometric screw, and the cylinder is previously covered with lampblack. Each of the black dots is then surrounded by a pale ring, and is easily recognized. The axis of the cylinder carries a gear, in connection with which the micrometric screw is disposed. The gear has 100 teeth, and the head of the screw is divided into 100 parts, so that at the rate of 100 turns per second each division of the head of the screw corresponds to 0·000001 second, an interval which can be subdivided. With a little practice in manipulation, the apparatus is made to give, for each shot fired, a number of indications of velocity proportional to the number of jars in the battery, and of communications with the gun.

The great precision thus reached in gunnery experiments has determined Dr. Siemens to apply the same principle to the estimate of velocity of electricity even in suspended wires. The usual method has been that of Wheatstone, according to which electricity in copper wire travels at the rate of 62,000 geographical miles per second. Wheatstone, in his experiments, used a rapidly revolving mirror, in which he observed three sparks, of which two came from the two ends of a conductor destined for the discharge of a Leyden jar, while the intermediate spark came from the middle of the conductor. Were the velocity of electricity infinitely great, the three sparks observed in the mirror would appear on a right line, parallel to the axis of rotation. But such is not the case, and Wheatstone deduced the velocity of the electricity from the intervals noted between the extreme sparks and that at the middle. It is evident that this kind of estimate is very uncertain, especially since results obtained later, by Fizeau, Gould, Gonnelle, and others, by different methods, differ greatly from those obtained by Wheatstone. Dr. Siemens' method of measuring the velocity of electricity in telegraphic lines consists in causing the electric discharge from a Leyden jar to reach the revolving cylinder, part directly and part through the length of wire. The interval between the two marks then gives a measure of the time occupied in traversing the wire. The indications have been noted with great accuracy, and they show that the velocity of electricity is just half that announced in Wheatstone's estimate, or 31,000 geographical miles per second.

Pneumatic Tubes.

The Western Union Telegraph Company, in its annual report to its stockholders, just issued, says, of the experiment in adopting the tube system of transmitting messages, that during the past year the central office in New York has been connected with the branch offices at No. 14 Broad street, No. 134 Pearl street, and the Cotton Exchange by pneumatic tubes. The tubes are made of brass, each 2¼ inches internal diameter and ⅛ of an inch thick, and are laid under the pavements in the streets at a depth of three feet.

Messages are sent from the central office to the several branch offices by compressed air, and from the branch offices to the central office by atmospheric pressure or vacuum. The motive power is furnished by a 50 horse power duplex engine situated in the basement of the central office, which operates two double acting air pumps communicating with the compressed and vacuum mains terminating in the operating room. These are connected to the tubes extending under the streets by means of double sluice valves, which are so constructed that carriers containing messages may be sent through the tubes in either direction by turning a cock connected with the compressed or exhaust air mains.

With the usual pressure employed—6 lbs. to the square inch—the time occupied in transmitting a box or carrier containing messages between the central office, corner of Broadway and Dey street, to the office at No. 14 Broad street (700 yards) is about 40 seconds; and between the central office and the offices at No. 134 Pearl street and the Cotton Exchange (900 and 1,100 yards) about one minute and five seconds and one minute and twenty seconds respectively.

The operation of the pneumatic tubes is very satisfactory, resulting in a material saving of both time and money.

The total cost of the system is less than $30,000, and about one half of the outlay will be saved annually, to say nothing of the saving in time, by the decreased cost of performing the service by pneumatic tubes between these stations as compared with the former cost by wire.

There are several other offices in the city where the traffic is large enough to warrant their connection by pneumatic tubes with the central office, and it is probable that the system will be extended to some of them after its value has been more fully ascertained.

A New Phylloxera Remedy.

M. Gachez recently announced to the French Academy of Sciences that red Indian corn (maize) is an efficient remedy against the phylloxera, and that when it is planted between the rows of vines in a vineyard, the vines are never injured. The insect, he says, leaves the vine roots in order to attack those of the corn. This is a new way of combating the phylloxera, and is easily tested.

CENTENNIAL NOTES.

THE ENGLISH SILVER WORK AND ENAMELS.

Some marvellously beautiful silver work is displayed in the exhibit of the Messrs. Elkington in the British section. The *repoussé* decorations on the silverware were produced entirely by the hammer, the plate being struck on the back until the figures of the design are sufficiently raised. One false blow might ruin the work of months. The English enamels are among the finest exhibited, not excepting the Chinese and Japanese. They were produced in the following manner: The vase or other article is hammered into the required shape. In *cloisonné* (panelled) work, which is by far the most prized, requiring as it goes greater skill and patience on the part of the artist, the patterns are traced very finely on the surface of the metal; very thin gold, copper, or other wire is then bent by hand with delicately made tweezers exactly into the shapes of the ornaments, birds, figures, flowers, etc., which are traced on the metal; the wire thus shaped is then soldered to the dish so as to follow out the design in all its intricacy; this requires the utmost skill and delicacy of touch, for upon these lines depends the success of the patterns. The enamel is then put in the spaces or cells between the wires; it consists of metallic oxides made into a paste which, when put into the cells and subjected to a great heat, develops the desired colors.

This process is repeated again and again, the shading of one color into another and the filling of all the cells requiring many meltings. The face of the work is then ground down smooth upon a revolving stone, or stoned down, as it is called. This method of enameling is of great antiquity, though it has never until late years obtained any great development in Europe. The Chinese and Japanese still practise it, and their work, both ancient and modern, has been described and can be seen in their sections. The *champ levé* (raised field) process is the reverse of this, the cells for the reception of the enamel being cut out of the metal on which it is placed, leaving the raised pattern. The enameling is done as before described.

HOW DOULTON WARE IS MADE.

The superb Doulton pottery in the English exhibit is only a refinement upon common stoneware. It is made of Devonshire and Dorsetshire clay, kneaded into a homogeneous mass, to which has been added a certain proportion of crushed stoneware of former manufacture. Mr. Doulton conceived the idea of making each piece unique, that there should be no copying of designs in shape or ornamentation, and that in every stage of manufacture the piece should be the direct result of the mind and hand of the workman. Workmen capable of being entrusted with this discretion he found in the Lambeth School of Art. Every bottle, vase, or cup is turned at the potter's wheel by the hands of a workman, and passes untouched from the wheel to the decorator.

The ornamentation is of four kinds: raised ornaments, indented or etched patterns, scroll work, figures or landscape engraved by incised lines, and they may be painted in various colors. The encrustation is with clay, which has been whitened by admixture with calcined flint, and the ornaments are first formed in a mold. The patterns are both simple and elaborate; the simple ones are laid on by young girls, while the more elaborate have to be arranged by an artist.

The incised work is all done by an artist, Miss Barlow, and some very exquisite productions of her graver can be seen in the Main Building. In animal drawing, she seems to excel, some of her groups of horses being in the highest style of art. This work is done after the piece has been partially baked, and when it is in the biscuit state and easily cut. Color is sometimes rubbed into the lines, or the lines may be left as they are. The coloring is done with metallic oxides, and the piece is then fired. There is a richness and harmony of coloring about a group of this stoneware which produces a pleasing impression. The ware is glazed, like all the common stoneware, by throwing salt in the kiln, and in every instance the piece is finished before it goes to the furnace. This enables the manufacturer to turn out works of great artistic merit at a much less cost than where so many processes are required to produce similar results.

THE ECLIPSE ENGINES IN MACHINERY HALL.

One of the most interesting exhibits in Machinery Hall includes the various forms of Eclipse engine, manufactured by Messrs. Frick & Co., of Waynesboro, Pa. The Eclipse stationary embodies a large number of minor improvements and a novel design governing the distribution of the material of which the frame consists, which keeps the different working parts compactly together, and is calculated to secure the greatest strength with a given amount of material. The Eclipse portable engine likewise is of new and improved construction, and is furnished complete with every appliance, so that it is ready for immediate work. The same may be said of the agricultural engine, which, in point of lightness, easy portability, and high indicated power, is excellently adapted to the uses of farmers. Of some of these improved machines we shall shortly publish engravings with detailed description. In the meantime they may be seen at D 10, 78 Machinery Hall.

THE CENTENNIAL POSTAL ENVELOPE.

In the Government Building is an exhibition of the manufacture of stamped envelopes, and a peculiar pattern of postage stamp is printed upon them. These envelopes were sold only on the ground, and the sale, from May 10 to November 1, amounted to 8,500,000 envelopes, valued at $245,000.

A PERMANENT MUSEUM OF MINERAL AND METALLURGICAL SPECIMENS.

The American Institute of Mining Engineers have appointed a committee to take charge of the arrangements for establishing a permanent museum of mineral and metallurgical products in connection with the Pennsylvania Museum and School of Industrial Art, the collection to be placed in one of the saloons of Memorial Hall. Many of the valuable collections from foreign nations which have been exhibited at the Centennial have been presented to the Institute, and among them the following: The entire collective exhibit of minerals displayed by the German Government, including maps, drawings, statistics, etc., presented by the Imperial German Minister of Trade and Commerce. Siegerland collective exhibit of iron ores, including the base of the Spiegel iron pyramid in Machinery Hall. Mr. A. Börsig's display, and the exhibit of the Luxembourg Mine and Saarbrücken Furnace Company, both in Machinery Hall. The entire exhibit of the Fagersta Iron and Steel Company, of Sweden, including the valuable suite of test specimens by Kirkaldy. The exhibits of Miller, Metcalf, & Parkins, Crescent Steel Works, of Pittsburgh, Pa., and Cooper, Hewitt, & Co., of New York city. Models of blast furnaces and hot blast stoves, by Thomas Whitwell, Middlesborough, England. Rock Hill Coal and Iron Company's exhibit, etc.

CHINESE VASES.

Several boxes of antique Chinese vases from the private collection of Hu Kwang Yung, Minister of Finance in China, were received, on the 2d instant, in the Chinese Department in the Main Building. The vases are extremely rare, and are beautifully tinted in vermilion, ultramarine, blue, and gold, and are regarded as some of the finest remnants of the Eastern lost arts now extant. The specimens of *cloisonné*, antique china, and bronzes are particularly beautiful.

THE CENTENNIAL AWARDS.

It is reported that the Centennial Commission has reconsidered its action, in causing all reports on awards to be signed by the President and Director General, and has decided to issue the papers with the judges' signatures, as previously intended.

THE CLOSING OF THE EXPOSITION.

All arrangements for closing the Centennial are being rapidly completed. The work of removing goods must begin on November 11, and be finished before December 31, unless otherwise ordered by the Director General. Goods remaining without authority after the specified time will be removed by the authorities and sold to pay expenses. Most of the railroad companies in the United States having officially announced that they would "transport at regular rates all articles intended for exhibition at the International Exhibition of 1876, at Philadelphia, as well as all other articles forwarded by exhibitors for their own use, in connection with the Exhibition, and would return unsold articles free; exhibitors who expect to secure free return transportation for their goods must apply for certificates at the office of the Bureau of Transportation, where proper blanks for the purpose will be furnished. These certificates will be issued to those exhibitors who have furnished to the Chief of the Bureau of Transportation duplicate bills of lading or like evidence of being entitled to them."

There will be a general sale of all the buildings belonging to the Centennial Board of Finance on Thursday, November 30, at 11 o'clock A. M. The list comprises the Main Building and Carriage Annexe, Agricultural Hall, with Wagon and Pomological Annexes, the Art Annexe, Photographers' Exhibition Building, Shoe and Leather Building, Judges' Hall, Butter and Cheese Building, Guard Station Houses, and various other small buildings. Particulars of the sale will be furnished in pamphlet form on application, ten days before the appointed time.

New Investigations on the Spontaneous Combustion of Oily Refuse.

Mr. J. J. Coleman, of Glasgow, has recently transmitted to the *Société Industrielle* of Mulhouse, France, a memoir on the spontaneous combustion of oily refuse and on the relative inflammability of the different oils employed for lubricating purposes. He describes a series of experiments upon fragments of cotton, linen, jute, and woolen waste, saturated with oils of different natures. The materials were placed in a box of tin, having a double bottom in which steam entered, so that the part which received the refuse could be maintained at a temperature of 180° Fah. A thermometer was inserted in the oily substance so that the variations of temperature occurring therein could be noted.

The results obtained show, first, that any vegetable or animal oil inevitably takes fire after a few hours, under the above conditions. On employing cotton waste, the mass burns quickly and with flame, in contact with the air. Wool refuse is slowly transformed into a black carbonaceous mass. Second, the addition of mineral oil—known as lubricating mineral oil—serves to retard the spontaneous combustion of vegetable or animal oil if mixed in small quantity. If a large amount be added, inflammation is entirely prevented. The mineral oil used by Mr. Coleman is a very dense product (density 890), having great viscosity and emitting no inflammable vapors even in contact with an ignited body at any point below 338° Fah., or in other words remaining safe at temperatures at which mixtures of less dense mineral oils or colza oil burn. The addition of 40 per cent of mineral oil is sufficient to prevent spontaneous combustion. Twenty per cent doubles the time necessary to determine conditions favorable to the same. Spontaneous combustion occurs most quickly when the cotton is soaked with its own weight of oil.

The Messrs. Dollfus, who presented Mr. Coleman's paper to the above named society, add the results of further investigations of their own. They note the fact that access of air is indispensable to the obtaining of a sufficient elevation of temperature to determine combustion, and that it was found necessary even to blow air into the hot box.

There is another advantage to be gained by mixing mineral oil with that of vegetable origin, in that the latter is thereby prevented from resinifying, or thickening, on prolonged exposure to the air. Mr. Coleman exposed in his hot air bath, for a period of 48 hours, vessels containing olive, colza, sesame, and cotton seed oils. The first thickened, the second the same to a greater degree, the third still more, and the last yielded a semi-liquid, amber-colored mass. The addition of 20 per cent of mineral oil caused all to remain perfectly fluid. The author concludes that, for the lubrication of machinery, as well as for the oiling of textile fibers, it is advantageous to employ a mixture containing as much mineral oil as is possible while retaining the material at the proper degree of viscosity. Colza and other oils employed for lubricating heavy machinery are greatly improved by the addition of from 10 to 20 per cent of mineral oil, the small viscosity of the former preventing a mixture of greater proportions of the latter. For spindles, on the contrary, it is better to use a larger amount of mineral oil, making a mixture of about the viscosity of sperm oil.

Professor Anthony's Electric Light Experiments.

Professor Wm. A. Anthony, of the Physical Department, Cornell University, sends us the following interesting account of his recent experiment, which we briefly noticed on page 289, current volume. In that notice the lamp used for comparison of light values was incorrectly designated as the one used in the engine. Professor Anthony says:

"The following is a brief description of my experiments: To the electro-magnetic machine, which was driven by a Brayton petroleum oil engine of five horse power, wires were connected for conveying the electricity produced to a room some 300 feet distant, from which daylight could be excluded, for photometric experiments. In this room, the wires were connected with a Foucault regulator for the electric light, the light being produced by the passage of the electric curve between two carbon points. The electric light being too brilliant for direct comparison with the standard candle, I took from my house a common coal oil lamp, having a flat wick one inch wide. The electric light was found to be equal to what would have been produced by 234 such lamps. But 234 such lamps would have consumed nearly 16 lbs. oil per hour, while the engine, whose power developed the electric current, which in turn produced the electric light, consumed but 6½ lbs. oil in the same time. This fact was stated in the paper giving the results of my experiments merely as showing, in a striking manner, how very small a proportion of the energy of combustion of the oil in the common lamp is utilized as light."

Right of Passenger to a Seat.

In the case of Barnet Le Van against the Pennsylvania Railroad Company, in Court of Common Pleas No. 4, at Philadelphia last week, the facts are given as follows: The plaintiff in November, 1868, purchased at Harrisburgh a ticket from the defendants for passage to Philadelphia, the train on which he was to take passage being known as the Cincinnati express. When the train reached the station at Harrisburgh it consisted of but two passenger cars, an ordinary car and a smoking car. The plaintiff asserts that he was constitutionally unable to ride in the smoking car, and the other car was full. The plaintiff was afflicted with a disease which made standing for any length of time positively injurious to him, and, as some other cars were added to the train at this place, he asked permission of the brakesman, and was directed by him to enter one of them, a sleeping car, where he found a seat. When the conductor took up his ticket he demanded $1.50 extra for the privilege of riding in the car, which plaintiff refused to pay, alleging that his ticket entitled him to a seat, and that there were no seats elsewhere on the train. The conductor afterwards put plaintiff off the train about eight miles from Lancaster. He walked in to Lancaster, and in the long walk his disease, as he alleges, was aggravated to such an extent that he has never entirely recovered from the effects of it. Le Van's suit for damages has been pending eight years. On the trial the company's version of the affair was that the conductor allowed the plaintiff to remain in the sleeping car until there were seats vacant in other parts of the train; that shortly after the train left Middletown the conductor requested him to take one of these seats and he refused, whereupon the train was stopped and he was ejected. There was no force, the defendants claimed, used on the plaintiff except the mere laying on of hands, so that he should not seem to assent to his being put off the train. It was the duty of the plaintiff, His Honor said, to accept the seat offered in the ordinary car, if such had been actually offered him, and that the conflicting versions of the affair must be reconciled by the jury. The jury, after a deliberation of over two hours, returned a verdict of $8,500 damages.—*Chicago Railway Review.*

IT is said that the price of steel rails, which has fallen one third within the last few years, is now so low that the business is really profitless. A movement is on foot for an agreement between the manufacturers for regulating the production and prices.

To Draw and Paint Magic Lantern Slides.

They are first prepared by having them cut the right size in width and about ten inches in length (they can be bought for a small sum at any glass warehouse); clean them, then lay your picture on a pad of blotting paper, and place your glass over it; the blotting paper will serve as a bed, and the glass will keep the picture in its place ready for tracing the outline, which is done with a camel's hair paint brush, using ivory black, ground up in the best drying oil, made thin with a little spirits of turpentine. The best outlines are funny men and women, animals, birds, and grotesque figures, sheets of characters, clowns, harlequins, etc. When done in outline with the black, they are filled in with the transparent colors, mixed up as the black: only use carmine, gamboge, Prussian blue (the more brilliant the colors, the better effect they produce), the above being for red, crimson, yellow, and blue. To form other transparent colors, mix carmine and Prussian blue for purple, and lavender, gamboge, and Prussian blue for all the shades of green, using for light green more gamboge. Carmine and gamboge make a fine orange color, and for brown shades mix a little ivory black with carmine or lake, with a little gamboge to temper it. Many other tints are made by mixing the primitive colors first named—red, blue, and yellow—by using less of one color with another; and if at any time the colors are too thick, thin with turpentine; it works more easily when not too thick and is more transparent.

When all the colors are finished, mix a nice thin black, and fill in carefully all the ground of the glass round the edges of the figures with the black, leaving no part of the glass slide plain. These slides should be made very well; and to take better care of them, have them put in small wooden frames, with a tongue at one end to move them in the lantern without the finger touching the glass part. Many beautiful designs can be copied from a kaleidoscope, which, when copied and painted on slides, are very beautiful, and show the colors to advantage. Drawing and painting slides is an instructive amusement, and worthy the attention of all persons connected with youth, as it gives them original ideas for combining colors, and thus can be brought into use for many pretty designs in a pleasing manner.

The Kahnweiler Cotton Seed Huller.

Some time ago, we published an engraving of what we considered at the time a very excellent machine for hulling cotton seed, the invention of Mr. David Kahnweiler, of this city. Attracted by the publication, an order was given for one of the machines by a gentleman from near Newbern, N. C. A few days ago, the machine was set in operation; and according to the *Newbernian*, a newspaper published in Newbern, "the cotton-seed huller was quite a curiosity; it did the work finely and thoroughly, the kernels being taken from the hulls and separated from the chaff, which operation prepares the seed for feeding to stock, while the hulls can be utilized for stock bedding. One tun of the cotton seed will furnish 1,000 lbs., or about 20 bushels, of kernels which are said to be better for food for mules, horses, cattle, hogs, and sheep than an equal weight of corn. If this is correct, it will enable the South to feed an unlimited amount of stock, and to raise her own mules and provisions, and literally to eat cotton."

A CORRESPONDENT, Mr. H. McMurtrie, of Boston, Mass., informs us that the Russian system of technical education, recently described by us, has already been adopted by the Massachusetts Institute of Technology, and will soon be in full operation.

NEW BOOKS AND PUBLICATIONS.

THE LEATHER MANUFACTURE IN THE UNITED STATES. By Jackson S. Schultz. Illustrated. New York city: Office of the Shoe and Leather Reporter.

The author of this work already possesses a worldwide reputation as one of the most enterprising and intelligent as well as one of the largest manufacturers in the American leather trade. The series of articles, reprinted from the *Shoe and Leather Reporter*, which compose this volume, could therefore have been written by no higher authority, certainly by none whose opinions and advice will command greater respect. While the whole book is eminently practical and is intended for practical use, it defends no preferred theories, nor enforces any especial views. On the contrary, it presents the merits and demerits of known systems and methods of leather making "as their advocates would state them," leaving all to the candid comparison of intelligent men; and this done, the autnor suggests his preference, warranted by his own experience. Mr. Schultz, besides, accomplishes the difficult task of writing a technical book without technicalities; and he does it admirably, for the general reader, knowing little or nothing of tanning, can read the work through with interest, and obtain a vast amount of really useful information. The selection and classification of hides is explained in the first chapter, the next takes up the sweating, then liming, then fleshing and trimming; then follows preparing the bark, and so on through all the various topics, including construction of tanneries, cost of tanning, utilization of refuse, tanning processes, and finally a valuable report on the burning of tan in furnaces—on which subject he possesses more knowledge than he communicates—closes the volume. A number of excellent illustrations are provided, and a portrait of the author constitutes the frontispiece.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED WINDMILL.

Andrew J. Ball, Mount Vernon, Ohio.—This invention relates to certain improvements in windmills, designed to render the vanes of the same automatically adjustable, together and as a whole, in their position to the wind so as to diminish their areas of resistance in proportion to the strength or force of the wind, and thus equalize its power. The invention consists mainly in the arrangement of an oscillating tail blade with a supplemental tail and a deflector blade, which together effect the desired result in a perfect and sensitive manner.

IMPROVED RATCHET WRENCH.

Robert R. Wilson, New Orleans, La.—This invention contemplates the saving of time and labor in putting on or taking off nuts from a bolt or axle where they are inaccessible to the ordinary wrench. The invention consists of a compound wrench, provided with a revolving part having several nut sockets or nut holders of different sizes. It is made to turn in either direction with the handle by means of a two-armed pawl lever held by a spring pin. One of the nut holders or sockets is open or cut out at the corners, to adapt it to turn nuts one or more of whose sides may be close to same obstacle.

IMPROVED PAPER PULP ENGINE.

John S. Warren, Cumberland Mills, Me.—In using the machine for beating and grinding, the case is filled or charged through an opening in the screen, and power is applied to give a rotary motion to the cone and tube and their attached knives. This revolution of said parts engenders a centrifugal force, which causes the pulp to flow up through the space between the tubes and cones, the knives operating upon it during its passage. The pulp, as it is thrown out, passes down the sides of the case and establishes a circuit, thus becoming thoroughly intermingled.

IMPROVED WATER METER.

Sebastian Plymale, Portland, Oregon, assignor to himself and Thomas Hutten, of same place.—This is so constructed as not to become choked by sediment or other impurities passing in through the supply pipe. In the case is placed a tank, which is divided into two equal compartments, and balanced upon pivots. When the said tank is tilted, the head of a valve stem strikes upon a stop attached to the bottom of the case to allow the water in said compartment to flow out. When the tank is tilted, the water flows into the upper compartment of said tank until that compartment overbalances the other and reverses the tank. This opens the valve of the full compartment, and allows the water contained in it to flow out, while the other compartment receives water. By this construction, exactly the same quantity of water must flow into each compartment each time to tilt it, and, by registering the number of times the tank tilts, the exact amount of water that has passed through the meter is ascertained.

IMPROVED GEAR PLANER.

Andrew Hanauer, Covington, Ky.—This machine has a radius bar upon which slides a tool rest, provided with two tool holders capable of moving vertically in opposite directions. One travels with the radius bar as it is guided by a form or templet, and the other moves oppositely, receiving its motion through a lever and connecting rod from the tool rest. It also consists in an arrangement of a crank and slotted lever driven by gearing, and connected with the tool rest by a connecting rod. It further consists in the arrangement of the pivot and feeding apparatus for the radius bar. The object of the invention is to accurately plane both sides of the teeth of cast gear wheels at one operation, thereby saving the expense of handwork or of doing it with ordinary planes or sharpers.

IMPROVED ORE CONCENTRATOR.

Francis E. Mills, Virginia City, Nev.—This invention consists first, in arranging inclined tables in vertical series, like shelves, one over another, all held in one frame, and sloping in the same direction, but with varying degrees of inclination. The purposes are to enable a concentrator of large working capacity to be constructed at small cost, occupying small ground space, be easily housed and operated in cold weather, and be quickly swept at one operation; also, to insure a proper and easy classification of the sands as they flow upon the respective tables, and thus secure a larger percentage of the ore; secondly, connecting with such vertical arrangement of tables a classifying head box, by means of which the sands naturally grade themselves as they flow out upon the different tables, the coarsest and heaviest flowing over the bottom tables, the finest and lightest over the top table, and grains of intermediate grades of fineness over the intermediate tables, the inclination of each table, respectively, and the volume of current, being adapted to the grade of sand it carries; thirdly, in employing on all stationary tables a traveling water broom, which, consisting of a perforated pipe, extending across the tables and fed with clean water under pressure, is made to traverse the length of the table, close to the surface, and sweep off the deposit in its progress by jets through the perforations.

IMPROVED SAFETY WHIFFLETREE HOOK.

Adam A. Wise, Belle Plaine, Iowa.—This invention consists in securing a trace to a whiffletree hook so that all liability of escape under any contingency is effectually removed, by making the end hook in two sections, each in the shape of a hook, but having the bend in opposite directions so that one may overlap the other, form an enclosed space for the ring or loop of the trace, and be allowed to rise in order to admit said loop or ring.

NEW HOUSEHOLD INVENTIONS.

IMPROVED LAMP CHIMNEY CLEANER.

Daniel T. Freese, North Amherst, O.—This consists in the arrangement of two flat bow springs secured to a handle, the bow of the springs being adjustable by a screw at the end of the handle, and also by a coil spring which permits the bow springs to yield more or less for chimneys of different sizes. The flat springs are covered with tufts of yarn.

IMPROVED STOVE PIPE JOINT.

Robert Mainer, Orilla, Ont., Canada, assignor to himself and Charles McInnes, of same place.—This invention consists of rivets at the end of one stovepipe entering into slits of the other stove pipe end, and being locked by pivoted fastening hooks of the same.

IMPROVED WASHING MACHINE.

Collins Fitch, Garnetsville, Ky.—As the rubber is moved back and forth upon the clothes interposed between it and a hurdle, by operating a lever the hinges of the arms attached thereto enable the rubber to adjust itself according to the amount of clothes being washed.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CHURN.

James M. Roberts, East Monroe, O.—This churn has no metal parts to stain or otherwise affect the milk or butter, and is so constructed that it may be readily repaired at home without its being necessary to take it to a foundery or blacksmith shop. Means are provided to give an oscillating motion to the dasher, which throws the milk toward the center of the churn and gathers the butter; and the cover and its attachments may be readily removed to give access to the interior of the churn body.

IMPROVED ROTARY CHURN.

John R. Bennett, Nunda, N. Y., assignor to James A. Duryea, of same place.—This churn is provided with dashers that revolve in opposite directions; and there is a combination of a floating dasher with a feathered shaft in such a manner that while the dasher floats on the surface of the cream it is carried around by the said shaft. The advantage claimed is that the cream is confined by the floating dasher, so that it is more thoroughly acted upon by the wings of the dashers, producing an increased quantity of butter in a shorter time than when the ordinary dasher is used.

IMPROVED ROTARY CHURN.

Andrew M. Mortimer, Salt Lake City, Utah Ter.—By suitable construction as a shaft and plates revolve, beaters are vibrated to throw the milk into agitation, and the currents thus formed are broken up by the revolving and stationary bars, throwing the milk into violent agitation, and bringing the butter in a very short time. By withdrawing the shaft the entire operating mechanism can be lifted out of the box for convenience in cleaning the churn.

IMPROVED HAY LOADER.

Thomas Elliott, Peterborough, Ontario, Canada.—The hay is elevated by endless belts. The novel feature in the device relates to means whereby the rake teeth may be conveniently adjusted closer to or farther from the ground, as desired.

IMPROVED AGRICULTURAL STEAMER.

Ruliff W. Ruliffson, Stamford, N. Y.—This consists in a fire box made of sheet iron, open at top and bottom, provided with a door a draft opening, a pipe collar, and crossbars, to assist in supporting the cooking vessel. Said vessel is also made of sheet iron, and has a flat bottom to rest and fit upon the upper edge of the fire box and upon the cross bars. Upon the bottom of the vessel is a rack to support the false bottom, which is perforated with numerous holes to allow the steam to pass through. The rack and perforated false bottom support the grain or vegetables above the water, and prevent any possibility of their burning upon the bottom of the vessel; and they also prevent any dirt that may be upon the vegetables to pass through and settle upon the bottom of the vessel.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED AXLE SET AND GAGE.

William C. Carlton, Boise City, Idaho Ter.—This is an improved instrument for setting and laying off axles, and getting the gather and dish of wheels. In applying the instrument to use, it is placed upon the axle, and right hand or double clamps are adjusted to the shoulder and end of the right hand spindle, and the left hand or single clamp is adjusted to the shoulder of the left hand spindle. To obtain the dish of the wheel, the instrument is placed across the wheel close to the hub, with the inner prongs of the double clamps against the tread of the tire. A sliding rule is moved to the center of the hub, and is secured with a screw, thus getting the half diameter of the wheel. The instrument, after having been set and an axle made to conform to it, will bring the wheel on a plumb spoke.

IMPROVED CHIMNEY.

Mercy C. Halsted, St. Louis, Mo.—The smoke is conveyed upward from the furnace at the cellar of the building, between the inner surface of an exterior cylinder and the outer surface of the interior cylinder, by a spiral flue. The interior cylinder is divided by a vertical partition wall into two passages, of which the larger one is designed for supplying fresh heated air to, and the other for carrying off the effete air from, the apartments.

IMPROVED VENTILATOR.

William H. Maxfield, Maysville, Harlan P. O., Ind.—The box fits in a collar, which is set in a hole in the ceiling or wall. From the box a pipe leads to the chimney flue; and in the lower part of the box is a grate formed of two sets of parallel slots, placed the one above the other, and so arranged that the upper set may be slid over the spaces between the bars of the lower set, to close, or partially close, the said spaces. The upper set is moved by a lever.

IMPROVED COMBINED CHIMNEY TOP AND VENTILATOR.

Joseph Harmon, Decorah, Iowa.—This consists of a ventilating tube that surrounds the chimney, and is enlarged at the chimney top, the enlarged part being connected by draft apertures at the bottom of the enlarged part, and at the sides of the base with the outer air, to draw the air drawn up to and out at the exit openings of the top cap piece.

NEW TEXTILE MACHINERY.

IMPROVED FRINGE-TWISTING MACHINE.

Samuel Mortimer, West Troy, N. Y.—The object of this invention is to improve the mechanical construction of the machine for twisting fringes. There are six novel devices introduced, the nature of which cannot be explained without drawings. The invention consists in sockets attached to the guide rods to receive the stems of the shells; in a spring with the jointed upper twisting finger; and in the spiral spring with the shaft that carries the lower twisting finger. A toothed roller and its spiral springs are combined with the front bar of the carriage; and there is a combination of the spiral springs with the fingers of the inner shell.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED GROCER'S SAMPLE CASE.

Hans A. Winden, Clermont, Iowa.—This triangular case is provided with an accurately fitting block of corresponding form. Said block rests on spiral springs which keep the cross partitions, inserted in the face of the block, in contact with the under side of the glass cover of the case, and thus prevent the samples from becoming mixed or wasted.

IMPROVED MASONIC BADGE.

James McCoy, Ypsilanti, Mich.—This consists of a masonic badge in which the legs of the compasses are pivoted to be carried above or below the square. There is a spring-acting pin, that slides by a thumb piece in guide projections at the back, to be readily attached to the coat.

IMPROVED PIANOFORTE ACTION.

Martin C. Knabe, Philadelphia, Pa.—This is an improved device for withdrawing the check from the butt nose, to allow the hammer to drop quickly and freely from the string after striking a blow. It may be adjusted to withdraw the check at any desired point.

IMPROVED PASSENGER REGISTER.

William Mehan, Hoboken, N. J., assignor to himself, Hezekiah Butts, and John Egan, of same place.—This consists in the arrangement of a cam and friction roller with a turnstile and movable platform, so constructed that the person passing the turnstile must step upon the movable platform, by the motion of which, under control of the cam, the apparatus is made to register once, and cannot be made to do more or less.

IMPROVED BREAST STRAP FENDER.

John C. Look, Bremen, O.—This consists of a wearing plate for the breast strap of a harness, made in two parts, hinged together. On one part is a brace for the joint and support for the neck yoke strap, and on the other forks to throw out the neck yoke ring, so that the latter is locked in the fender when the strap is in position. When it is disconnected the ring is unlocked and thrown out by flexing of the plate on the joint. The fender is attached to he straps by loops, through which straps are passed.

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

G. E. P. will find a description of a cheap galvanic battery on p. 234, vol. 34.—J. M. will find a good recipe for shoe blacking on p. 27, vol. 34.—H. L. G. will find directions for coloring gold on p. 43, vol. 30.—C. H. will find a recipe for a depilatory on p. 186, vol. 34.—J. R. C. will find something on moles in the skin on p. 347, vol. 32.—W. S. will find directions for straightening wire on p. 299, vol. 34.—L. R. P. will find a good recipe for mucilage for labels on p. 202, vol. 31.—H. R. E. will find directions for making printing inks on p. 298, vol. 31. A cheap battery is described on p. 234, vol. 34.—A. A. A. will find a recipe for a cement for fastening glass to brass on p. 117, vol. 32.—H. N. H. should varnish his brass with the preparation described on p. 310, vol. 35, for silver.—H. E. N. will find directions for making an incubator on p. 273, vol. 33.—F. W. M. will find directions for galvanizing iron on p. 346, vol. 31.—P. will find an answer to his query as to speed of navy cutters on p. 251, vol. 35.—R. T. M. will find an explanation of his wagon wheel difficulty on p. 298, vol. 31.—E. H. will find a formula for the width of belting on p. 244, vol. 34.—A. B. C. will find an explanation of the transmission of vocal sounds by electric wires on p. 327, vol. 33.—E. B. will find an article on taking the kinks out of saws on p. 11, vol. 33.—J. H. will find directions for lacquer or bronze on cast iron on p. 11, vol. 33. For japanning cast iron, see p. 122, vol. 27.—D. & D. will find directions for enameling leather on p. 122, vol. 27.—M. S., F. G., J. A. T., C. A., J. C. C., G. A. C., 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) A. E. H. says: I send you by this mail a piece of copper tube taken from a coil used for cooling brine. You will notice that there has been a chemical action which destroys the copper, but this only occurs when it is threaded, or close to the threads. What is it that produces this action? The coil was put together with plumbago and oil as a lubricant. A. It seems very probable that the corrosion was caused by the galvanic action set up between the copper and carbon (graphite) in contact with moisture and the fatty acids in the lubricant. The salt water is in no way accountable for the corrosion.

(2) W. H. A. says: Please give me the theory, causes, and circumstances attending the undertow on the sea coast. A. The following statement, from Maury's "Physical Geography of the Sea," may be of interest in this connection: "Suppose the case of a long trough, opening into a vat of oil, with a partition to keep the oil from running into the trough. Now suppose the trough to be filled up with wine on one side of the partition to the level of the oil on the other. The oil is introduced to represent the lighter water as it enters either of these seas from the ocean, and the wine the same water after it has lost some of its freshness by evaporation, and therefore has become salter and heavier. Now suppose the partition to be raised, what would take place? Why, the oil would run in as an upper current, overflowing the wine, and the wine would run out as an under current."

(3) J. O. G. says: You state under the heading of "English Fire Engines" that the engine lifted the water 32 feet in a perpendicular line. Is it possible for a fire engine, with its many joints and imperfections, to raise a column of water 32 feet without the intervention of a foot valve in the suction? A. From all that appears in the statement, we should say that the engine just lifted the water slowly, which would be quite possible, with a very accurately constructed pump.

(4) G. A. A. says: I am building a steam chimney 90 feet high with 6 feet base, with a round flue 2 feet across inside; should this flue run to the top of chimney or not, to get better draft? A. To the top, as we understand you.

1. For a lightning rod, will common gas pipes do? A. It will be better to make the rod of a single piece of metal, with a copper tip added. 2. Is it necessary in connecting lightning rods with city water pipes to connect underground, or can I connect it with a right and left coupling above the ground, say inside the shop? A. It is better to connect it underground.

I intend to reset my boiler, which is a 50 horse power tubular, horizontal. My principal fuel is wet tan. How shall I set the boiler to get best results? A. See p. 339, vol. 31.

(5) O. T. B. asks: How many cubic feet of water per minute will a cast iron pipe 150 feet long of 6 inches bore discharge, if laid horizontally, receiving its supply under 12 inches head and discharging into open air? A. About seventeen, if the interior of the pipe is smooth.

(6) V. asks: Can the water in a newly cemented cistern of 4,000 gallons, which is strongly impregnated with lime, be made fit for drinking, cooking, and washing with by the use of alum? If so, what quantity should be used? The cistern has been filled and emptied; and having again been filled with rain water, it is not convenient to empty it again. A. The cement lining of the cistern has evidently been allowed a sufficient length of time in which to set and dry perfectly; the result is that the water has dissolved out a considerable quantity of the lime. The greater part of the lime may be removed as sulphate by the addition of a calculated quantity of alum (sulphate of alumina and potash). Take a gallon of the water in question and add to it a strong aqueous solution of alum, of a known strength, in varying quantities, until the precise quantity of the reagent necessary has been determined. This quantity, multiplied by the number of gallons contained in the cistern, will be the total amount required. This is one of the best methods that can be employed in such cases; but it is somewhat objectionable where the water is to be employed for cooking and drinking purposes, as it leaves in solution in the water a notable quantity of the soluble sulphate of potash. There are many other methods by which the lime might be removed from the water; but owing to the poisonous character of the reagents or the impracticability of their application in your case, they are out of the question. Where the water is to be used only for washing purposes, perhaps the cheapest plan would be to precipitate the lime by the addition of a solution of common soap. This answers the queries of several other correspondents.

(7) J. P. M. asks: Will mercury evaporate when heat is applied? How long will it last under a constant heat of 104°? A. Mercury is volatile under the temperature mentioned, and will evaporate, but not very rapidly.

(8) J. W. B. says: Please give the chemical analysis of quinine. A. The sulphate of quinine $[(C_{20}H_{24}N_2O_2)_2SO_4+14(H_2O)]$ is the medicinal preparation commonly called quinine. The vegetable alkali *quinia* is obtained from the yellow bark (*cinchona cordifolia*), in which it occurs mixed with cinchona, and combined with quinic and quinotannic acids.

(9) T. M. asks: 1. How many cubic feet of carbonic acid gas can be obtained from 1 lb. of marble dust? A. About five. 2. What amount of acid per lb. is needed? A. About ½ lb. This is the calculated amount; it will require something more than this in practice.

(10) J. D. says: Please give me a recipe for filling the grain of sole or other heavy leather, and making it firm and stiff so that it will resist pressure and dampness, which will not rot or destroy the durability of the leather? A. We understand that very good results have been obtained in similar cases by the use of carbolic acid, but cannot furnish you with the details of the process. It is necessary to have the leather very dry, and to force the acid into the pores by hydraulic pressure.

(11) J. H. N. asks: Does everything that exists on the face of the earth contain poison? A. Every known substance, if taken in excessive quantity, will prove destructive to human life.

(12) W. S. D. says: 1. I have a keel boat 11 feet 2 inches long, 3 feet 2 inches wide. She draws 16 inches when loaded. I have an engine, inverted cylinder style, with link motion. Cylinder is 2½ inches in diameter with 4 inches stroke; the engine weighs 100 lbs. without wheel. Is the engine (with boiler in proportion) too large for the boat? Would it do to build a boiler a little too small, say 18 x 30 inches, and run the engine with a ⅜ or ½ cut off? What should be the diameter and hight of fire box, and the size and number of tubes for upright boiler of that size? A. Build a boiler large enough to supply the engine. You can use tubes 1¾ or 2 inches in diameter. 2. What should be the diameter and pitch of propeller? A. It may be 15 inches in diameter, and have 2 to 2½ feet pitch.

(13) T. J. G. says: In a book of instruction on shooting the following rule is laid down: "When the sun shines from the left, it will illuminate the right side of the back sight and the left side of the fore sight; and when these two points are aligned on the target, it will cause the ball to go to the right of the mark, and *vice versa*." Now I maintain the very opposite, that is, that the ball will go to the right in this case. Who is right? A. As the sights on a rifle are usually arranged, we do not see how the statement in the book will hold good.

(14) J. H. D. asks: What substance, suitable for a traveller's pocket, will, by burning, best disinfect the air of a room? A. The vapor of burning sulphur (sulphurous acid) is one of the best of disinfectants, but has the disadvantage of a very pungent odor, and in any considerable quantity is irrespirable. Chlorine or bromine water, chloride of lime (hypochlorite of lime), carbolic acid, etc., are very powerful disinfectants, so that a small quantity only will be requisite. Such a quantity may be carried in the pocket. These will not burn, but an ethereal solution of bromine probably will.

(15) E. H. asks: 1. In speaking of cement to be used in making concrete buildings, do you mean ordinary water lime, or some of the imported cements, such as Portland, etc.? A. Rosendale and like cements of this country make a very good concrete. Portland cement makes a very superior concrete. 2. There are concrete buildings in this vicinity, the mortar of which is composed of sand and gravel mixed with quicklime only; would such buildings be durable? A. Walls of concrete in which common lime is the only binding ingredient cannot be depended upon for a permanent career in this climate. 3. Would concrete make a good building for a shop in which to run woodworking machinery, or would the jar have a tendency to crumble the walls? A. When properly constructed and time given them to harden, there is no reason why they should not answer well. 4. How thick ought the walls to be for a building 30 x 40 feet, 16 or 18 feet high? A. Such a building would require a girder through the center if two stories in hight, and the walls would do at 14 inches thick; if one story in hight, the walls should be 18 inches thick. 5. Would concrete do for the foundation on ground overflowed by water during part of the year, or would it be preferable to lay up a stone wall with hydraulic mortar? A. Concrete would do.

What is the rule for finding the size of shafts for transmitting a given horse power, speed being given? I wish to know how large a line shaft 30 feet long, to run at 300 revolutions per minute, would be needed to transmit the power of a 12 horse engine. A. About 1¾ inches in diameter.

(16) C. asks: What is the weight of a 13 inch cast iron ball? A. About 300·37 lbs.

(17) J. H. L. says: 1. I am about to erect an outside cellar of brick; it is to be entirely separate from any other building, and I want to have it frost-proof. It is to be 18 x 22 outside; the outer wall will be 9 inches and the inner wall 4 inches thick, with a space of 12 inches between the two walls. Should this 12 inch space be filled in with something, or left open, to secure a perfectly frost-proof building? A. If your cellar is to be sunk into the ground its whole depth, or the greater part thereof, it would be better to make its outside wall 13 inches, the space 6 inches, and the inside wall 4 inches, the floor joists being extended to rest upon the exterior wall. The intermediate space will answer without filling, if made tight. 2. What is the best means of ventilation? A. A slight ventilation may be provided for the cellar itself without materially reducing the temperature.

(18) J. R. B. asks: Does the ostrich, after laying her eggs in the sand, brood them like other birds, or does she leave them to be hatched by the sun? A. She incubates at night, and leaves them in the sun in the day.

(19) X. says: We are digging a reservoir to supply a trough for horses and cattle on the street; the reservoir is ¼ mile away, fall about 30 feet. Wood pipe, about 2 inches internal diameter, is used. The reservoir is 17 feet deep. Is it economical to dig the trench for laying the pipe as deep as the reservoir, that is, 17 feet? They are doing this for 25 or 30 rods, in order, as they say, to take all the water from the reservoir (or in other words, from the bottom) in a dry season. A. A regularly graded pipe from the bottom of the reservoir will make the surest job, as in many cases siphon pipes have failed to act, mainly, it is thought, from the common cause—the collection of air at the highest point of the pipe. In this case the use of wooden pipes would be likely to add to the difficulty.

(20) A. B. C. says: 1. I have a cast iron frame for a lamp, that has become soiled by smoke and flies. How can I cleanse it for rebronzing? A. Use sulphuric acid diluted in water. 2. How can I put on the bronze so that kerosene smoke will not remove it? A. Try the recipe given on p. 231: vol. 32.

(21) J. M. B. asks: Which is the best way to make a telescope speculum, 5 or 6 inches in diameter? A. We would advise you to make your reflector of glass, and silver it. Unless you have had some experience in working specula, you will find it not easy to make and not very good when made. Take a thick piece of glass and grind and polish it to the curve you wish. If you wish it to have 5 feet focus, you must grind it on a curve of 10 feet radius.

(22) W. L. W. asks: What substance could I put on the sights of my rifle to make them visible in the dark? A. Put a little phosphorus on the foresight.

(23) W. H. E. says: I am copying photographs on glass, in oil paints. Can you give me a recipe for a mixture to make the photograph stick to the glass, so that it will not peel off or leave a shiny appearance between the picture and the glass? A. Use a paste made by mixing starch with a little cold water; then add boiling water, and stir until it is of a uniform creamy consistence. Press out the air bubbles and excess of paste from between the picture and glass, and let dry slowly.

(24) P. H. C. asks: How can I obtain the meridian altitude of the sun for any place at any given date? A. From 90°, subtract the latitude of the place, which gives the co-latitude or its equal, which is the distance from the horizon to the equator; then, if the sun is north, add his declination, and if south, subtract it.

(25) E. C. says: In building a new house, second hand brick were used for partition walls, some of which were from an old chimney. Plastering is laid directly upon the bricks, then hard finish and paint. Several coats of the latter fail to cover a stain which comes through from the bricks. What is the remedy? A. The most effectual remedy is to cut out the smoky bricks and replace them with new ones.

(26) E. S. W. asks: 1. How can I construct a portable retort, to make gas of coal, wood, or grease, to fill a 30 x 40 inch gas bag? How large a retort will be required? A. A retort about 18 inches long, having a diameter of about 10 inches and a movable cap at one end, will answer. The retort may be of iron. 2. What degree of heat is needed to bring the gas over? A. The heat of a good coal or charcoal fire will be requisite. You will find descriptions of gas apparatus in any good work on chemistry or chemical technology.

(27) B. S. C. B. says: I have an astronomical glass of 60 inches focus. How can I fix it so that I can look at the sun with impunity, overcoming the extreme brightness? A. Put a diaphragm over the object glass with ¼ inch aperture; then use a neutral tint shade glass between the eye and eyepiece.

(28) J. E M. asks: Is there a non-co ductor of magnetism? A. Yes. An interval of space.

(29) C. E. T. says: An "Engineers' Pocket Book" states: "Water may be reduced to 5° Fah. if confined in tubes of from 0·003 to 0·005 inch in diameter; this is in consequence of the adhesion of the water to the surface of the tube, interfering with a change in its state. Is this true, and if so, how do you know it? A. We do not know whether it is true or not. It might be tested by observing whether the water would flow in the tube at this temperature. Probably the author has some authority for his statement, although he does not give it.

(30) T. M. says: 1. I. F. states that, in building a grist mill, to use 48 cubic feet of water per second, with a 48 inch pipe to convey water, the flow must be 4 feet per second, or 240 feet per minute. Would not a larger pipe or penstock give better results with less velocity, say 100 feet per minute? A. There might be some gain, but possibly not enough to pay for the increased price of pipe. 2. What would be the difference in the velocity of water under any head, say 15 feet, with a draft tube (and vacuum pipe) or without one? What is the formula for velocity in a vacuum? A. Without the draft tube, the total head is that of the water. With the draft tube, the head is increased by the weight of the atmosphere, equivalent, for a perfect vacuum in the tube, to a column of water 34 feet high.

(31) M. B. L. says: I am making a magneto-electric machine, in which I have two 9 inch permanent horseshoe magnets. I tried a pair of electro-magnets $1\frac{3}{4}$ inches long, with a diameter of $1\frac{1}{4}$ inches and $\frac{1}{2}$ inch core; the resistance of the magnets is 300 ohms (each spool 150 ohms). The current from these could not be felt. Please let me know what the resistance of a pair of spools for such a machine should be. A. The resistance of your spools is correct, and you ought to get a powerful shock from your machine. If you do not get it, the fault will probably be found in your connections.

(32) C. E. A. says: The following is a cheap device for oiling loose pulleys: Cut a shallow screw thread, of 1 inch pitch, right and left hand, nearly the whole length of the eye of pulley hub (the threads can be cut after the pulley is bored and while it is in the lathe). Then it will readily be seen that, while the pulley is in motion, the oil will follow in the grooves from right to left and left to right, nearly the whole length of pulley hub, without any chance to escape, as the groove ends within $\frac{1}{4}$ inch from the end of hub. It will be necessary to fit a plug in the oil hole, as the centrifugal force will have a tendency to throw the oil out. A. This is a very good idea where the bearing surface is ample.

(33) J. M. L. asks: How can I make a fluid that, when a stick or paper are dipped into it, and exposed to the air, will take fire? A. Phosphorus is slightly soluble in ether, more so in benzole or turpentine. If a solution of phosphorus be made in either of the above solvents, and a drop of the solution be allowed to evaporate in the air, the phosphorus, which is left behind in a very finely divided condition—thus exposing a very extended surface for oxidation—takes fire spontaneously. If paper or other similar combustible material be moistened with one of the above solutions and subsequently allowed to dry in a warm air, it will become inflamed at the moment of the ignition of the phosphorus; this flame, however, will speedily be extinguished by the coating formed on its surface by the deposition of the white anhydrous phosphoric acid. The best solvent for phosphorus is bisulphide of carbon.

(34) H. B. asks: How can I make hyposulphite of lead? A. Add a slight excess of an aqueous solution of acetate of lead (sugar of lead) to a strong solution of hyposulphite of soda; the white precipitate which forms is hyposulphite of lead. It is very sparingly soluble in water, but dissolves in alkaline hyposulphites with the formation of double salts. It may be dried at 212° Fah. without decomposition; but at a higher temperature it blackens and gives off sulphurous oxide, and leaves a residue of sulphate and sulphide of lead. When heated in the air it glows like tinder.

(35) J. D. B. asks: 1. What will make gelatin insoluble in water, without losing its adhesive property? A. If treated with a strong solution of bichromate of potassa in water, and then exposed to strong sunlight, any form of gelatin is rendered superficially insoluble. Tannic acid renders gelatin insoluble by forming with it an insoluble tannate. Gelatin is also rendered insoluble by solutions of corrosive sublimate. 2. Is glue or gelatin soluble in ether, and how rapidly does it dissolve therein in comparison with water? A. It is insoluble in ether, but dissolves to some extent in a mixture of strong vinegar or acetic acid and alcohol (vinegar 4 parts, alcohol 1 part: heat.) 3. What acid is best for etching type metal? A. Use nitric acid. 4. Is kerosene injurious to leather? A. Kerosene is liable to render the leather brittle and reduce its tenacity by removing a part of its natural oil. 5. Inking rollers can be kept soft in kerosene, but will the kerosene have an injurious effect? A. If the rollers are of the same composition as those usually employed by printers, the oil will not injure them.

(36) W. S. V. says: O. W. J. can preserve citron by boiling the sliced fruit, in enough water to cover it well, until tender; then to 2 lbs. fruit add 1 lb. sugar (A) and 1 lemon, sliced, and cook until the sirup is thick. The first water should be poured off, and as much more added before adding the sugar, etc. The better the sugar, the better the sauce.

(37) Professor C. W. MacCord says: You give place to the statement that the curve described by a point in the connecting rod, between the centers of the crank pin and the crosshead journals, is a perfect ellipse: This statement is correct if the length of the connecting rod be equal to that of the crank, and the stroke of the crosshead four times as great, that is, twice the throw of the crank, but not otherwise.

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

J. H. P.—No. 1 is sulphuret of iron. No. 2 is graphite in quartz rock.—J. B. P.—The markings are a thin coat of oxide of manganese, formed by deposition between surfaces nearly in contact.—E. A. C. D.—It is carbonate of soda mixed with some sulphate of soda.—A box, with no name or address on it, contains one of the *epeira*—large garden spiders.—O. S.—The gelatin sent is prepared from the finest material, tinted with one of the aniline colors, by passing it, while in a viscid condition, between rollers.

T. H. B. asks: How can rice imitations of alabaster ornaments be made?—A. R. asks: How can I brighten bronze castings?—J. K. asks: What paint is the most durable for coating mirrors over the silvering?—W. D. asks: Why, in English coaches, are the hind wheels turned in at the base instead of being at right angles with the axle?

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 Trisection of an Angle. By A. B., J. B., and H. A. H.
On the Russian Frost Plant. By J. S.
On the Sun's Retrograde Motion. By J. H.
On Measuring the Width of a Stream. By W. A. D.
On the Canadian Patent Office. By F. L. J.
On the Sun's Heat. By H. S. W.
On the Ball Puzzle. By J. D.
On Hats and Bald Heads. By J. H.
On Professor Huxley's Lectures. By W. M.
On Land Waterspouts. By S. McD.

Also inquiries and answers from the following:
W. W. P.—C. F. G.—J. W. H.—R. J. L.—J. K. F.—C. M.—W. K.—N. J.—J. C. D.—G. L. P.

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 the best utensil for steaming cattle fodder, etc.? Who makes machines for making square biscuit tins? Who sells phosphor bronze? Whose is the best apparatus for extracting lead from ores?" 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.

VALUE OF PATENTS,

AND

How to Obtain Them.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent, even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & CO. during the THIRTY years they have acted as solicitors and publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & CO. to do everything appertaining to patents CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents*. This is the closing inquiry in nearly every letter, describing some invention, which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his right.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & CO., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such a search, make out a written description of the invention, in your own words, and a pencil, or pen and ink sketch. Send these, with the fee of $5, by mail, addressed to MUNN & CO., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

To Make an Application for a Patent.

The applicant for a patent must furnish a model of his invention, if susceptible of one; or if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft or postal order, on New York, to the order of MUNN & CO. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; Russia, 70,000,000. Patents may be secured by American citizens in all these countries. Now is the time, when business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Patents obtained in Canada, England, France, Belgium, Germany, Russia, Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are granted, at prices greatly reduced from former rates. Send for pamphlet pertaining specially to foreign patents, which states the cost, time granted, and the requirements of each country. Address MUNN & CO., 37 Park Row, New York. Circulars, with full information on foreign patents, furnished free.

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In order to apply for a patent in Canada, the applicant must furnish a working model, showing the operation of the improved parts; the model need not exceed eighteen inches on the longest side. Send the model, with a description of its merits, by express or otherwise, to Munn & Co., 37 Park Row. Also remit to their order by draft, check, or postal order, the money to pay expenses, which are as follows: For a five years' patent, $50; for a ten years' patent, $75; for a fifteen years' patent, $100. The five and ten years' patents are granted with privilege of extension to fifteen years.

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Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars, address MUNN & CO., 37 Park Row, New York.

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Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

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We recommend to every person who is about to purchase a patent, or about to commence the manufacture of any article under a license, to have the patent carefully examined by a competent party, and to have a research made in the Patent Office to see what the condition of the art was when the patent was issued. He should also see that the claims are so worded as to cover all the inventor was entitled to when his patent was issued; and it is still more essential that he be informed whether it is an infringement on some other existing patent. Parties desiring to have such searches made can have them done through the Scientific American Patent Agency, by giving the date of the patent and stating the nature of the information desired. For further information, address MUNN & CO., 37 PARK ROW, New York.

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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.

Continued on page 344.

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

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Contents.

(Illustrated articles are marked with an asterisk.)

THE SCIENTIFIC AMERICAN SUPPLEMENT.

Vol. II., No. 48.

For the Week ending November 25, 1876.

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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 unfrequently 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 enormousiy 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 13 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 ¼ 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.

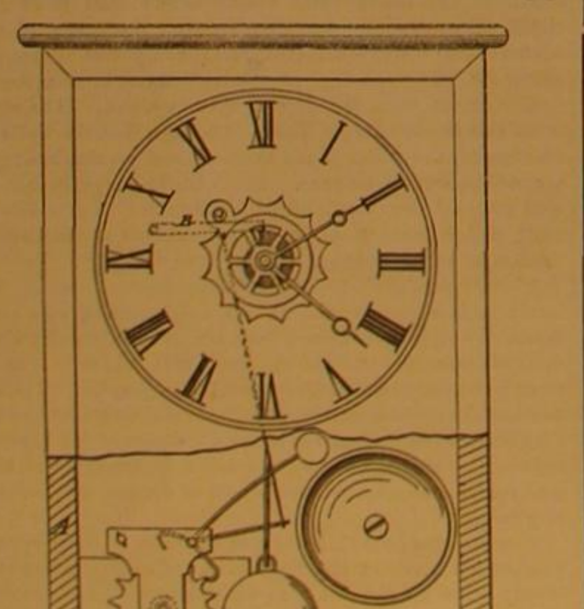
The invention was patented through the Scientific American Patent Agency, September 26, 1876, by Mr. I. J. Gray, of Pentwater, Mich.

In Case of Fire.

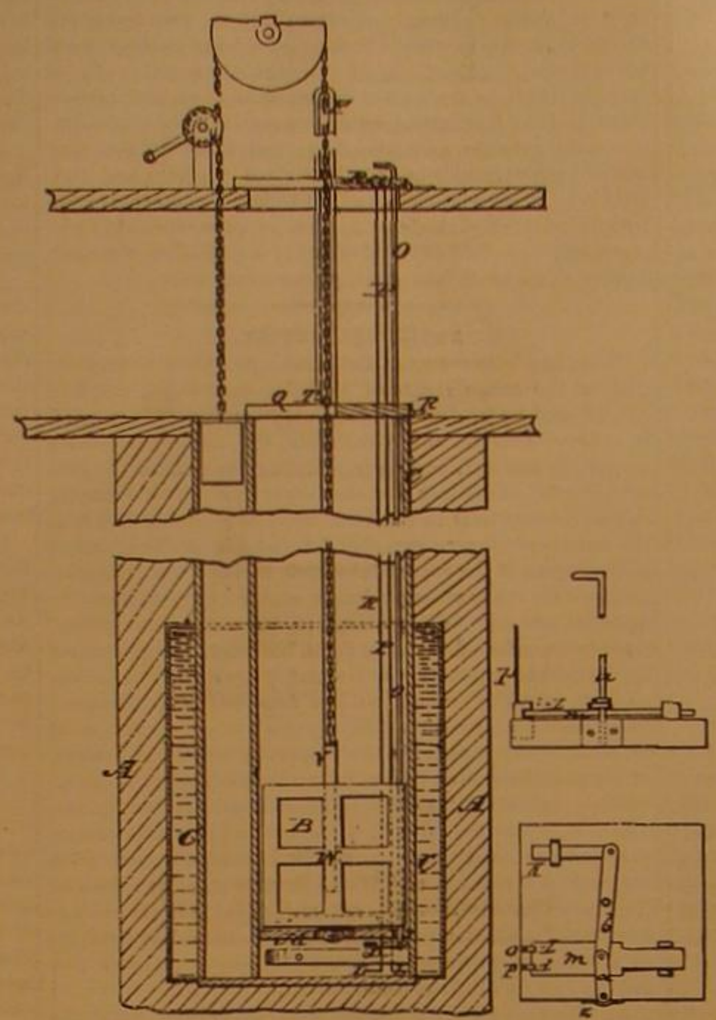
The season is at hand when fires most prevail, and when the precautionary hints of the late Dr. Hall are most important to be heeded. They are as follows: Keep doors and windows of the structure closed until the firemen come; put a wet cloth over the mouth, and get down on all fours in a smoky room; 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 le-



GRAY'S FIREPROOF SAFE.

ver, 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.

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

Fig. 1

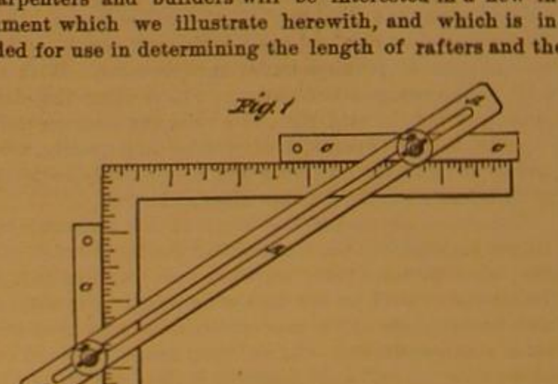


Fig. 2

bevels of their ends, when the width of the building nd 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.

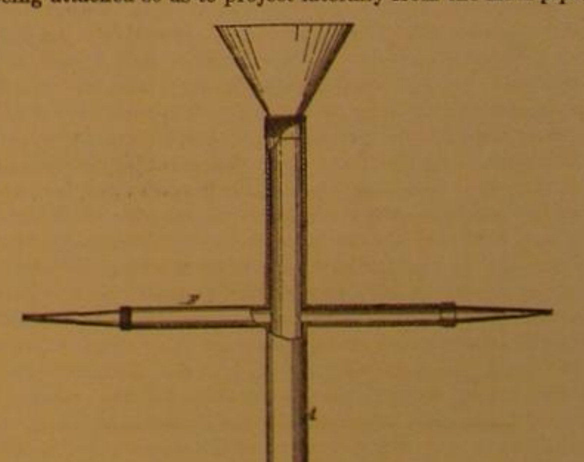
Enameled Cooking Vessels.

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.

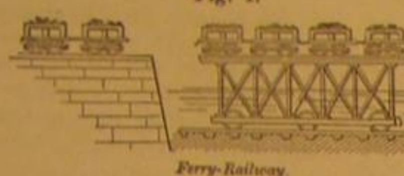
LOCOMOTIVES AND RAILWAYS.

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.



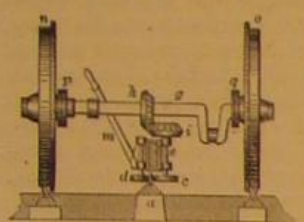
Ferry-Railway.

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.

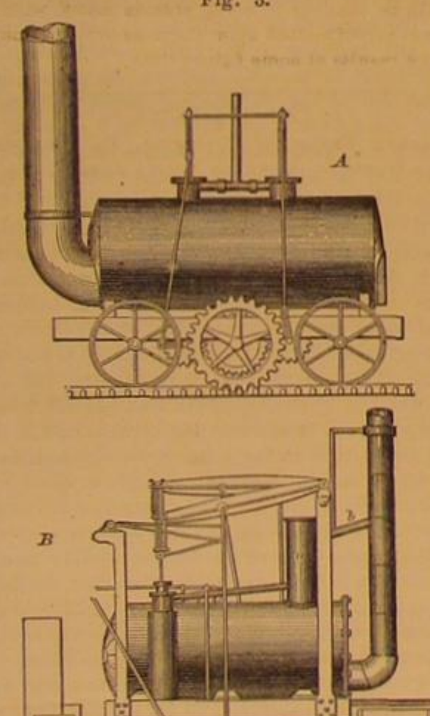


Vignoles and Ericsson's Central Rail.

BLENKINSOP'S AND HEDLEY'S LOCOMOTIVES,

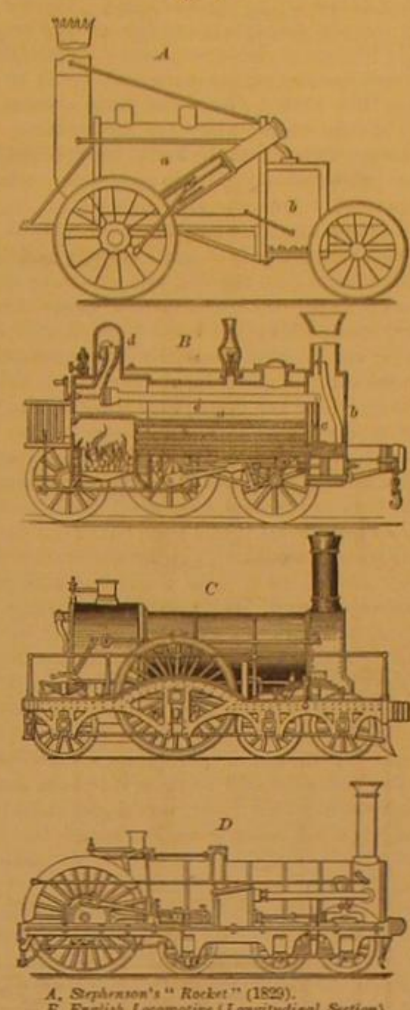
two of the earliest constructed machines. Blenkinsop's locomotive, in 1811, was usefully employed at the Middleton colliery in hauling coals on a tramway, the engine having spur wheels working into a rack on one side of the track. The engine, A, Fig. 3, was otherwise supported on four wheels. The fire 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, $3\frac{1}{2}$ miles distant, and perhaps was the first successful locomotive in regular use. It drew trains of 30 tuns weight at $3\frac{3}{4}$ 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.

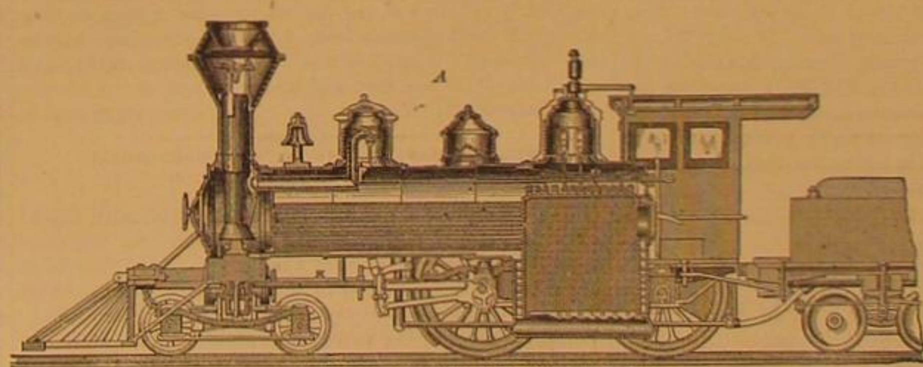
THE "ROCKET."

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 carriages attached, weighing a little over 9 tuns and 10 cwt. The greatest velocity attained was $24\frac{1}{2}$ miles per hour, and the average consumption of coke per hour 217 lbs. See A, Fig. 5. The Sanspareil attained a speed of $22\frac{2}{3}$ 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

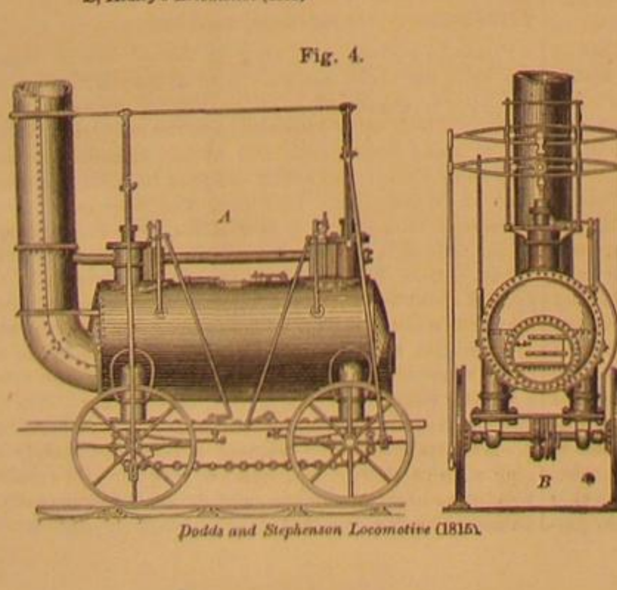


Baldwin Locomotive (Central Longitudinal Section).

Fig. 7.

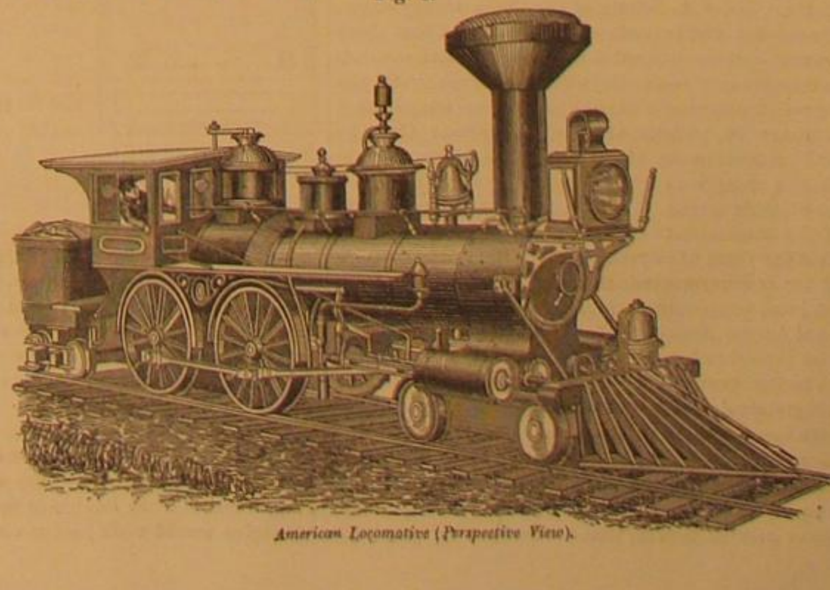
Baldwin Locomotive (End Elevation and Transverse Section).

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 degree 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 driving wheels, 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 70⅔ 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.

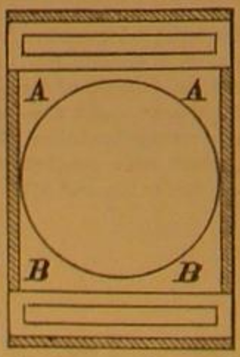
When astronomers, meteorologists, and other scientists, can clearly see the sun and the whole solar system moving retrograde in the plane proper of the ecliptic, they will be much more able to tell how and why phenomena occur; and it will cost them less time and labor too, I think.

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 measuring 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

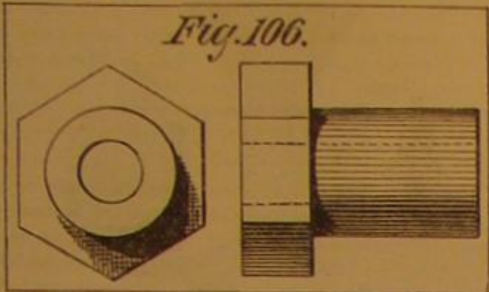


Fig. 106.

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

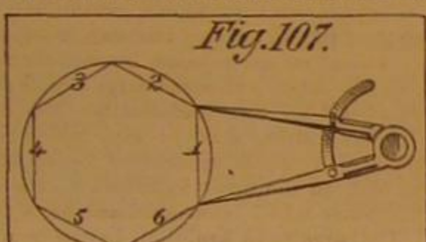


Fig. 107.

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

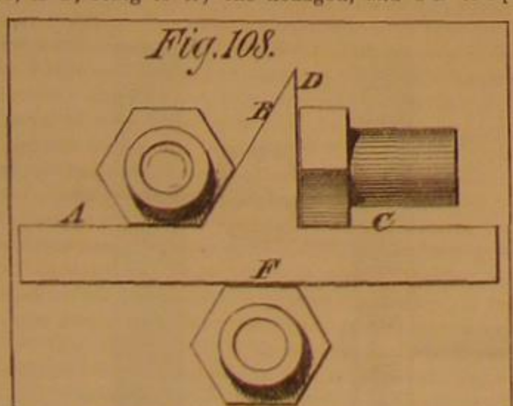


Fig. 108.

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

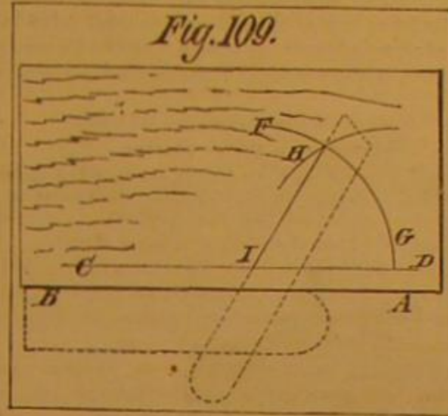


Fig. 109.

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

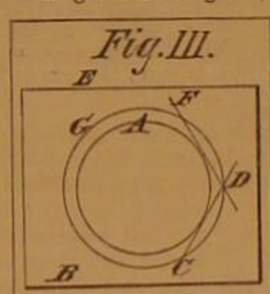


Fig. 111.

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:

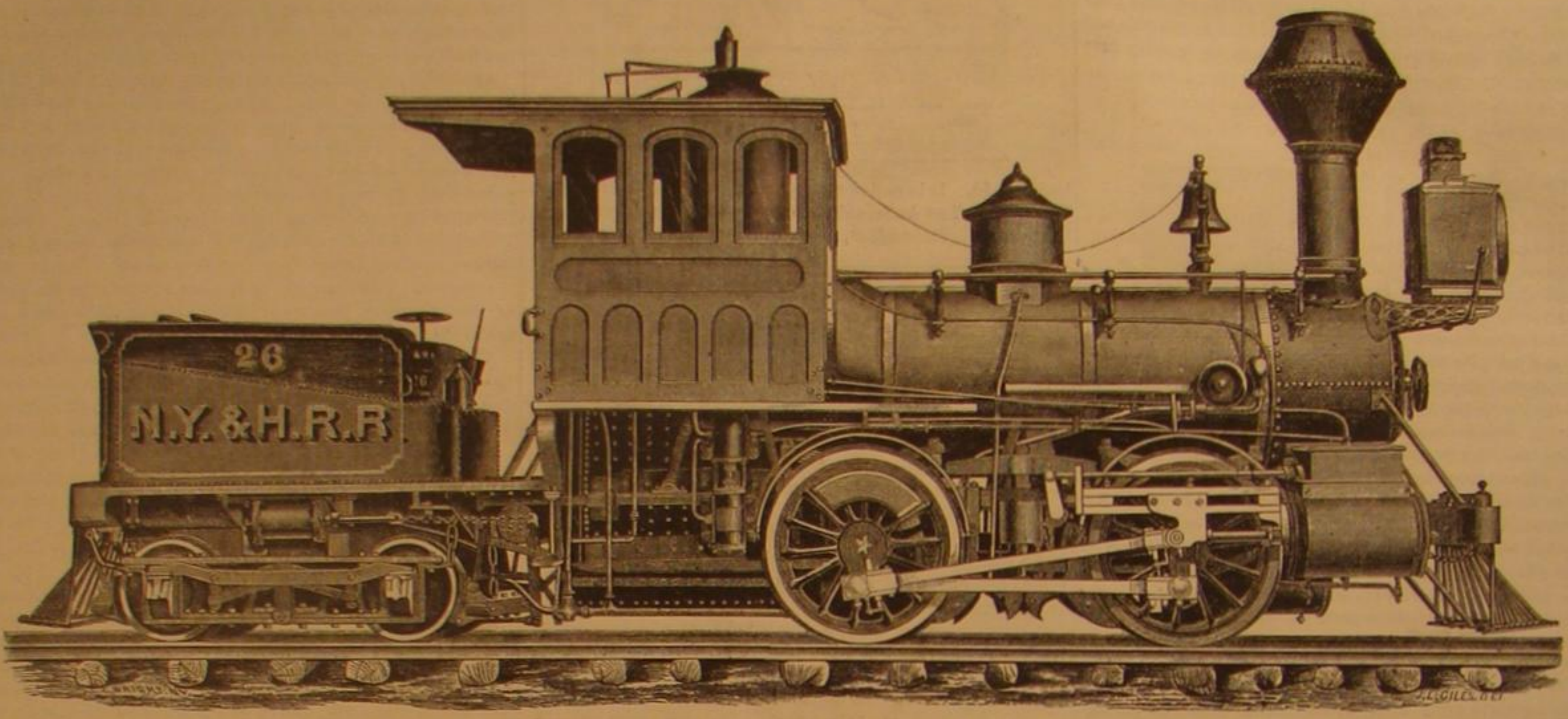
Every merchant and most well-to-do farmers and mechanics have visited some one of our large cities. But never before did they bring their wives and daughters. This last is the marked feature of the travel this year. For the first time, in a number of cases, the wife, mother, and daughters have passed 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, 44½ 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, 2½ inches; size of steam ports, 1x13 inches; size of exhaust ports, 2½x13 inches; throw of eccentrics, 4¼ 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, 3¼ 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.

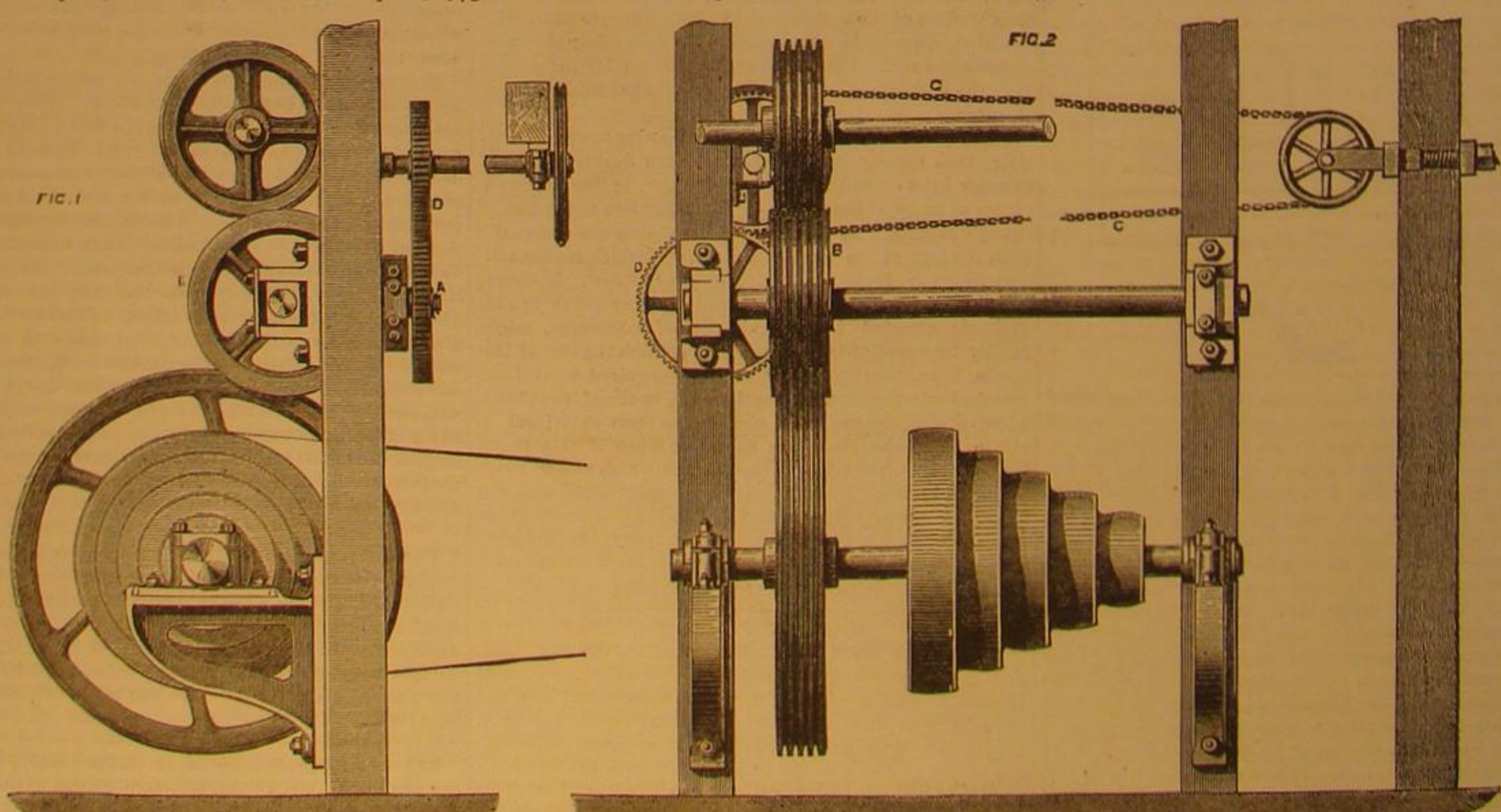
Our engraving shows a new driving gear for lathes, etc., now being introduced by Messrs. Hind, of Nottingham, England. The illustration practically explains itself. Friction wheels are used. That marked B can be wedged out between or withdrawn from the other two by a screw on the axis of A. This latter 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, $6\frac{1}{2}$ 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 $1\frac{3}{4}$ 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 js 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 $1\frac{3}{4}$ 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 $\frac{3}{8}$ inch panels, planed on both sides, can be produced from 1 inch lumber, whereas, by other methods, $1\frac{1}{2}$ 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 $2\frac{1}{2}$ 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 maker 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 12½ 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 $\frac{1}{18}$ 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 extensively 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 hypogœa*) 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 1½ 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 the 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 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 ⅑ 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.]

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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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9,590.—BRACELETS.—H. Carlisle, Jr., Philadelphia, Pa.
9,591.—SPOONS.—H. W. Hirschfeld, West Meriden, Conn.
9,592.—FLOOR OIL CLOTHS.—J. Meyer, Lansingburg, N. Y.

[A copy of any one of the above patents may be had by remitting one dollar to MUNN & Co., 37 Park Row, New York city.

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SCIENTIFIC AMERICAN

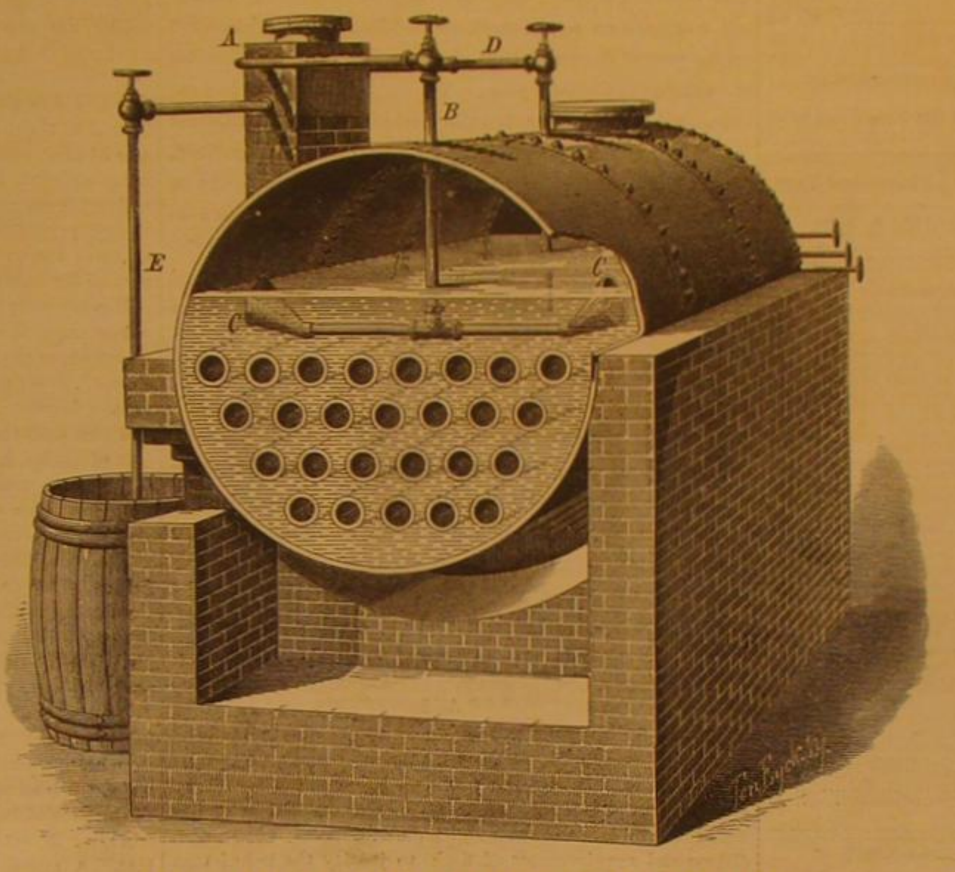
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXV.—No. 23.] [NEW SERIES.] NEW YORK, DECEMBER 2, 1876. [$3.20 per Annum. [POSTAGE PREPAID.]

IMPROVED BOILER CLEANER AND MUD EXTRACTOR.

In the accompanying engraving we illustrate a novel device for the immediate removal of mud and sediment of all kinds, as fast as the same is separated from the water in steam boilers. The impurities are thus given no opportunity to deposit or adhere, and all formations of scale or accumulations of mud, so destructive to boilers and prejudicial to their economical use of fuel, are consequently, as it is claimed, prevented, as is the evil of foaming

The illustration represents the device applied to a return tubular boiler. A is a box or reservoir, located above or upon the arch wall of the boiler. In marine boilers the reservoir may be suspended from the deck frame above. From this reservoir three pipes extend; the first pipe, B, enters the rear part of the top shell of the boiler or generator, and is connected with a horizontal pipe, which is adjusted a little below the water line. At either end of this horizontal pipe is an enlarged mouth, C, partly submerged, but extending a little above the surface of the water, the mouths being of a diameter to allow several inches variation in the water line. The second pipe, D, leading from the reservoir, A, enters the other end of the boiler in similar manner, terminating below the water surface. When the boiler is heated, a constant current of water is immediately established through the bell mouths, C, and pipe, B, filling the reservoir, A; and, cooling to a certain extent, it returns to the boiler by the pipe, D. It will be observed that the up flow pipe is placed about midway between the fire bridge and the back end of the boiler, at a point where the water is presumably hottest. On the other hand the down flow pipe enters the front or cooler portion of the water; and while the water may rise and fall in the boiler to any moderate extent, the enlarged mouths, C, will constantly maintain a current (free from steam) from the surface. As the sediment and impurities are chiefly separated from the water by ebullition, in that part of the boiler where the horizontal pipe, C, is located, they are immediately drawn in by the current and carried into the reservoir, A; here the current, weakened by expansion, can support the impurities no longer, and they settle in the reservoir, and are retained until blown off through the third pipe, E, as seen in the engraving. The reservoir may be located at any desired point above the level of the water line, as most convenient, and occupies no appreciable room. It usually holds about three gallons of water.

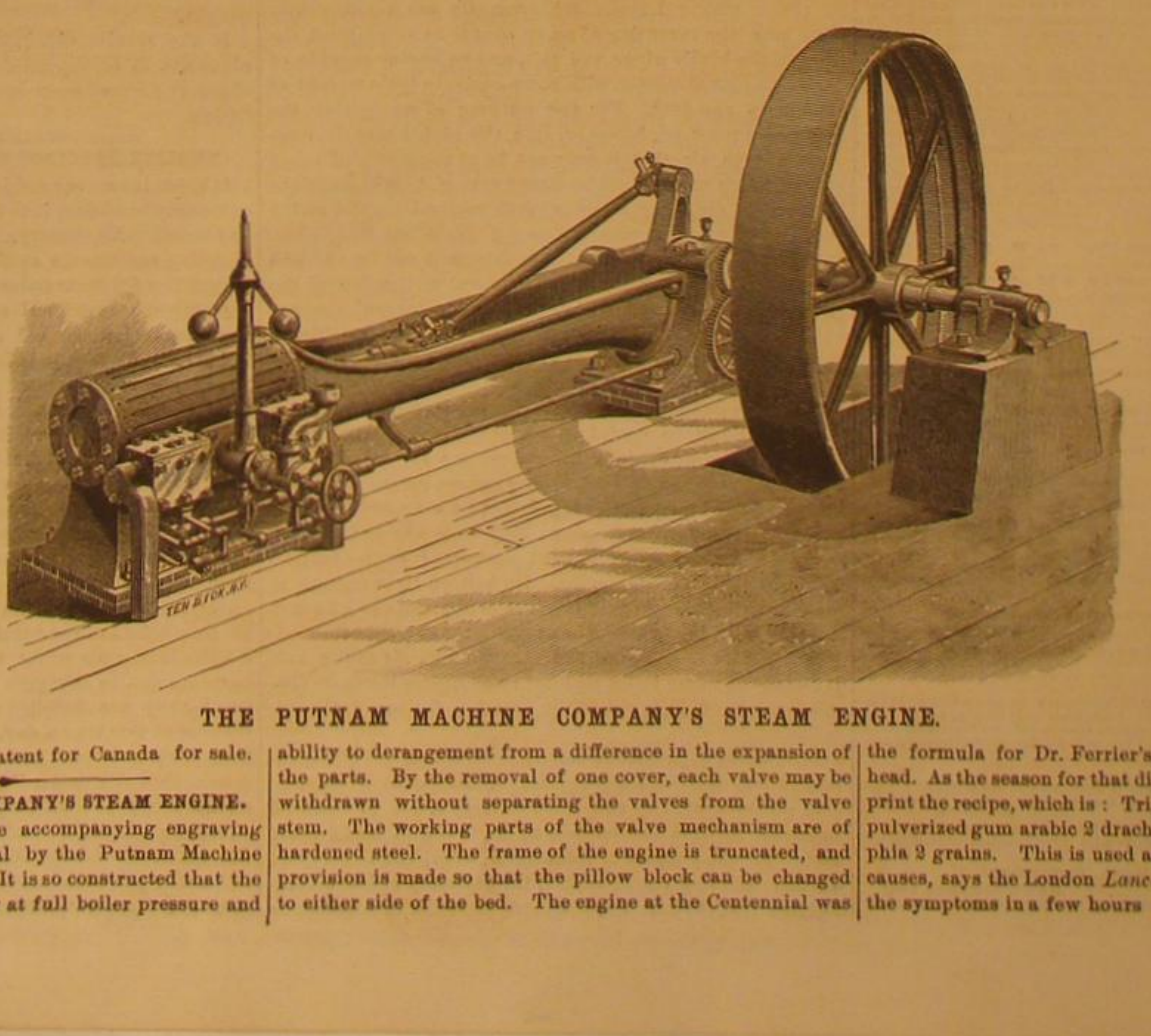


KEMP'S BOILER CLEANER AND MUD EXTRACTOR.

The invention has now undergone tests for over two years, and is claimed to have proved its efficiency, numerous testimonials from the many practical engineers in Canada and mill men on the Saginaw river, as well as owners of steamboats plying on that turbid and saline stream, bearing witness to that fact.

For fire box boilers it is well adapted, preventing, we are informed, all accumulations of sediment in the water legs; while after four week's run, no sediment has been found in the boiler, the old scale meantime becoming loosened and dropping off. The invention is applicable to all kinds of boilers, single or in batteries.

Patented August 17, 1875. For further particulars address James F. Hotchkiss (owner of the patent), Bay City, Mich. Patent for Canada for sale.



THE PUTNAM MACHINE COMPANY'S STEAM ENGINE.

THE PUTNAM MACHINE COMPANY'S STEAM ENGINE.

The engine represented in the accompanying engraving was exhibited at the Centennial by the Putnam Machine Company, of Fitchburg, Mass. It is so constructed that the steam is admitted to the cylinder at *full* boiler pressure and at any point of the stroke, the point of cut-off being regulated by the governor, which is claimed to enable the engine to maintain a uniform rate of speed, notwithstanding variations in load or steam pressure. The valves are of the poppet order, and are self-balancing. Cut gears upon the fly wheel shaft operate a horizontal shaft beside the engine frame, and upon this shaft are cams which raise the valves at the beginning of the piston stroke. The length of time during which the cams hold the valves open for the admission of steam is regulated from the governor direct; and the valve-closing mechanism is so arranged that, no matter at what point of the piston stroke the cut-off takes place, it is done very rapidly and without shock. In the steam chests the upper and lower seats of the steam and exhaust valves are placed so near together as to leave only the requisite area of steam passage between them: thus reducing any liability to derangement from a difference in the expansion of the parts. By the removal of one cover, each valve may be withdrawn without separating the valves from the valve stem. The working parts of the valve mechanism are of hardened steel. The frame of the engine is truncated, and provision is made so that the pillow block can be changed to either side of the bed. The engine at the Centennial was of excellent workmanship throughout. For further particulars address the manufacturers as above.

A Snake Show at Calcutta.

"It was early in the morning—not, however, before the snakes, which were in a series of wire-covered boxes, were awake and lively—that we were shown," says a correspondent, "into a stone-floored room some twenty feet long and twelve broad. In the boxes were the strongest and deadliest snakes in India: pythons, ophiophagi, cobras, korites, Russell snakes, and many others. The Hindoos who had charge of them were two slim, wiry, little men, nude to the waist, as most of their countrymen are. They wore neither gloves nor had any other protection, and had no instrument of any kind in the place. After showing the varied collection under their care, they proceeded to open the python cage, and one of them, putting his head in, seized a monster serpent and threw him upon the floor close to our feet. The python objected to such treatment, and began to hiss, making at the same time a vigorous effort to rise. But the snake-keeper was waiting for this, and no sooner did that huge, shining back begin to curve than the keeper put out his hand, and, seizing the creature's tail, pulled it back with a jerk. Instantly the python was powerless—hissing, but unable to move; the more he struggled, the more tenaciously did the keeper hold his tail, explaining meanwhile that so long as the reptile was controlled in that fashion there was no danger of its doing mischief; then, just as its rage was becoming ungovernable, the man lifted it quickly, and with a jerk deposited it in the box. Its companion was taken out in a similar manner, and slapped and buffeted till, throughout its entire length, some twelve feet, it quivered with passion, but all to no purpose; it, too, was replaced in the cage, and shut up to hiss at its leisure. The fact that an ophiophagus is in the Regent's Park Zoölogical Gardens, London, rendered the next exhibition more interesting, although it may be doubted whether the sudden throwing into so small a room of a snake seven feet long was agreeable to the visitors. However, there was really no danger, for the venomous creature was so completely in its keeper's power that we had no occasion to fear. One bite from the reptile, and any one of us would have been dead in five minutes, for it was exceptionally strong and lively; but it was no more able to bite us than the little mongoose caged outside the door. Up rose its head, out came its slithering tongue, its eyes dilated, its huge throat swelled, and all seemed ready for a desperate attack, when the keeper struck the reptile's mouth with the back of his hand, and, before it could strike him, had seized it just under the head. Then it struggled, but only to get away—it had met that native before, and did not at all approve of his treatment. Its tongue might move in and out as often as it pleased, but all to no purpose; and when the cage was opened, it slunk in."

THE medical journals, last spring, published repeatedly the formula for Dr. Ferrier's new remedy for cold in the head. As the season for that distressing malady is at hand, we print the recipe, which is: Trisnitrate of bismuth 6 drachms, pulverized gum arabic 2 drachms, and hydrochlorate of morphia 2 grains. This is used as a snuff, creates no pain, and causes, says the London *Lancet*, the entire disappearance of the symptoms in a few hours

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VOLUME XXXV., No. 23. [NEW SERIES.] *Thirty-first Year.*

NEW YORK, SATURDAY, DECEMBER 2, 1876.

Contents.

(Illustrated articles are marked with an asterisk.)

THE SCIENTIFIC AMERICAN SUPPLEMENT.

Vol. II., No. 49.

For the Week ending December 2, 1876.

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[With 49 Engravings.

PUBLISHERS' CARD.

Some twenty thousand of the subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT will find printed on the wrappers which envelope this week's papers the information that their subscriptions are about to expire, coupled with a request that the same may be renewed for the coming year. But three numbers of either journal, including the present issue, remain to complete the volume; and as it is our fixed rule not to send papers after the term subscribed for is ended, those desiring the weekly visits of our papers to continue without interruption; will therefore serve themselves by remitting as soon as possible. At the same time they will, in so doing, greatly favor the publishers, as the latter are thus enabled to form proper estimates as to the magnitude of the edition which it will be necessary to print at the commencement of the year. The rates of subscription to either journal or to both combined remain as heretofore.

The SCIENTIFIC AMERICAN SUPPLEMENT, we would here take occasion to state, was started, as its prospectus intimated, partly as an experiment, and without definite intention on the part of the publishers regarding its continuance after the present Centennial year. The success which it has encountered has, however, been so genuine, and the circulation which it has achieved so greatly beyond our anticipations, that it has been decided to continue its publication. As to the preparation and plans which we have in hand for rendering both SCIENTIFIC AMERICAN and SUPPLEMENT indispensable to workers in every branch of art, of industry, and of Science, the reader will find them fully detailed in our announcements on the advertising pages of this issue.

Those who have taken the papers through newsdealers are recommended to continue to do so, and those in the habit of procuring their papers weekly from the stands will find them there as of old; and those who neither subscribe for nor buy the SCIENTIFIC AMERICAN nor its SUPPLEMENT may peruse them both on file in any working men's reading room in the country, or in the library of any institution of learning in the world.

A handsome subscription list will be sent as usual on application by those desiring to form clubs.

PROSPECTS OF AERONAUTICS.

Though failure more or less signal and complete has been the fate of every attempt thus far made to navigate the air by mechanical devices, the problem has by no means been given up as hopeless. Better still, sufficient progress has been made of late toward a right understanding of the conditions and requirements of flight to justify the belief that the obstacles to be overcome are purely mechanical, and sure, sooner or later, to be successfully surmounted. The long sustained flight of birds sufficiently demonstrates the possibility of propelling heavy objects at great speed through the air by a purely mechanical apparatus: while the small amount of food which birds require for the generation of the energy expended in flight proves that only a moderate amount of force, rightly applied, is required for that sort of work.

The problems to be solved before aerial navigation takes its place among human achievements are consequently these two: the invention of an apparatus to accomplish the work of the bird's wings and tail, and an engine capable of developing great power with comparatively little weight of machinery and fuel. For the purpose of navigation, the flying ship must be, however, like the bird, heavy in comparison with air, that it may not be at the mercy of every gust of wind; and it must be strong enough to withstand the pressure of strong gales or what is equivalent, the resistance due to rapid motion. Hence it is evident that, whatever it may be the successful air ship will not be and will not contain a gas bag. For the practical navigation of the air, the balloon is and will ever be a delusion and a snare; and the general recognition of this truth by intelligent workers in this field is one of the most encouraging features of modern aeronautics.

It is quite possible that aerial rafts, supported by balloons, may sometimes be useful in regions favored with winds which blow steadily in a fixed direction for months at a time; but in ordinary climates, they cannot but be as useless for commercial purposes as log rafts in a sea everywhere as vexed by conflicting currents as Hell Gate was in its worst days. A self-propelling vessel supported by a balloon would be little if any, better. No balloon light enough to sustain such a vessel could begin to withstand the pressure it would meet in stemming or crossing the current of a moderate wind, or in being driven through still air at the rate of twenty or thirty miles an hour; and unless it can do this and much more, it is out of the question for practical navigation.

After many experiments and no small amount of costly investigation, the Aeronautical Society of Great Britain, so long presided over by the Duke of Argyll, has pronounced decisively against the balloon as incapable of being made useful for the purpose of locomotion, except in the way of waftage; and in a recent report, the secretary of the society declares that the sole improvement of which the balloon is capable is the invention of some means to secure its ascent and descent without the expenditure of gas or ballast.

Suppose we have, for example, a balloon so weighted that it would float on the discharge of 35 lbs. of ballast, or on receiving an additional thousand cubic feet of gas. It is plain that, if some mechanical means (say a screw acting vertically) were added, capable of exerting a lifting force of 35 lbs. more than its own weight—a light two horse power would drive it—the voyager would be able to rise without discharging ballast, or sink without discharging gas; and so be able to avoid obstacles while drifting over the surface, or to rise above adverse currents to such as might be more favorable.

But for the purposes of real aerial navigation, such drifting is wholly inadequate. The work to be accomplished is not the floating of a relatively light body in more or less favorable air currents, but the propulsion of a heavy body with a force sufficient to overcome all aerial resistance, and with velocity enough to make the inevitable driftage relatively unimportant.

This has not yet been achieved, though the efforts toward it have shown some very encouraging results. Certain experiments made at the expense of the Aeronautical Society, to determine the exact lifting pressure of air currents against a plane inclined at different angles, obtained results which are especially promising. The plane used was a steel plate a foot square, and the substitute for wind or the resistance, occasioned by the passage of a body at high speed through the air, was the blast of a powerful fan blower. Placed at right angles to this blast, the pressure on the plate was 3½ lbs., indicating a wind velocity of about twenty-five miles an hour. Inclined at an angle of 15°, the plate received a direct pressure of only one third of a pound, while the lifting pressure amounted to 1¼ lbs. In other words, a plane of 1 square foot, held at an angle of 15° against a current of air having the velocity of twenty-five miles an hour, will carry four times as much weight as it meets resistance. A less angle than 15° could not be tried, owing to some obstruction to the action of the apparatus. The experiments showed, however, that the ratio of the lift to the thrust greatly increased as the inclination of the plane diminished, and also that the lifting power of the current, per square foot of plane, increased with the extension of the sustaining surface, probably on the same principle that makes a large sail on a ship so much more efficient than an equal area of small sails.

The chief thing that remains to be done for the successful solution of the problem of flight is therefore this: To drive a sufficiently broad-bottomed car, say from forty to sixty miles an hour, by means of apparatus acting on the air. With this velocity the resistance of the air would support the car, at the cost of a relatively small part of the driving force. A number of experiments have been made in this direction, perhaps the nearest to success being one in which a small engine drove a plane, carrying, with its weight, a load of 214 lbs. around a circular course (planked) at the rate of twelve miles an hour, by means of two wheels working in air and having a driving surface of 60 square feet. A speed three times as great would have been required to lift the apparatus from the ground.

Other experiments have shown that, by direct acting vertical screws, a constant force of three horse power will support 100 lbs.; and inasmuch as a one horse power engine has been made weighing no more than 13 lbs., the possibility of an engine's lifting itself in that way is clear. In another experiment made to ascertain what lifting power could be got from planes moving in horizontal orbits, an engine weighing 186 lbs. was prove capable, under very unfavorable conditions, of lifting itself with 40 lbs. additional weight.

If the results obtained by the fan blast and inclined plane are to be depended on, an engine used for propulsion ought to succeed even better than those employed direct in lifting.

ENGLISH DEALINGS WITH FOOD ADULTERATIONS.

If there is any one subject on which the British public is extremely sensitive, it is the quality and purity of its food and drink. No country, we believe, has such stringent legislative enactments against adulterations; and the legal formalities for their enforcement are made so few and simple that the aggrieved consumers now waste no time in vain denunciations, but summon the offending grocer or butterman forthwith before the nearest magistrate to answer for the fraud.

An excellent instance, showing how persistently warfare against spurious materials is waged, is found in attacks now being made in England on artificial butter. It is a well known fact that, until recently, attempts to produce even a moderately palatable artificial butter have failed; and although the product has been made of fair savor while fresh, a day or two's keeping has turned it into mere tallow. In England, however, the fraud has not ended at this. Conscienceless individuals have sold as butter, it is said, horrible concoctions of old lubricating tallow, and even old tallow candles *minus* the wicks, which an official analyst describes as "supplied to the poor in the last stages of rottenness." One factory was detected making this delectable product at the rate of two tuns a day. This and many other like cases being well known, it is but natural that the British public should cordially detest "grease butter." The London *Grocer* has lately printed long reports of trials of sellers of the adulterated material; and to show how rigidly the penalties against the adulterations are enforced, we note that a retailer who purchased grease butter, innocently supposing it to be genuine cream butter, and who sold it to a customer as the latter, was nevertheless fined $50, and further proceedings were ordered to be taken against the wholesale merchant from whom he obtained his supply.

We have frequently remarked this same severe dealing in England with every other species of food fraud. At the same time, no one need remain in ignorance as to what constitutes fraud, because the parliamentary reports on the subject, even in respect to tobacco and other unnecessary luxuries not classified as food, contain reliable and full information relating thereto. The whole matter is a suggestive one for us in this country. Here a prosecution of a retailer by a private citizen, because of the former selling ¾ lb. of grease for 1 lb. genuine butter,as in the above cited instance, would be considered extraordinary. Our main reliance for protection is in the vigilance of health boards, whose jurisdiction is local and limited in authority. Hence, in most cities, we may look in vain for either frequent prosecutions or reports of adulterations prepared under official auspices, although the possibility of such reports being compiled is plainly indicated by the admirable yearly work of the Massachusetts State Board of Health. Reports, however, can merely warn us of evils in the shape of food adulterations, under which we shall probably continue to suffer until penalties are enforced, as rigidly here as they are in England, against each and every retailer who wittingly or unwittingly sells a spurious article.

WHAT NEW YORK MIGHT DO WITH THE GREAT FRENCH STATUE.

Some time ago a number of enthusiastic Frenchmen, admirers of the United States, conceived the idea of presenting some monument to the people of this country, in commemoration of the ancient friendship of the two republics. Meetings were held in Paris, a subscription list was opened, and finally it was decided that the monument should be an immense statue, over 200 feet high, to be erected on Bedloe's Island, New York Harbor. The design is "Liberty Illuminating the World;" and in harmony therewith, the hand of the figure holds a torch with a gilded flame, while at night a halo of electric light surrounds the head, so that the statue becomes a lighthouse. M. Bartholdi, a celebrated French sculptor, was commissioned to execute the work, and his operations have progressed as far as the completion of one hand and fore arm, at present erected in the Centennial grounds. Now, however, there is a hitch in the money matter; and unless the citizens of New York manifest a greater interest in the enterprise than they have hitherto done, it is feared that the project will meet the fate of the proposed colossal Washington monument, the corner stone of which was laid by Governor Young, in this city with impressive ceremonies some thirty years ago, but of which even the site is almost forgotten. It appears that it has been left to the people of New York to erect the pedestal and also to pay part of the expense of making the statue; but probably for the reasons that our harbor is already brilliantly lighted, and that a statue for ornamental purposes is not particularly needed among the shipping, and that the sum to be subscribed is quite large, our citizens have thus far failed to respond to the call upon their purses. Meanwhile, in Philadelphia it has been proposed that, if New York thus virtually declines the gift, Philadelphia shall secure it for her inland harbor.

We are not among those who favor letting the project die or be transferred to our sister city for want of pecuniary help here, first, in consideration of the donors' munificence, and second, because New York is rather deficient in works of art, and therefore the more we can get of them the better. We think, however, that a much superior site to the lowlying island might be selected, and that, if a proper situation were ch sen, our citizens would view the matter much more favorably. Our idea is that the Battery is the place for the statue, and we would erect it there in lieu of on the place assigned to it.

AMMONIUMNITRODIPHENYLAMIN.

This remarkable compound, the chemical name of which is rather long, but scientifically correct, is manufactured in Switzerland; and it was, in the year 1874, introduced into trade, for dyeing silk and wool with a most magnificent orange color. But it produced the most alarming poisonous symptoms among the workmen who handled it; the use was therefore soon discontinued, and the manufacture abandoned. Dr. C. A. Martins, director of the Berlin anilin manufactory, found that the poisonous properties were not constantly inherent in the pure article, and that they were due either to impurities or to certain methods of manufacture; and he succeeded in making a harmless ammoniumhexanitrodiphenylamid, which is now sold under the more convenient name of aurantia. The longer name is, however, the proper one, as it gives the chemical composition and derivation, which, for the benefit of non-chemical readers, we will now explain.

Amin is a derivation of ammonium, the formula of the latter being NH_3, while that of amin is NH_2. This base, combined with phenylic acid, or rather with phenyl alcohol, $C_6H_5(OH)$, forms phenylamin, $C_6H_5(NH_2)$, which is sold under the name of anilin, C_6H_7N. Diphenylamin contains two molecules of phenyl, and is represented by the formula $2(C_6H_5)(NH_2)$. Nitro-diphenylamin is a combination of the latter substance (as a base) with nitric acid, the formula being $NO_2, 2(C_6H_5)(NH_2)$. *Hexa* means six; and six molecules of nitric acid can be combined with the base, as the latter is a hexad, with the formula: $6(NO_2)2(C_6H_5)(NH_2)$. This is the hexanitrodiphenylamin: and finally, this substance being an acid salt, it is neutralized with ammonium, making an ammoniumnitrodiphenylamin, of which the formula is $NH_3, 6(NO_2)2(C_6H_5)(NH_2)$, which is equivalent by contraction to $C_{12}H_{12}O_{12}N_8$, the formula for aurantia.

The latter formula only shows the ultimate sum total of atoms, and not the nature of the compound, which is shown in the former formulæ: but it is well known that the same number of atoms can be combined in various ways, producing compounds of the same ultimate composition, although they differ in all their chemical and physical properties, so that the simplest formulæ cannot always be trusted as the true one.

We give these details to show to the uninitiated that the apparently unnecessary long chemical names, often used in these days, are not a mere fancy of the chemists, but are based on elementary principles, combined according to a well considered practical system.

SILENCE AND HASTE AT DINNER.

There is probably not one among the readers of this paper who would not assent to the general proposition that habitual haste in eating is hurtful to digestion. Everybody knows that food hurriedly eaten is very likely to be insufficiently masticated, and not properly mixed with those salivary secretions which are essential to the perfect digestion of many kinds of food, particularly breadstuffs and other starchy preparations. Everybody knows, further, that food hastily swallowed is very apt to carry with it more air than is good for the stomach. Each bolus fills the bore of the œsophagus, and pushes before it all the air that tube contains; the successive charges fill the stomach to distention, often paralyzing its action for a time, and always favoring fermentation of the food rather than its proper solution. All this, and much more of equal physiological importance, is well known to every intelligent reader, and we may safely assume that all our readers belong to that class.

It is therefore no easy task which a fair correspondent has set us in a well written communication just received. The gentlemen of her family, she tells us, have long been subscribers to the SCIENTIFIC AMERICAN, and they hold its utterances in high esteem. Consequently she appeals to us to read them a lesson on the evils of hasty eating, hoping that our advice will be heeded, to the benefit of their health and the material enhancement of her enjoyment of the dinner hour.

She writes: "It has become the custom of our gentlemen to devour a newspaper with their breakfast, which, being light, we must permit; but when the meal of the day, dinner, is eaten, it is surely as unwholesome as it is disagreeable to all present to have the head of the house sit with absorbed look, eating as if for a wager, and impatiently watching the servant hand around and clear away the dishes. I am one of five suffering wives, who never eat our dinner without feeling that we are taking time from some business which our husbands long to return to. We have therefore resolved to appeal to you to address from your editorial chair these men who are seeking dyspepsia and making our tempers sour by the trying ordeal of dinner."

If any word of ours could arrest so suicidal a course on the part of any of our readers, our petitioners may be sure that it would be spoken with all emphasis. But here's the rub: the evil complained of is in many cases one of habit, and not amenable to correction through reason; in more cases, probably, it is one of necessity, under conditions for which the offender is not morally responsible; very rarely, we fear, is it the result of deficient or defective information. And since we know nothing of the circumstances of the present case, any suggestion we may make must necessarily be of the most general character, as likely to miss as to hit.

For example, we might enlarge upon the horrors of dyspepsia, its disastrous influence upon character, its power to acidify and eclipse all the sweetness and light of living, even where it does not put an end to life outright: only to receive the crushing reply from five, or five thousand, suffering husbands: "We know all that, probably as well as you do. But how can we help ourselves? If we were independent of the duties and responsibilities of active life, we might, and certainly would,very gladly eat our dinners with leisurely enjoyment; but the demand upon our time and thoughts are such that we cannot do as we would; we are parts of a great machine, and are driven to sacrifice our pleasure, our health, may be: and possibly, what we regret still more, the good temper of our wives, because of the rights and requirements of those with whom we have to do business."

This is very largely the case where dinner is eaten before the day's work is done. And when it comes in the evening, physical fatigue and nervous exhaustion from the conflicts of the day are not unseldom equally fatal to the social enjoyment of dinner. It is easy to say that men should lay aside their business schemes and anxieties at such a time, and we admit that it is both the moral and the physiological duty of men to try to do so: still men, as a rule, have not yet reached a stage of moral development at which duty perceived is equivalent to duty done. When the penalty for wrong-doing is apt to be indefinitely deferred, as in the case of silent and hasty eating, and when the reward for right-doing is not always immediately apparent, right-doing is likely to depend upon incidental conditions; and here the truth compels us to observe that the ladies are often quite as much to blame as the gentlemen for the unsocial and unsanitary habits of eating which the latter so frequently acquire.

For our own part, we approve of the morning paper at breakfast. Generally it is the only means of securing deliberate eating at that hour. It is easy enough for those who have little to do to enjoy a social breakfast at ten or eleven o'clock in the morning; but earlier—and especially if the battle of business is to follow at once—humanity is not social, and conversation, except with regard to the morning's news, is all but impossible. The morning paper therefore is in most cases not only a sanitary brake upon the jaws at breakfast, but a real blessing to the family as well as to the reader's stomach.

At the midday meal, business is pressing and time brief. As a rule, whatever a business man eats at such a time must be taken hurriedly. The effect is bad, it is true: but it is a choice of evils, either to eat quickly or go without. For this reason it is, whenever possible, the custom to take the main meal of the day after the business hours are over. It is with reference to this meal, we take it, that the just protest against haste and silence has been uttered.

The pestilent heresy, moral as well as sanitary, that it is unbecoming an immortal being to enjoy his dinner is well nigh extinct; we trust the once prevalent insanity of self-immolation upon the altar of business push and worry is also dying out. Active men are learning that the human machine can be run to death; that moderation pays best in the long run; and that no time is more wickedly wasted than that which is unduly saved (?) from the hours of rest and *re*-creation—including in the latter the dinner hour. In the scientific code of conduct, deliberate and enjoyable eating is one of the fundamental virtues. It ranks with justice in the moral code. It is a virtue, too, which can be, and ought to be, cultivated by all, most of all by those who are doing the world's best work.

But, generally speaking, it is a virtue, the cultivation of which calls for effort on the part of the ladies as well as self-restraint on the part of the gentlemen. No sensible man will willingly hurry through a meal when he is keenly enjoying the food and its accompaniments; and it depends chiefly upon the ladies to secure such conditions at the family table. How they can do so, it is not for us to say. There can be no general rule for their attainment any more than a single specific for all diseases. The special conditions and requirements of each household and the idiosyncracies of its members must chiefly determine the course to be pursued.

There is one point, however, a very important point, which ladies very often overlook. It is this: Civilization and hunger are incompatible. All the virtues and graces of of humanity—certainly of male humanity—fly before an empty stomach. It may be possible for a man to be hungry and amiable at the same time, but it is not safe for any wife to presume upon so unlikely an occurrence habitually. Ignorance of their physiological truth has been the ruin of many an otherwise happy household. And we may set it down from both observations and experiences—premising that our experience in this respect has been exceptionally happy—that prepandial discretion is the severest test of a good wife. Just before dinner is the worst possible time to bother a husband with questions or complaints, or even with efforts to be aggressively agreeable. There is the time above all others when social silence should grace the home, and make it seem to the tired man the most delightful and restful place on earth. Half an hour of quiet just then is the best possible preparation for the social enjoyment of the coming meal, for then the nervous tension and mental strain of business care and anxiety can be gradually relaxed, and the entire system brought into conditions for enjoying food and the amenities of social life. Yet how frequently does the wife choose that particular time to speak of her own trials and troubles, the misconduct of servants or children, the petty requirements of the household, or other things trivial or disagreeable, and then marvel that her husband's temper is not so sweet as it ought to be! The offense is worse even than introduction of such topics at meal time.

Another physiological fact is often overlooked by well meaning wives who have to complain of the husband's haste or taciturnity at table: that is, the softening influence of a little savory and easily assimilated food to begin with, something calculated to alloy the irritant cravings of hunger while stimulating the appetite: this especially when the gentlemen are mentally or physically exhausted by the labors of the day. At such times soup is even more conducive to sociability than wine.

This is perhaps not at all what our correspondent asked for, still it seems to us the most practicable way to cure the evil complained of. The kindness, tact, and skill of the ladies before and during dinner can, in our opinion, do infinitely more to correct their husbands' unphysiological habits in eating than any amount of scientific disquisition. Let the ladies recognize the physiological conditions of the offence and the offenders, and—while trying to prevent or correct them—study to make the dinner hour so agreeable that their husbands will not be in haste to have it over, and the desired reform will most probably come as a natural consequence, if any reform is possible.

HOT WATERPROOF CEMENT.—The following is a valuable cement which, if properly applied, will be insoluble even in boiling water: Gelatin, 5 parts; soluble acid chromate of lime, 1 part. Cover the broken edges with this, press lightly together, and expose to the sunlight: the effect of the latter being to render the compound insoluble.

A HARMLESS glaze for earthenware, destined to replace the lead glazes hitherto employed, has lately been devised by M. Constantin. One recipe is 100 parts silicate of soda, 15 powdered quartz, and 25 Meudon chalk. Another is the same with the addition of 10 parts of borax. The articles glazed can be colored by copper for green, and manganese for brown.

NEW MACHINE FOR PRINTING COLORED PAPER.

The annexed engraving represents a new apparatus for printing colored paper, devised by M. Flintsch, the engraving of which we extract from the *Revue Industrielle*. The paper is led from the roll, *a*, Fig. 1, above and below guide rollers, *b*, *c*, and *d*, and thence to a felted roller, *e*, where it receives the color from the printing roller, *f*. The paint is held in a reservoir, *g*, and the paper passes over the roller, *h*, while the color is uniformly distributed by the fixed brushes, *j*, and movable brushes, *i*. The paper is then led over a guide roller, *s*; and as soon as one of the sockets attached to the inclined chain engages one of the bars of wood placed in the box, *t*, the paper is looped over the bar, and is thus carried upward by the moving chain. On reaching the summit of the inclined plane, the bar passes to a horizontal chain which moves very slowly forward. The paper, lastly, reaches a pair of cylinders (shown on the right of Fig. 2, which is a general view of the whole apparatus), on one of which it is rolled.

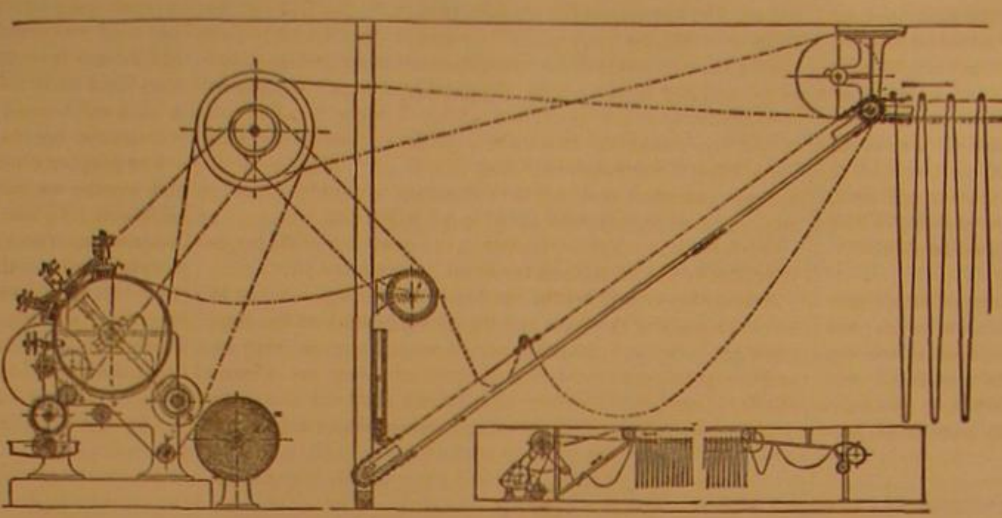


Fig. 1. Fig. 2.

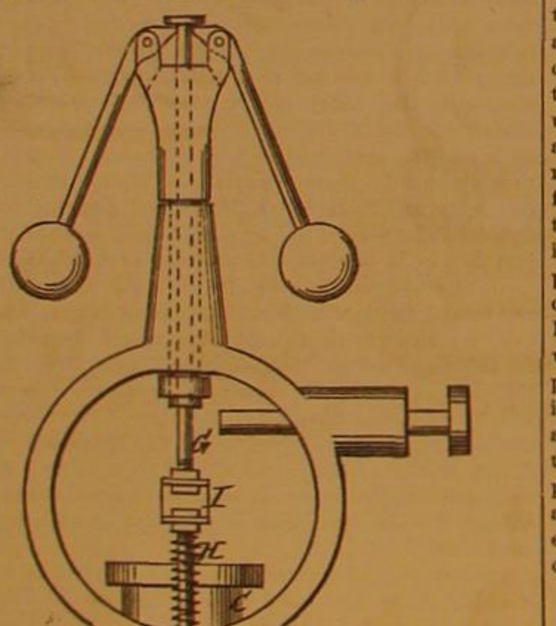
FLINTSCH'S PAPER-COLORING MACHINE.

Chloride of Lead Disinfectant.

The London *Lancet* directs attention to the value of chloride of lead as a deodorizer. The manner of its use is to dissolve half a drachm of the nitrate in a pint of boiling water, and pour this solution into a bucket of water in which two drachms of sodic chloride (common salt) have been dissolved. After chemical action has taken place, the clear supernatant liquid is an odorless saturated solution of chloride of lead. If this solution be thrown into a sink or vault from time to time, the disagreeable odors will soon be destroyed. A ship's bilge was completely disinfected in this way by simply dissolving half an ounce of nitrate of lead in boiling water, and pouring it into the bilge water, which itself supplied the necessary sodic chloride. Cloths wet with this solution, and hung in fever and accident wards of hospitals, are said to keep the atmosphere sweet and healthy.

A NEW STEAM GOVERNOR.

Mr. John K. True, of San Francisco, Cal., has patented through the Scientific American Patent Agency, September



19, 1876, an improved steam governor, an engraving of which is given herewith. A is the chest containing the throttle valve, B, admitting steam to the valve chest of the engine to be regulated. D is the small engine for working the valve, B, which is connected to the piston rod, E. F is the valve to the small engine, the rod of which is coupled to the governor, G; so that when the balls of the governor rise by increase of speed, valve, F, will descend, and admit steam in the upper end of engine, D, which will close the valve, B; and when the balls fall, it will admit steam to the lower end and raise the valve, B. The spring, H, on the rod of valve, F, balances the weight of the valve. The valve, F, can be set for high or low speed by the adjustable coupling, I. J is the exhaust pipe for engine, D. It is proposed to construct the valve, F, so that both steam ports will be a little open when both exhausts are closed, and thus the piston will be prevented from making full strokes, and when the opening of one steam port is slightly increased by the movement of the valve, the opposite exhaust will be slightly opened, to allow a little movement of the piston.

The Cheese Industry.

Our English cousins are still unhappy over the immense importation of cheese from the United States. Their agricultural journals are still scolding the farmers, for making an inferior article, and thus allowing our factory-made cheese to supply the English market. The London *Grocer*, in referring to a meeting just held by the cheese makers, states that an association was formed, called the British Dairy Farmers' Association, to which the editor alludes as follows:

"There is plenty of work for the new association to do. Our cheesemakers may be taught a good deal with advantage, and there are many reforms which they may usefully adopt. Hitherto they have been an isolated and unsocial community. As a consequence, they have made no progress; their trade has languished; the Americans have been gradually driving them out of the market. Some few years ago, dairy farmers saw that, if they were to live by cheesemaking, they must make some radical alteration; and this fact being especially evident in Derbyshire and Cheshire, the farmers there took a hint from their American competitors, and established cheese factories on the American principle. The Americans are running us hard, and send cheese over here which for price and quality is hard to beat. But it is mostly cheese of the lower sort, and cannot in any way be compared with some of the fine qualities of English production. What we want, however, is an improvement in the general quality of the cheese made in this country, and we hope that in this respect the enlightened teaching of the Dairy Farmers' Association will do great good. With proper care and skill in the processes of production, with a better knowledge of the nature of the materials they are employed upon, and with a little more enterprise, English cheesemakers may defy the competition of the world."

Honorable Employment.

There is noting derogatory in any employment which ministers to the well being of the race. The plowman that turns the clod may be a Cincinnatus or a Washington, or he may be a brother to the clod he turns. It is in every way creditable to handle the yard, and to measure tape; the only discredit consists in having a soul whose range of thought is as short as the stick and as narrow as the tape. There is no glory in the act of affixing a signature by which treasures of commerce are transferred, or treaties between nations are ratified; the glory consists in the rectitude of the purpose that approves the one and the grandeur of the philanthropy that sanctifies the other. The time is soon coming, the Chicago *Journal of Commerce* thinks, when, by the common consent of mankind, it will be esteemed more honorable to have been John Pounds, putting new and beautiful souls into the ragged children of the neighborhood, while he mended their fathers' shoes, than to have been set on a throne.

Treatment of Ash.

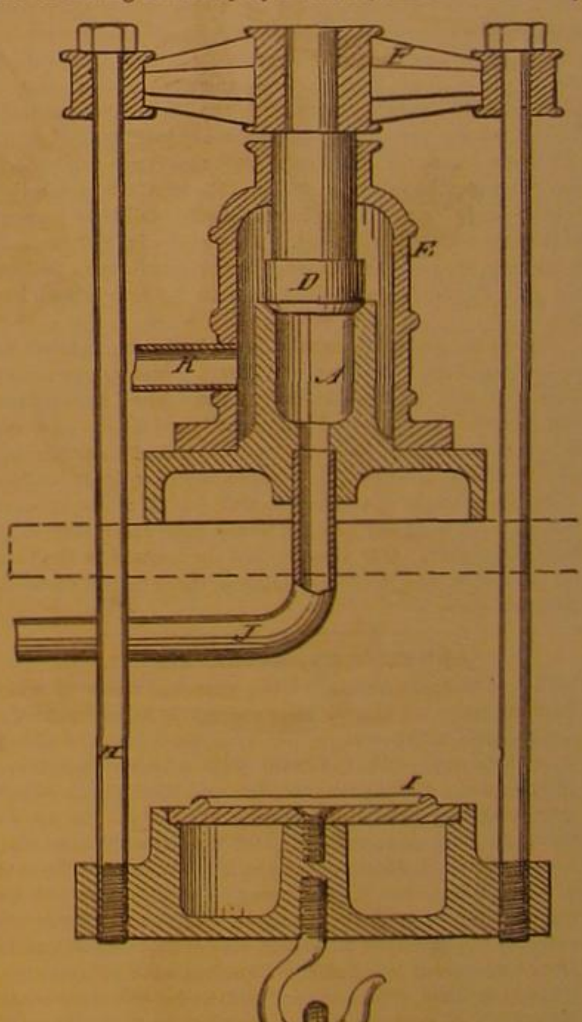
Woodworkers will find the following advice, from the *Northwestern Lumberman*, useful in the treatment of ash, to render it pliable.

Steam is the ordinary means used to soften ash; but when it is practicable, boiling in water is the best. The chief thing is to have the right kind of ash, as some kinds bend and others do not. One tract of land may furnish the best of ash; while another, lying close by and having just as good a soil, may produce only an inferior quality. The timber must be heavy and tough, and cut from good trunks. No matter if it has been cut and dried three years. A splinter of this quality of ash can scarcely be torn off, and runs the whole length of the wood before it ceases. Half an hour's boiling is sufficient to soften a piece of wood 2⅜ inches thick. When the wood is taken out of the kettle, put it in the brace, screw and wedge it in the desired form without relaxing, and let it cool a few hours. After the wood is thoroughly dried in the brace, unscrew it and take out the wedges; it will always then retain its form.

IMPROVED STEAM GAGE.

Messrs. H. and A. Greenleaf, Brooklyn, N. Y., have patented through the Scientific American Patent Agency, August 29, 1876, a novel apparatus for testing steam pressure, by which the pressure of steam on an area of any given size—say a square inch—may be weighed by means of weights lifted directly by the steam without a lever or spring. In the annexed engraving, A is a hollow cylinder, setting upright on a base adapted to rest on a shelf. It is open at the top, on which a circular valve, D, one square inch in area, is seated. The rod of the valve works without friction through the top of a case, E, surrounding the cylinder, and has the cross beam, F, attached to its upper end. The weight, G, for weighing the steam pressure, is suspended from this beam by the rods, H. There is a holder, I, for weights to be added when required. The rods pass through the table for a guide and support against lateral movement. Steam enters the cylinder, A, under the valve by the pipe, J, and the exhaust passes off through the pipe, K. The apparatus is intended as a permanent fixture in a boiler room, and is a positive and comprehensive instrument, readily at hand to test the accuracy of the steam gage and working condition of safety valve, whether the engine is running or not, without the necessity of disconnecting steam fittings, or mathematical calculations. The action of the steam is a direct dead lift of the exact counterbalance of the pressure upon the valve; and the weights being hung directly under the valve, the valve will seat in its proper place without the necessity of the valve stem fitting tightly in the guides.

For want of such a device, engineers generally depend upon their steam gages, the accuracy of which is doubtful, as in many cases they are seldom or never tested, and thus run great risks that may be avoided by this instrument. In case of testing boilers by hydrostatics, this instrument may



be used to any given pressure by simply adding weights up to the required amount.

A GOOD CEMENT FOR GLASS.—Orange shellac, bruised, 4 ozs.; rectified spirits, 3 ozs. Set this solution in a warm place, and shake frequently until the shellac is dissolved. This cement will stand every contingency but a heat equal to that of boiling water.

TO ATTACH TIN TO METALLIC SUBSTANCES.—Mucilage tragacanth, 10 ozs.; honey of roses, 10 ozs.; flour, 1 oz. Mix

CURIOSITIES OF THE CENTENNIAL.

The Mineral Annexe to the Main Building was probably less visited by the general multitude than any other part of the great display. It was off the line of travel, obscured by its huge neighbor and (owing to its containing, "nothing but old stones," as we heard a rural visitor contemptuously remark as he turned on his heel on the threshold) people, when limited on time, invariably omitted it from their sight-seeing programme. Mineralists and antiquarians selfishly viewed this state of affairs with vast satisfaction, because, even when the crowds elsewhere rendered aisles impassible, the passages of this annexe were free, and one might study the collection leisurely and undisturbed. A great many thoughtful people, who belonged to neither of the above professions, however, found the "old stones" one of the most interesting exhibits in the whole Exposition, and for the reason that those rudely fashioned fragments tell us all that we know concerning that mysterious race that owned our land, long before the Indians became possessed of it.

MOUND BUILDERS' RELICS.

Here were arrow heads of flint, broad axes of stone, mortars and pestles the same as Mexican tribes use today, copper pots and kettles, rude needles of bone, spears, and personal ornaments. There were skulls dry and black with age, belonging to that race which came whence we know not, and which disappeared as mysteriously as it arose, leaving us nothing but the mounds which dot the Mississippi and Ohio valleys, and these crude relics, to tell of their existence. All that the strictest research has determined regarding this strange people may be told in a paragraph. Their works, in magnitude, dispersion, and uniformity, indicate a numerous population essentially homogeneous in customs, habits, religion, and government. They belonged to a family of men, says one learned antiquarian, "moving in the same general direction, acting under common impulses, and influenced by similar causes." No tribe of Indians ever known has attained the social state which would enable them to compel the unproductive labor of the people to be applied to the works that we now find. Geological formations and the condition of the human remains obtained prove that the monuments of the Mississippi valley are at least 2 000 years old. And this is all. Who built the mounds, whether their authors migrated to remote lands, or whether they were swept away by a conquering people or by a terrible epidemic or famine, are questions probably beyond the power of human investigation to answer.

It is curious that, while the cuneiform characters of the ancient people of the East and the hieroglyphics of the Egyptians can now be translated into modern tongues with ease and certainty, American inscriptions still defy the efforts of the antiquarians. Yet we have monuments of the Aztecs with engraving upon them which we are reasonably certain is written speech, and in this respect we have a foothold for further efforts, which, as regards the mound builders, we do not possess. We have inscribed stones, it is true. Some are merely covered with representations of animals and no writing, as are the Arizona Painted Rocks, illustrated in this issue. In our collection of Centennial curiosities, we give sketches of two examples, having inscriptions similar to writing, but there is no certainty that such is the fact. The Michigan tablet has scratches on it resembling Runic characters; some of the marks correspond to the A, K, S, D, I, and O of the old Norse tongue, as a comparison with the alphabet shows; others are destitude of any like resemblance. The Cincinnati tablet is an elaborately engraved stone, found with some human remains in a mound in Cincinnati, Ohio. The engraving may be merely ornamental, a view to which its symmetry would lead; but, on the other hand, it bears a not remote resemblance to known Central American hieroglyphics. Again, so many such tablets have been found and declared spurious, or as belonging to a later race, that, even admitting these that presented were, as they doubtless are, genuine mound relics, there is no proof that the race which built the mounds originally deposited them there. And thus even these slender aids to lifting the veil, which covers the past history of the land we live in, are of no real use.

BARTHOLDI'S STATUE OF LIBERTY.

The hand of the great statue which it is proposed to erect

Curiosities at THE CENTENNIAL EXHIBITION.

on Bedloe's Island, New York harbor, is set up in the Centennial grounds, in order to afford to the people an idea of the colossal size of the figure when it shall be completed. The weight of the member, with the torch which it holds, is about ten tuns. It is not cast, but is made of thin copper plates hammered into shape and riveted together. The length of hand and wrist is about eleven feet, the second finger is six feet long, and the thumb nail is thirteen inches square. The circumference of the thickest part of the fore arm is sixteen feet six inches. The gallery around the torch accommodates about twelve persons. The total hight of the statue will be one hundred and fifteen feet, or, including that of the pedestal, two hundred and twenty feet, about thirty feet less than the hight of Trinity church steeple in this city.

JAPANESE ART OBJECTS.

In a large number of the famous Japanese bronzes, exhibited in the Main Building, the subjects were notably derived from Chinese or Japanese mythology. One of the most magnificent of these works of art is represented, though of course without its exquisite detail, in our sketch, and is an incense-burning vessel held in the hands of a sea god or devil, above whose head the legendary dragon rears itself. For bronzes of this description, the metal is cast in clay molds formed upon models made of a mixture of wax and resin, which is melted out from the finished mold previous to pouring the metal in. The melting furnaces are of exceedingly small dimensions, and generally are iron kettles lined with clay. After casting, the pattern is carefully corrected and worked out by chiseling; but the best bronze casters prepare the model, the mold, and the alloy in such a way as to produce casting which needs no further correcting or finishing. The garments of the divinity represented are elaborately covered with a damask pattern of exquisite inlaid work. The process by which this is done differs according to the nature of the material on which it is produced. Sometimes the design is hollowed out to a certain depth with a graver or chisel, and the ornamenting metal, silver, gold, etc., generally in the shape of threads, is laid into the hollow spaces and hammered over, should the alloy be soft enough. The edges of these grooves are first slightly driven up, so that, when the metal has been laid in, they can easily be hammered down again, thus confining the latter in place. Or else the surface is merely covered in the required places with a narrow network of lines by means of filing, and the thin gold or silver leaf fastened on to this rough surface by hammering. When astrology was a living and not a very dead science, as it now is, those who credited its teachings likewise believed that certain persons were possessed of wonderful powers, which enabled them, when they looked into a crystal globe, of seeing future events transpire. We doubt if the Japanese have any similar superstition; but unless they have, there is no obvious use to which their magnificent crystals (two of which we represent) can be devoted, outside of ornamental purposes. The smaller crystal is cut in pear or fig shape, and is surrounded by strangely twisted ivory leaves. The larger one is a perfect sphere, some seven inches in diameter. Both are mounted on superbly lacquered stands. The small crystal is valued at $800, and the larger at $1,000.

THE RUSSIAN GOLD AND SILVER WORK

we have already quite fully described in our notes on the Centennial during its progress. The sketch represents a salver and bowl of ornamented silver gilt, over which exquisite fringed or lace-bordered napkins, of some silver tissue, appear to be thrown. Close examination shows that the napkins are no fabric, but are solid metal, forming in one case a part of the salver, and in the other the cover for the bowl. Every thread of the texture, or of the lace border, even a colored edging pattern, is copied with minute accuracy; and the perfectly natural falling of the folds adds to a deception which can scarcely be discerned save by touch.

Two very curious

EMU EGG ORNAMENTS

are also depicted. The egg looks as if made of dark green morocco leather, and is about five inches in its long diameter. After removing the contents, the Australian jewelers mount them in silver in very tasteful designs. In one the egg is supported on the twisted trunks of palm trees, and ferns rise up on either side. On top, an Australian aboriginal native is standing. The other design introduces the emu and the kangaroo, while the egg is supported by a kneeling figure.

PORTUGUESE WATER MONKEYS

are universally used in all hot countries where ice is a luxury not to be obtained save at ruinous prices. They are vessels of unbaked clay, perfectly porous, and made in the form shown. The larger is intended to hang in a window or wherever a draft of air can be had, so that the evaporation which takes place on the exterior of the vessel may be hastened, and the water within thus more rapidly cooled. The other jar is of the kind which usually replaces the pitcher on the table. The ornamentation of the exteriors is quite tasteful, although the design is merely scratched in.

A curious growth of wood is also represented in the engraving. The material appears to be a species of vine which has been trained and its parts united so as to form a perfectly formed screen or trellis. Lastly, we give sketches of Young Africa's playthings, which show that the youthful denizen of the Gold Coast demands toys not a whit less realistic than his civilized brethren of the rest of the world. Besides, there is a good deal of crude talent exhibited in the carving. The leopard, for instance, with an unknown animal of incognate species in his mouth, shows far greater skill in carving and knowledge of anatomy withal than the frightful spotted horses or jointless-legged cats wherewith Young America amuses himself. The animal, it will be observed, stands at bay, lashing its sides with its tail and holding its prey in its mouth. His spots are burned on with a hot iron. The bird shows a similar imitative ability; the doll, we cannot say so much for; but here the baneful influence of the vices of civilization affect the untutored intellect, for a bit of English or American calico is added to form a very obvious crinoline.

Correspondence.

The Duration of Vulcan's Transit.

To the Editor of the Scientific American:

The distance from the sun of an intra-Mercurial planet, to be in proportion with the grade of solar distances of other planets, ought to be in the neighborhood of 20,000,000 miles, at which distance Kepler's third law would determine the periodic time of the planet to be about 35 days. Assuming these figures to be substantially correct, and the supposititious planet to have an orbit similar in shape to those of other planets, it would move through about 2° of its orbit while passing centrally across the solar disk, the duration of which transit could not much exceed five hours time.

These figures are roughly calculated, but they indicate the impossibility of Vulcan's remaining upon the sun's face as long as the periods suggested by some of your correspondents. To make the duration of transit fifteen hours would be to locate Vulcan's orbit outside that of Venus.

Rochester, N. Y. E. B. Whitmore.

The Scientific American Supplement.

We are in the frequent receipt of enquiries like the following:

"*Publishers of Scientific American:*

You advertise to furnish the Scientific American and Supplement for one year, postage prepaid, for *seven dollars*. Having already sent my subscription for the Scientific American, $3.20, I would like to know if, by now forwarding the balance of $3.80, you will send the Supplement along? J. H."

Answer: Yes. Any person now a subscriber to the Scientific American, by remitting to us the difference between seven dollars and the amount he has already paid to us, may receive the Supplement for one year: dating from No. 1 of the Supplement or from the present time, as he prefers. We can furnish all the back numbers. In addition to the large quantity of illustrated information pertaining to all the various branches of Science, the Supplement for 1876 will be especially valuable for preservation as a general pictorial and scientific record of the great Centennial International Exhibition.

Intelligence the Key to Success.

"It may be laid down as a general rule that, in any business, whether it be in trade, in mechanics, or manufacturing, the intelligent educated man will be the most apt to succeed. Of course there are exceptions, but they only prove the truth of the general rule. And by this we do not mean the collegian or the man liberally educated in the schools, for as a general thing they are not the men we find in shops and factories. But we do mean those mechanics and proprietors or superintendents of manufacturing establishments who make it a point to improve upon their common school education by judicious reading and study, by which means they keep themselves posted upon all the improvements and advances made, not only in the industries generally, but especially in that particular industry in which they are personally interested.

"For several years past our business has brought us into frequent contact with manufacturers in almost every branch of industry, and we have observed closely the general intellectual status of this large and growing class of our population. There are two classes of manufacturers occupying opposite extremes—those devoting all the time they can spare, or even more, to the acquisition of mechanical information—in some instances, perhaps, to the neglect of the practical business details of their calling; the other class, which is much the larger, refusing or neglecting to avail themselves of the information furnished by those publications and journals devoted exclusively to mechanical, manufacturing, and scientific subjects. They claim that they have no time to spend in reading papers—no time to waste in the pursuit of knowledge. Indeed they rather boast that, although they have subscribed for some paper devoted to mechanical, scientific, and useful information, they have not even opened it for months, and not unfrequently they will point to a dust-covered pile of unopened papers, with a smile of self-satisfied pride, as an evidence of their independence of all editorial or extraneous assistance. Such men forget that this is an age of progress—that nearly all our manufacturing industries are in that transition state, as it were, between a hopeful opening and a full fruition of final success. Improvements in methods, improvements in machinery, and improvements in products are constantly being made; and the manufacturer who neglects to keep himself posted on all such matters not unfrequently deprives himself of the information and experience of others, that would contribute largely to his own success. Intelligence is one of the first essentials to the successful prosecution of profitable industries; and the proprietor or manager of extensive manufacturing establishments, who goes on the assumption *that* he already knows all that is worth knowing in relation to the industry in which he is engaged, will be apt to find himself, in the long run, left far behind in the race by many who have started out later in the day and under far less favorable circumstances, apparently, who have availed themselves of all the aids offered to keep fully up with the march of improvement.

"The growth and progress of manufacturing industries in this country have been stimulated and urged on to their present development largely by the advocacy and encouragement of editors and writers who have given their whole time and talent to the study and investigation of the subject in all its bearings—who have accumulated a vast amount of valuable, practical as well as theoretical, information, that can only fail of its object to benefit and advance the cause to which they are devoted by want of application by those for whose advantage it was collated, digested, and prepared. The ancients had a saying which, literally translated, reads: 'Life is short but art is long.' The range of knowledge, information, or intelligence is so extensive that one man can hardly expect, or be expected, to cover the whole ground. Hence we have a variety of journals or publications devoted to a variety of subjects, covering a variety of fields of thought, study, and investigation. First of all comes the newspaper devoted to the current events of the day. This, of course, every intelligent citizen, whatever his calling or occupation, should read. After that come political, literary, scientific, religious, industrial news, etc. And this latter class is still further divided into agricultural, mechanical, manufacturing news, etc. These journals are, or should be, conducted by men of intelligence, of careful and thoughtful study—men who honestly and earnestly labor for the advancement of the special interest to which they are devoted. It would be a libel on human nature to suppose that such an editor would not collect, collate, and present many useful and practical facts and much valuable information that could not be otherwise obtained. The men, or class of men, for whose especial benefit or edification such information is prepared, who, through ignorance, prejudice, self-sufficiency, or any other cause, ignore and disregard it, neglect their own interests and punish themselves much worse than they do the editors whose labors they treat so cavalierly. In this age of the world, ignorance will not win in the race with intelligence, though circumstances may, for the time being, seem to be in its favor.

"There are undoubtedly many persons involved in the care and anxiety of the management of a manufacturing establishment who honestly think they have not the time to read and study a journal published in the interest of their special calling, no matter how able or valuable it may be. But that should not be the case, and if it is, that fact alone shows the necessity for the very information they refuse to accept. It shows that there is not a wise division and disposition of time. One of the most important factors in the problem of successful management of any business is system, method: a time for everything and everything in its time, as well as 'a place for everything and everything in its place.' It is only the man of intelligence who is capable of so systematizing his time and his business as to make both yield the most satisfactory results. The man who is always in a hurry, always just a little behindhand, so that he feels anxious and fearful lest some important matter will not be accomplished in its own time, may calculate that his system is at fault, and that it is not more time that he needs, but a better and wiser disposition of the time he already has.

"The earnest and honest manufacturer who sets out to build up a great, flourishing, and profitable industrial establishment will avail himself of all the information that can be gleaned from the journal, or journals even, devoted to the particular industry in which he is engaged. And in the term 'journals' we do not include that numerous brood of advertising sheets that, under high sounding titles, are circulated gratuitously and at random, to whomsoever will take them from the post office. Though sometimes containing a few well selected or pilfered articles to give them the appearance of what they are not, reliable journals, they are not edited with that care and ability which alone gives the special journal any value, or any claim to the support of the class to whose interests it is devoted. We earnestly commend these facts and ideas to the great multitude of workers in the industrial fields of the West, in whose interests we have enlisted, and to whose complete success we look forward with hope and gratification."—*Western Manufacturer.*

The United States Skate Trade.

It was not many years ago when all the skates used in the United States came from abroad, chiefly from Germany, and the German skate importation was a lucrative branch of trade. Of late this has almost entirely ceased. The Americans make their own skates now, and, oddly enough, the announcement is made that one of their leading skate factories, the Northampton Skate Company, in Massachusetts is filling orders for nickel-plated skates to be sent to Germany.—*Ironmonger.*

A Fortune in Toothpicks.

It seems that it was not the invention of the wooden toothpick, *per se*, that netted the inventor $50,000, but the idea of making the toothpicks out of soft, brittle wood. It it is said that, when first brought out, the toothpicks were made of hard, fibrous wood; but the inventor soon found that this would not pay, as the picks lasted too long, and he went to pine. It now takes four sound picks to get the broken end of one out from between the teeth; and it is the latter discovery that is said to have realized the inventor his fortune.

THE PRACTICAL RESULTS OF THE ENGLISH ARCTIC EXPLORING EXPEDITION.

We have before us the connected and detailed narrative of the English expedition, which has lately returned from the arctic regions. A general outline of the voyage we have already presented, noting the fact that the sledge parties from the Alert had reached the highest northern point ever attained, and only turned back when further progress toward the pole became impossible owing to the roughness of the ice and the terrible cold. The official report of the attempt says that, instead of land extending far towards the north, as reported by the Polaris, Robeson Channel opens directly into the Polar Sea. The Alert rounded the northeast point of Grant Land, but, instead of finding a continuous coast line leading one hundred miles further towards the north, as everyone had expected, found herself on the border of what was evidently a very extensive sea, with impenetrable ice on every side. No harbor being obtainable, the ship was secured as far north as possible, inside a sheltering barrier of grounded ice, close to the land, and there she passed the winter. During her stay of eleven months no navigable channel of water permitting further advance to the northward ever presented itself. Instead of finding an "open Polar Sea," the ice was of most unusual age and thickness, resembling, in a marked degree, both in appearance and formation, low floating icebergs rather than ordinary salt water ice. It has now been termed the "Sea of Ancient Ice"—the Palæocrystal or Paiæcruic Sea; and a stranded mass of ice broken away from an icefloe is named a floeberg.

Whereas ordinary ice is usually two feet to ten feet in thickness, that in the Polar Sea, in consequence of having so few outlets by which to escape to the southward in any appreciable quantity, gradually increases in age and thickness until it measures from 80 feet to 100 feet, floating with its surface at the lowest part 15 feet above the water line.

Strange as it may appear, this extraordinary thickness of the ice saved the ship from being driven on shore: for, owing to its great depth of flotation, on nearing the shallow beach it grounded and formed a barrier, inside which the ship was comparatively safe. When two pieces of ordinary ice are driven one against the other and the edges broken up, the crushed pieces are raised by the pressure into a high, long, wall-like hedge of ice.

When two of the ancient floes of the Polar Sea meet, the intermediate lighter, broken-up ice, which may happen to be floating about between, alone suffers; it is pressed up between the two closing masses to a great hight, producing a chaotic wilderness of angular blocks of all shapes and sizes, varying in hight up to 50 feet above water, and frequently covering an area upwards of a mile in diameter.

Such an icy road, which was sure to be continuous, destroyed all hope of the pole itself being reached by sledges. Commander Markham and Lieutenant Parr were, however, absent seventy-two days from the ship; and on May 12 succeeded in reaching latitude 83° 20′ 26″ N., as marked on the annexed map. From this position there was no appearance of land to the northward, but, curiously enough, the depth of water was found to be only seventy-two fathoms.

In addition to the dispatch of the northern travelers, the coast line to the westward of the Alert's position was traced for a distance of 220 miles by a party under the command of Lieutenant Aldrich; the extreme position reached was in latitude 82° 40′ N., longitude 86° 30′ W., the coast line being continuous from the Alert's winter quarters. The most northern land, Cape Columbia, is in latitude 83° 7′, longitude 70° 30′ W.

The coast of Greenland was explored by traveling parties from the Discovery, under the command of Lieutenants Beaumont and Rawson. They succeeded in reaching a position in latitude 83° 18′ N., longitude 50° 40′ W., 70 miles northeast of Repulse Harbor. The land extended as far as latitude 82° 54′ N., longitude 48° 33′ W., but very misty weather prevented its character being determined with exactness. Lieutenant Archer, with a party from the Discovery, explored Lady Franklin Sound, proving that it terminates at a distance of 65 miles from the mouth, with lofty mountains and glacier-filled valleys to the westward. Lieutenant Fulford and Dr. Coppinger explored Petermann Fiord, finding it blocked up with a low glacier, which extends across from shore to shore. With the exception of Hayes Sound, the coast line of Smith Sound has now been explored from north to south.

When all had come back to the ships, Captain Nares found that the sufferings had been terrible, that the work achieved was unsurpassed in the annals of discovery; but he also found that the heroic devotion of officers and men had secured for the expedition complete success. The work was done, and he was able to decide upon returning to England. While the pole had, it is true, not been reached, the impracticability of any one ever attaining it had been placed beyond doubt.

We have noticed that because Captain Nares did not accomplish the discovery of the pole, which by common consent rather than through any scientific reason is considered the goal of all arctic expeditions, his work has been hastily pronounced a failure. This is not only unjust but unfounded; for the expedition really accomplished all it started to perform, namely, the exploration of the region adjacent to the pole, and only ceased when insuperable difficulties and the practical completion of its task rendered further labors both impossible and unnecessary. Mr. Clements R. Markham sums up its splendid achievements as follows:

First, a great Polar Ocean has been discovered and fully described, which will revolutionize most preconceived ideas, and a knowledge of which will be most valuable to the science of hydrography. Next, a coast line, stretching from 50° of longitude along the Polar Ocean, has been discovered and carefully delineated; and an exhaustive knowledge of its geology, fauna, and flora has been obtained. The long channel, from Smith Sound to the Polar Ocean, has also been carefully delineated, and the shores on both sides have been explored and described. Most important discoveries have been made with reference to the geology of the unknown area, the value of one of which—namely, the former existence of an evergreen forest in 82° 44′ N.—is alone worth all that has been expended on the expedition. In zoölogy and botany the results are equally valuable, especially as regards the distribution of plants and animals. Add to this that complete series of observations, at two separate stations, have been recorded in meteorology, magnetism, tides, electricity, and spectrum analysis: besides other results not yet reported.

MAP OF THE COURSE OF THE BRITISH POLAR EXPEDITION.

Business Precepts.

We find it stated that the founder of the great banking house of Rothschilds made the following rules the guide of a business career culminating in magnificent success:

1. Combination of three profits. "I made the manufacturer my customer, and the one I bought of, my customer; that is, I supplied the manufacturer with raw materials and dyes, on each of which I made a profit, and took his manufactured goods, which I sold at a profit, and thus combined three profits."

2. Make a bargain at once. Be an off-handed man.

3. Never have anything to do with an unlucky man or place. "I have seen many clever men who have not shoes to their feet. I never act with them. Their advice seems very well, but fate is against them; they cannot get on themselves, how can they do good to me?"

4. Be cautious and bold. "It requires a great deal of boldness and a great deal of caution to make a great fortune, and when you have got it it requires ten times as much to keep it."

A Fish of Seven Colors and Three Tails.

Mr. Gill, of Martin, Gillet & Co., of Baltimore, Md., has just returned from Japan, bringing with him a beautiful and rare fish, never before seen in this country, and which he has kindly loaned to the New York Aquarium. The peculiar features are several brilliant colors and three separate and distinct tails, all of which the Japanese claim are the result of many and successful years of the most careful breeding. A number of attempts have been made to introduce this fish into American waters, but this is the only instance of success. A tank, suspended like a compass, to avoid the ship's motion, was especially constructed, and then, notwithstanding the greatest care, attention, and constant watching, out of eighty-eight only seven survived the journey. The remaining six that Mr. Gill has have spawned, resulting in fifty young fry, which exhibit all the peculiarities of the originals. It is Mr. Gill's intention, as soon as he has a sufficient stock, to give some of them to persons who will endeavor to raise them. The fish loaned to the aquarium is a magnificent specimen, and exhibits all the several beautiful colors in perfection.

What British Hardware Manufacturers Have to Do.

The last number of the *Ironmonger* takes the British manufacturers to task for not furnishing what the people demand, and admonishes them, if they expect to retain their trade, to adopt the plan of supplying the article the consumer requires. "Many old patterns will have to give way in this country," it says, "in favor of more handy goods in frequent use throughout the New World. The essence of the American's success consists in the fact that he always supplies just what the consumer wants, or thinks he wants, and that he supplies the want promptly. While an Englishman cannot for the life of him sacrifice stock, the American, who, as a salesman, is frequently 'two or three hours ahead' of our own countrymen, does so without compunction. Only let him see his opportunity, and he will not hesitate a moment. Of this an instance was recently recorded in the method of dealing by two traders of different nationalities, who were selling goods required by the miners at the gold diggings. The articles were dippers, and they were supplied by the hundred by an English and an American firm respectively. When the goods were delivered upon the ground, the tide of popular opinion had turned, and something different was wanted. The American tossed all his dippers into a shed and thought no more of them; in less than a week he had a supply of new dippers on the ground. Not so the Englishman: he persisted in trying to sell what he had got, and refused to sell anything else. 'Is it a matter of surprise,' it is asked, 'that the American did a roaring trade, while the Britisher retired in disgust?' Why have we lost the ax trade? Because the English ax makers were too proud or too indolent to take a lesson from the Americans, who, utilizing their great experience in the use of such a tool, have produced the best possible instrument for the purpose. Doggedly the English ax maker has gone on making an imperfect tool, and has forced the consumer at home as well as abroad to buy oftentimes reluctantly, the American product. Less than ever can we afford to repeat that and other mistakes which are now occurring in a not dissimilar line of business; for it will most certainly come about that additional agencies will be opened in this country for supplying such goods. Even at this moment the electroplate goods of a leading electroplate company of America are being sold in Birmingham; and through a central agency there, what are known as 'Canadian' gold Albert chains, which are really excellent goods of United States make, are being sold throughout the whole of England. Established English ironmongers have a right to look to English hardware firms to supply them with goods that the English people may demand, without driving them to resort to present or future American agencies, either in Birmingham, Liverpool, or London."

To Distinguish between Cotton and Wool in Fabrics.

Ravel out the suspected cotton fiber from the wool and apply flame. The cotton will burn with a flash, the wool will curl up, carbonize, and emit a burnt, disagreeable smell. Even to the naked eye the cotton is noticeably different from the filaments of wool, and under the magnifier this difference comes out strongly. The cotton is a flattened, more or less twisted band, having a very striking resemblance to hair, which, in reality, it is; since, in the condition of elongated cells, it lines the inner surface of the pod. The wool may be recognized at once by the zigzag transverse markings on its fibers. The surface of wool is covered with these furrowed and twisted fine cross lines, of which there are 2,000 to 4,000 in an inch. On this structure depends its felting property. Finally, a simple and very striking chemical test may be applied. The mixed goods are unraveled, a little of the cotton fiber put into one dish and the woolen in another, and a drop of strong nitric acid added. The cotton will be little or not at all affected; the wool, on the contrary, will be changed to a bright yellow. The color is due to the development of a picrate.

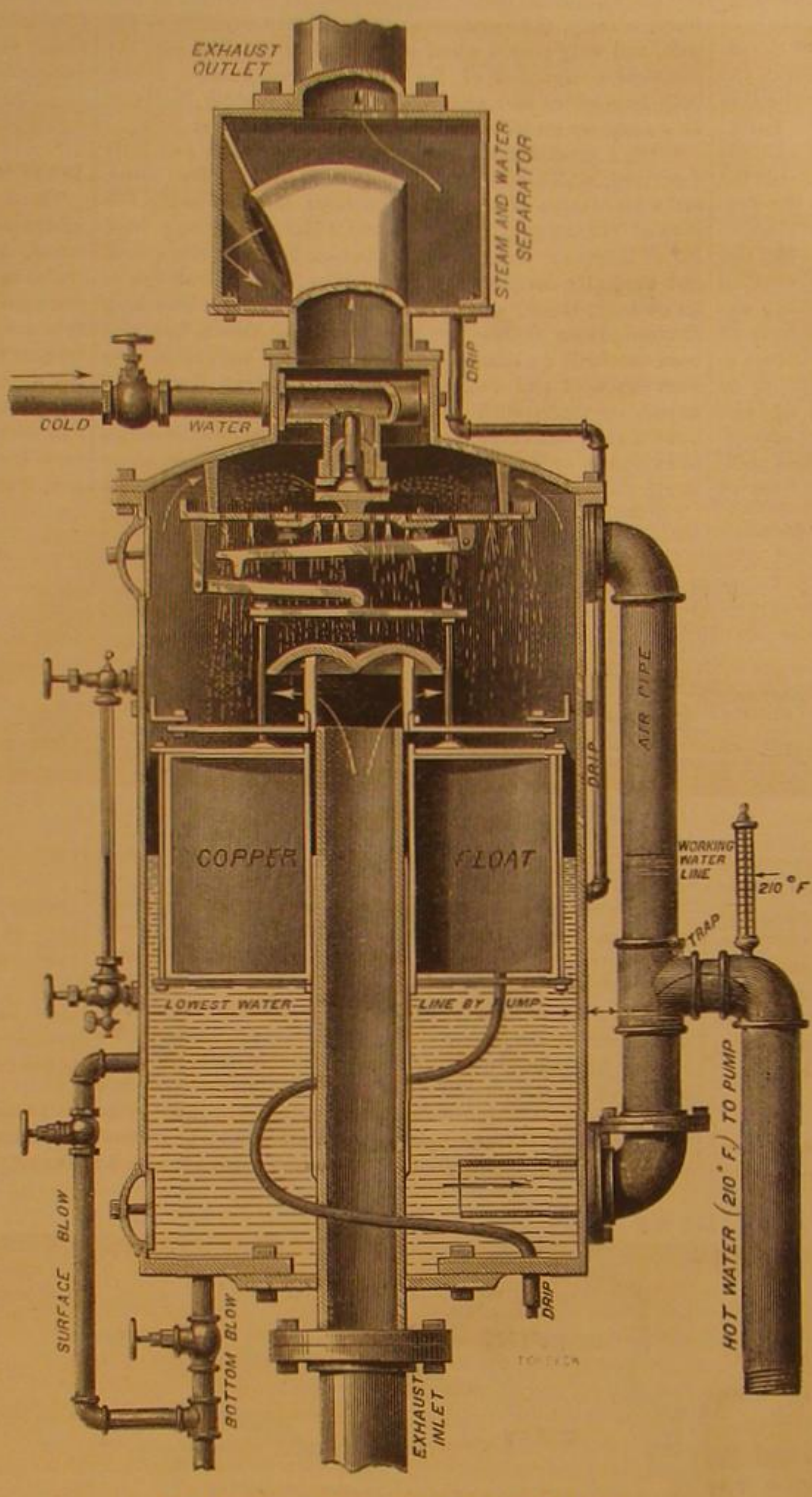
ONE per cent of lime with silica makes the most infusible brick known.

IMPROVED FEED WATER HEATER.

We illustrate herewith a new self-regulating feed water heater, the operation of which will be readily understood from the following description: Referring to the illustration, the cold water enters through its pipe to the valve, a little above the perforated plate. This valve rests upon levers connected with the float, seen below, which effectually controls it. The water escaping from the valve passes through the perforated plate in the form of rain or spray. The exhaust steam, entering from below through the large central pipe, strikes the deflecting disk at its top, and is directed against the rain or spray falling from the perforated plate, heating it, it is claimed, instantaneously to the boiling point. The steam then passes around the perforated plate to the steam and water separator on top, where it drops any water it may have taken up, and passes to the exit well dried. The water thus collected travels through a drip pipe to the bottom of the heater. The heated water in the bottom of the heater passes to the pump through the pipe on the right. It will readily be seen that whenever, from the shutting off of the main or from any other cause, the water is pumped down, it cannot fall below the line marked "lowest water line by pumping," as when that line is reached the pump draws air and steam through the air pipe. The object of this arrangement is to collect any oil or floating dirt above this outlet to the pump, where it can be drawn off nightly through this surface blow, and any heavy dirt below the outlet, where it can be drawn off weekly through the bottom blow. The float is substantially made, and gives no trouble; but as an additional precaution, a spiral drip pipe is used, which preserves its buoyancy unless it leaks more than the pipe can carry off. The float and the plate seen above it also act as pacificators, and prevent the constant turmoil of the water, so that in practical operation the level of the water does not vary over one half inch.

It is claimed that this apparatus, using exhaust steam only, will heat over three times the water needed for the purpose of making steam for power to an unvarying temperature of 210° Fah., no matter how fast the water may be pumped. It is also entirely self-regulating and requires no attention. A thermometer for testing is attached to and furnished with each heater, and a trial of thirty days is allowed. We are informed that the apparatus has been in successful operation for the past eighteen months. The Brooklyn navy yard is using one, the government tests showing, it is stated, a gain of thirty per cent in heating power over their tubular heater. The engineer of the New York Post Office building testifies to a saving by the two in use there of twenty-two per cent by actual weight. One in the Equitable Life Insurance building shows a saving of about eighteen per cent, and others in use by private parties show like advantageous results.

For further information apply to the Green Feed Water Heater Company, 86 Liberty street, New York city.



GREEN'S FEED WATER HEATER.

IMPROVED FURNACE FEEDER.

Years ago Dr. Arnott taught us that the proper method was to light a fire from the top and let it burn downwards, consuming the gases as they were evolved; and in accordance with this view, he invented a domestic grate for charging at the bottom. Mr. Frisbie's patent feeder, represented in the annexed engraving, which we select from the pages of *Iron*, is designed to accomplish the same object in furnaces and the fire grates of steam boilers.

The accompanying engravings are longitudinal vertical sections, Fig. 1 showing the charging cylinder in a vertical position and with the piston raised; while Fig. 2 shows the cylinder brought back to an inclined position and filled, with the piston at the bottom. In place of the usual fire bars is a central aperture, surrounded by segmental gratings, which are easily removable, while the whole annular arrangement of grate bars runs on friction rollers, like a turntable, and may be rotated by means of a crowbar inserted in the holes for that purpose. Underneath the central aperture is hung the cylinder or hopper, swinging on pivots, and provided with a movable bottom or piston. This cylinder is supported by side plates working in bearings on the floor of the furnace; and, after being filled in the inclined position, is brought up to the vertical by one set of arms and crank pins on the crank shaft, taking into notches in links jointed to the supporting plates. The crank shaft is driven by means of the hand winch and bevel gearing; and when the cylinder has reached the full extent of its swing which brings it directly underneath the central circular aperture, the crank pins leave the notches, and the links then rest upon the shaft, thus locking the hopper in a vertical position. By a continued turning of the winch handle, the crank of the shaft, which is provided with a friction roller, now comes into contact with another set of arms on the shaft, which raise the piston with its charge of fuel to the top of the cylinder, thus causing the fresh charge to displace the previous one (shown at Fig. 2), and propel it into the incandescent mass above. Turning the handle in the contrary direction has the effect of bringing the cylinder back to the inclined position, the crank pin of the first set of arms taking into the notches, and disengaging the links by raising them. A cast iron apron follows the cylinder up, so as to retain in its place the coal just charged into the furnace. The piston remains at the top of the cylinder until it has passed the opening in the center, when it is released by a catch coming in contact with a cross bar, and falls to the bottom of the cylinder, ready for a fresh charge of fuel.

It is claimed that, by this arrangement, the gases evolved from the coal cannot escape without being consumed; and so perfect is the combustion that nearly all the residuum forms a fine ash, which falls between the bars on their being moved round. Any clinker or incombustible substance contained in the fuel is continually lifted and loosened, and gradually carried to the circumference of the grate by the successive charges of fresh fuel forced up in the center, and may be removed from all portions of the grate by its being brought, in its revolution, opposite the fire hole door. Raking of the bars is entirely superseded, and the fire door need be opened only rare occasions. Again, the stoker is completely protected from the violent heat, and has a much less laborious task than in hand stoking. There is no fear, as might at first be supposed, of the cylinder being melted by the heat; the fact is that it does not come in contact with the fire itself, but only with fresh coals. The draft through the grating also tends to keep the gear cool. We learn that there are already over thirty of the feeders now in use in Birmingham, England.

Explosion of Benzolin.

Persons who have occasion to repair barrels which have contained naphtha, benzole, or any of the light petroleum oils should be careful how they use a light or even a hot iron about their work. A Mr. Bower, of Sheffield, England, had in his cellar an empty benzolin cask which needed to be repaired, and in doing it he, with singular indiscretion, applied a red hot solder iron to the inside. The spirit or gas which still remained in the barrel exploded with great violence. Mr. Bower escaped with a good fright; but the globes and glass in his shop were smashed, a skylight was blown out in the back kitchen, and other damage was done.

Fig. 1.

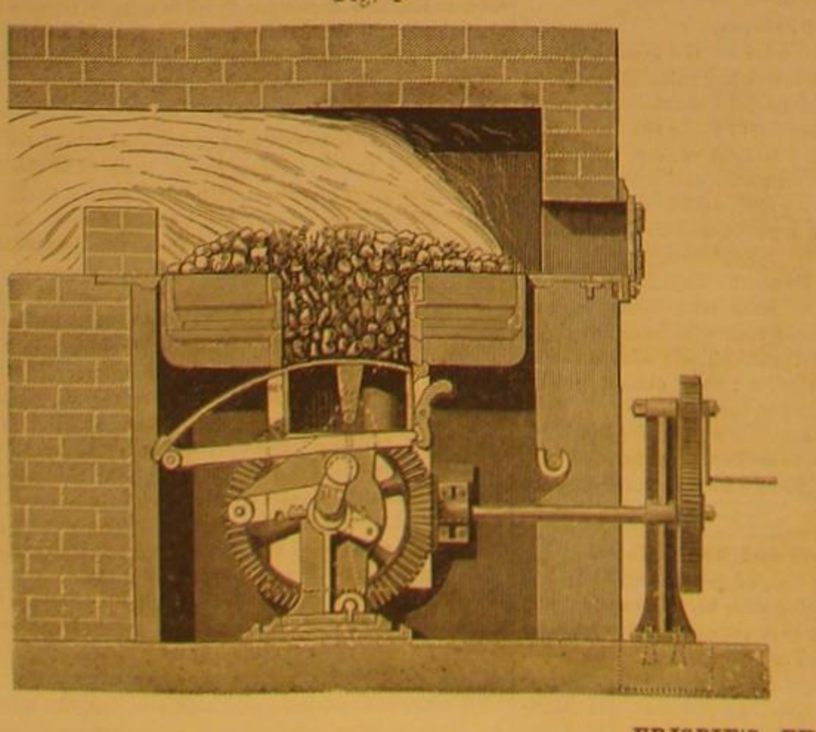
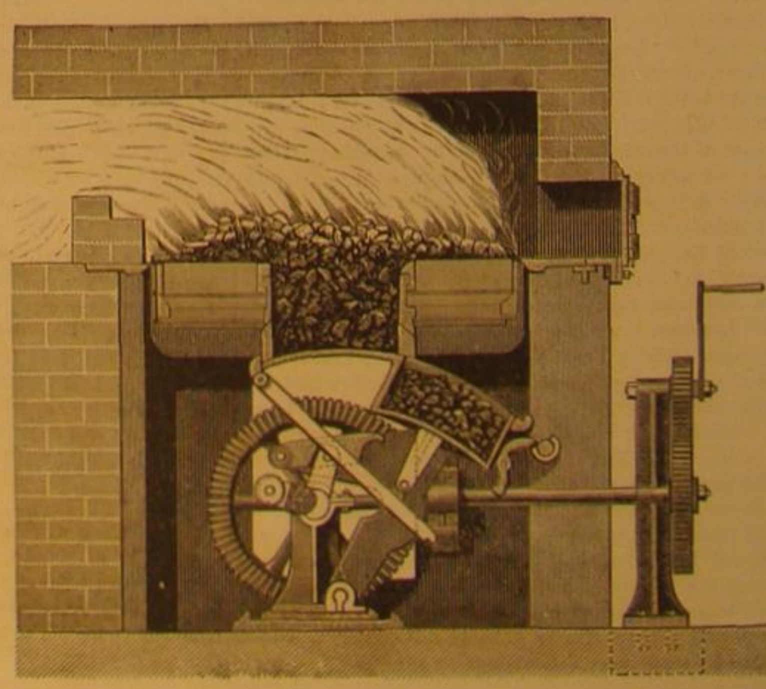


Fig. 2.



FRISBIE'S FURNACE FEEDER

SEA SERPENTS.

There have been so many "mariners' yarns" told about gigantic sea serpents that few believe that any true member of the snake family ever lives in the sea, despite the fact that in our temperate climate there are many of the reptiles known as water snakes which are rarely met with except in ponds and marshes. The truth is that there are sea serpents, to be sure not colossal monsters with heads as big as hogsheads, and capable of crushing small vessels in their vast folds, but moderate-sized snakes, growing sometimes to a length of over nine feet, but generally about half that. The family of thantophidians to which they belong has only seven genera and about twenty species, and is indigenous to the Indian Ocean and archipelago. The serpents have flat tails and a compressed body, perfectly adapted to their aquatic existence. They are, in fact, compromises between snakes and eels. Like snakes they are venomous, and their bite is often deadly, although their poison loses its power after the reptile has been out of water a few days. The jaws and teeth are smaller than those of land serpents of the same dimensions. The head is always small. The body changes its form according to the season of the year, being sometimes long and thin, again short and thick.

THE HYDROPHIS.

The serpents belonging to the genus *hydrophis* are nearest allied to their land brethren, and one especially, the *platura*, appears to be a connecting link between the two orders. Its general conformity and its large ventral scales all indicate an animal capable of locomotion on the and as well as in the water. The food of the family—one member of which is well represented in the annexed illustration, from *La Nature*—is fish, crustaceans, and small turtles, which they kill by their venomous bite. A curious fact is that the snakes in time become literally covered with barnacles, as when these parasites affix themselves to their bodies the serpents make no attempts to remove them.

PREHISTORIC RELICS IN ARIZONA.

Arizona Territory is perhaps less known, to the majority of our inhabitants, than any other part of the country; and yet it has a remarkably fine climate, moderate temperature, fertile soil, and unbounded mineral wealth. No railways, however, have as yet been constructed in Arizona: but the Atlantic and Pacific and the Texas Pacific companies have obtained charters and land grants, and, when these roads are constructed, there is every likelihood of this beautiful region being reached by settlers from the East; and its lands, now chiefly occupied by nomadic tribes of Pimas, Maricopas, Mohaves, Utes, and Apaches, will be brought into cultivation.

To the traveler and antiquary, Arizona is a land possessing especial interest, as it abounds with relics of two populations, probably widely separate in point of time. There are to be found here numerous ruins of Aztec sculptures and buildings, which were probably of great antiquity when Cortes arrived in Mexico, and Don José de Vasconcellos crossed Arizona towards the Great Cañon, in 1526. But the remarkable painted rocks, shown in our illustration, are doubtless much older than the Aztec relics; and there is no history, legend, or tradition that even attempts to explain the origin of the inscriptions. The marks are not painted but scratched on the surface of the rock, which is a kind of gritty sandstone, of red color; and many of the animals thus rudely depicted are not, and perhaps never have been, indigenous to Arizona. The alpaca, for instance, belongs to the uplands of South America; and the buffalo's native land is far to the northeast of these rocks. It seems reasonable, therefore, to believe that the inscriptions were part of an account of some travelers' wanderings, who thus recorded news of the remarkable countries they had visited.

The pitahiya, or giant cactus, several specimens of which are shown in our engraving (which we select from the pages of the *Illustrated London News*), sometimes reaches the hight of seventy feet. It has a curiously weird appearance, with its huge pronged branches looming in the distance. The fruit is a favorite food with the natives, who knock it down from the trees with arrows. They also use the fibers of the trunks, matting them together to roof their wigwams with.

The Aztec relics are very numerous on the Colorado plateau, in the northwestern part of Arizona; and the Spaniards subsequently erected reservoirs, terraces, and buildings of great extent. Stone fortifications are also very frequently met; and it has been estimated from such indications that at least 100,000 people inhabited the Gila valley at one time. It is probable, moreover, that some further light may be thrown on the history of this wonderful region, as much of the northern part of the country has never been explored.

FOR KEEPING crackers dry, unslaked lime is recommended. The wooden boxes for the crackers should be about 12 inches deep, and have a tray 1 inch deep to rest just beneath the lid, which should fit tightly. The lime is placed on the tray, and is said to keep the crackers dry for six months if the box is not opened, or for about two months if the box is visited daily.

THE *Herald of Health* says that the right way to cook an egg is to pour water on it at a boiling temperature and leave the egg in it for fifteen minutes.

THE PAINTED ROCKS, ARIZONA TERRITORY.

CENTENNIAL NOTES.

AFTER THE FAIR.

The dismantling of the Great Exposition is being pushed forward with great rapidity, and the scene in the grounds reminds one of the busy haste incident to the week prior to the opening. Freight cars, wagons, and trucks, loaded with filled boxes, are everywhere; the machinery is motionless, and much of it is taken apart and covered with white lead; on such of the State buildings as are not sold (but most of them are), the placard "For Sale" stares the visitor in the face; and barriers at every hand prevent the accustomed free rambling about the grounds. In the Main Building nearly all the foreign exhibits are fenced in, and admittance to them is denied. The Japanese display is surrounded by a high partition which prevents even the empty cases being seen. The paintings are nearly all packed. Visitors who puzzled over how Markart's immense work was transported may now have their curiosity satisfied by beholding the canvas removed from its stretchers and carefully rolled on a huge cylinder, a proceeding which smaller oil paintings would hardly undergo without cracking. Most of the statuary is to be sold, and some is already advertised to be offered at auction in this city. The Government Building is closed, and a sentry paces his beat in front of the door. Visitors are still admitted to the grounds at the usual price, but they number scarcely 15,000 a day. Bargain hunters are present in full force, there being a prevalent idea that exhibitors will offer their wares at greatly reduced rates rather than remove them. The reverse, however, appears to be the case; and with some exceptions, the exorbitant prices hitherto charged are maintained. To judge from the immense number of objects that were sold during the fair and the sums they brought, visitors must have become imbued with the notion that everything exhibited was unique and unattainable elsewhere. We doubt if there was anything, with the exception of certain works of art and oriental objects, that could not be duplicated in this city or even imported from Europe at a very much less cost. The Italian trinkets, which are sold in Genoa for their weight in silver, were universally purchased at about four times their value; the Chinese porcelain went at about the same ratio as compared with New York prices; and as for the supposed Turkish jewelry, thousands of dollars worth of the spurious trash was bought at at least five times its usual cost. At the beginning of the Centennial, some real Turkish goods were offered for sale; and these Mr. Bayard Taylor probably saw when he wrote the letter to a New York journal attesting their genuineness. That letter was posted conspicuously by the dealers; and under its innocent guarantee, thousands were induced into buying glass and brass which elsewhere they would have scorned, and which now is gladly sold on the grounds at less than half price. The United States government seems to have profited considerably by the generosity of foreign exhibitors, and in this respect to share the advantages with the city of Philadelphia. Nearly every government represented on the grounds has given something to the National Museum, while many have given all and others the greater portion of their specimens in certain departments. Philadelphia has lately been presented with the German Pavilion; and the Jewish statue of "Religious Liberty" which has just arrived, unfortunately too late for the Exhibition, will be set up permanently in Fairmount Park.

The Centennial Commission are finishing the award business, and shortly will adjourn for a period of several months, leaving the entire management in the hands of that less cumbersome body, the Executive Committee. The members of the Commission are determined to completely wind up the affairs of the Exposition just as soon as the accounts can be revised and final reports prepared, and thus creditably to finish their creditable work.

With the close of the Exposition comes the period of statistics, and they are appearing with a frequency that presupposes a pre-eminent popular mathematical taste. We are told that the total number of cash admissions was 8,004,214, and receipts $3,674,883.74. The hotels in West Philadelphia report the accommodation of 2,564,000 guests. The Globe hotel is to be removed to Long Branch, the Atlas will be demolished, and many of the others will be altered back into dwelling houses. The attendance at the Exposition was lowest during the month of May, averaging 19,946 daily; it steadily increased, and during October averaged 102,456. The fund realized by the 15 per cent royalty on beer and soda water amounts to $500,000. The Corliss engine flywheel made 2,355,300 revolutions during the Exhibition. Any point in its periphery therefore traveled an average of 260 miles per day, or 40,147 miles during the entire Fair.

Science in America.

Professor John W. Draper delivered an inaugural address, as President of the newly formed Chemical Society, on the above subject, at Chickering Hall, this city, on the evening of the 15th of November. He began by stating that the progress of Science depends on two elements, our educational establishments and our scientific societies. Briefly sketching the scientific and industrial progress of the century, he said that in 1840 it had become apparent that there was provision in the existing educational establishments for instruction in accordance with the world's advance in substantial knowledge. The colleges clung to the mediæval as long as they could, and only accepted the modern when they were compelled; and generally, the lecturer considered that the sooner colleges emancipated themselves from the mediæval confines of the classics, and assumed thoroughly and sincerely the modern cast of study, the more the cause of scientific progress would be promoted.

Dr. Draper then sketched the growth of scientific societies and pointed out the benefits of their organized efforts. He thought that endowment of colleges was a noble disposition of money, but considered that the bestowal of funds on any scientific society was still nobler. The one is a local and transitory benefaction, the other enduring and universal benevolence.

The most important part of the address related to scientific progress due to Americans, and was in answer to many of the addresses made during the last summer on the Centennial occasion, in which the shortcomings of the United States in extending the boundaries of scientific knowledge, especially in the physical and chemical departments, have been set forth. The persons who make these humiliating accusations mistake what is merely a blank in their own information for a blank in reality.

"Perhaps, then, we may without vanity recall some facts that may relieve us in a measure from the weight of this heavy accusation. We have sent out expeditions of exploration both to the Arctic and Antarctic Seas. We have submitted our own coast to a hydrographic and geodesic survey, not excelled in exactness and extent by any similar works elsewhere. In the accomplishment of this we have been compelled to solve many physical problems of the greatest delicacy and highest importance, and we have done it successfully. The measuring rods with which the three great base lines, of Maine, Long Island, Georgia, were determined, and their beautiful mechanical appliances, have exacted the publicly expressed admiration of some of the greatest European philosophers, and the conduct of that survey their unstinted applause. We have instituted geological surveys of many of our States and much of our territories, and have been rewarded, not merely by manifold local benefits, but also by the higher honor of extending very greatly the boundaries of that noble science. At an enormous annual cost we have maintained a meteorological signal system, which I think is not equaled, and certainly is not surpassed, in the world.

"Should it be said that selfish interests have been mixed up with some of these undertakings, we may demand whether there was any selfishness in the survey of the Dead Sea? Was there any selfishness in that mission that a citizen of New York sent to Equatorial Africa for the finding and relief of Livingstone, any in the astronomical expedition to South America, any in that to the valley of the Amazon? Was there any in the sending out of parties for the observation of the total eclipse of the sun? It was by American astronomers that the true character of his corona was first determined. Was there any in the seven expeditions that were dispatched for observing the transit of Venus? Was it not here that the bi-partition of Biela's comet was first detected, here that the eighth satellite of Saturn was discovered, here that the dusky ring of that planet, which had escaped the penetrating eye of Herschel and all the great European astronomers, was first seen? Was it not by an American telescope that the companion of Sirius, the brightest star in the heavens, was revealed, and the mathematical prediction of the cause of his perturbations verified? Was it not by a Yale College professor that the showers of shooting stars were first scientifically discussed, on the occasion of the grand American display of that meteoric phenomenon in 1833? Did we not join in the investigations respecting terrestrial magnetism instituted by European governments at the suggestion of Humboldt, and contribute our quota to the results obtained? Did not the Congress of the United States vote a money grant to carry into effect the invention of the electric telegraph? Does not the published flora of the United States show that something has been done in botany? Have not very important investigations been made here on the induction of magnetism in iron, the effect of magnetic currents on one another, the translation of quantity into intensity, and the converse? Was it not here that the radiations of incandescence were first investigated, the connection of increasing temperature with increasing refrangibility shown, the distribution of light, heat, and chemical activity in the solar spectrum ascertained, and some of the fundamental facts in spectrum analysis developed, long before general attention was given to that subject in Europe? Here the first photograph of the moon was taken, here the first of the diffraction spectrums was produced, here the first portraits of the human face were made—an experiment that has given rise to an important industrial art!

"Those who make it their practice to decry the contributions of their own country to the stock of knowledge may perhaps stand rebuked by the expressions that sometimes fall from her generous rivals. How can they read without blushing at their own conduct such declarations as that recently uttered by the great organ of English opinion, the foremost of English journals? The *Times*, which no one will accuse of partiality in this instance, says: "In the natural distribution of subjects, the history of enterprise, discovery, conquest, and the growth of republics fell to America, and she has dealt nobly with them. In the wider and multifarious provinces of art and science she runs neck to neck with the mother country, and is never left behind!"

Spontaneous Combustion in Coal.

At this season it is advisable to test the temperature of all piles of coal, whether in sheds or out of doors, in order to detect any tendency to heating. The usual method of running down tubes (ordinary inch pipes, sharpened at lower end) from the top of the piles to the bottom, at frequent intervals, will repay for the trouble. Whether in sheds or out of doors, coal is apt to heat, and more particularly so after being stored about three months. In many places, tubes are always kept in the piles, and the temperature taken daily, by lowering a thermometer into them: in this way any accumulation of heat can be easily detected, and the remedy applied before loss is incurred. When undue heat is detected, turning over that portion of the pile is the surest remedy. In several cases of heating that have occurred recently, only the watchfulness and promptitude of those in charge have prevented serious losses.—*American Gaslight Journal.*

Preservation of Timber with Salts of Copper.

Experiments by M. Rottier show that wood impregnated with copper may be long preserved, but will not last underground for an indefinite time. However carefully prepared, it decays after a longer or shorter interval.

So long as the wood contains a certain proportion of copper, it resists decay; when the copper is no longer there, it is in pretty much the same condition as unprepared wood, and speedily decomposes.

Some thin slips of soft poplar wood were carefully dried and afterwards impregnated with a solution of pure copper sulphate, containing 1½ lbs. of crystallized sulphate of copper per 100 lbs. water. It was not found necessary to resort to pressure, as, the wood being very thin, mere immersion sufficed for its thorough impregnation with the antiseptic fluid. The strips were washed several times with plenty of water, and dried. Some were then set apart for analysis, and others buried, in a box filled with ordinary garden mold kept continually moist by repeated waterings. The annexed table shows the results:

—	Length of time the strips were interred.	Proportion of crystallized sulphate of copper found in them.	REMARKS.
	days.	grains.	
15 grains of wood prepared and dried....	0	0·63263	
15 grains of wood prepared and dried...	68	0·38575	Wood still perfectly sound.
15 grains of wood prepared and dried....	117	0·33946	Strips showing a few black spots.
15 grains of wood prepared and dried....	179	0·26231	Wood almost entirely decayed.

Here we see, as plainly as it can well be shown, that the preservation of the wood was due to the presence of the cupreous sulphate; by degrees, as it parted with this metallic salt, it decayed. Now let us consider the causes of removal of the copper. They are three: 1. The presence of iron. 2. The presence of certain saline solutions. 3. The presence of carbonic acid.

Timber prepared with copper is liable to decay when the proportion of the latter contained in it becomes very small. It appears probable that its duration might be prolonged by fixing more copper in the ligneous tissue.

The ordinary method of preparing timber does not permit of the solution of the question; wood plunged in a solution of copper sulphate takes up a pretty nearly constant quantity of the metal; and that quantity is very small. Special processes are requisite to introduce larger quantities of the metal into the tissues.

Ammoniacal copper salts: The use of the ammoniated salts of copper allows of the introduction of large quantities of copper in woody tissue. Numerous experiments showed that wood so prepared contained from 0·255038 grain to 0·112639 grain of copper per 15·43 grains of wood.

It appears, therefore, that there are various ways of impregnating wood with copper in excess of the ordinary proportion. It remains to be seen whether the excess of copper gives a notable increase of durability. To decide this question seven strips of wood were buried in the ground side by side: 1. A strip unprepared, A. 2. A strip prepared with sulphate of copper, B. 3. A strip prepared with acetate, C. 4. A strip prepared with catechu, D. 5. A strip prepared with sulphate and afterwards heated, E. 6. A strip prepared with acetate and heated, F. 7. A strip prepared with cuprammonium sulphate. The results are:

—	15·43 grains of wood contained of Cu So_4, 5 H_2O	Wood completely rotted after
	grains.	days.
A. Unprepared wood..............	0·0003086	30
B. Wood prepared with copper sulphate in the ordinary way....	0·0112639	67
C. Wood prepared with acetate of copper......................	0·1543	95
D. Wood prepared with sulphate of copper and catechu..........	0·20059	120
E. Wood prepared with sulphate of copper and heated afterwards.	0·1543	80
F. Wood prepared with acetate of copper and heated afterwards.	0·35489	160
G. Wood prepared with ammoniacal copper sulphate..............	0·255038	130

These results have been confirmed by repeated experiments, in some of which the prepared slips of wood were found as fresh and sound after an interment of 200 days as when first consigned to the ground.

Of the several methods above described, one only, the employment of ammoniacal copper salts, appears of any practical utility. Acetate of copper and indigo are each of them too expensive; catechu is too restricted in its action. On the other hand, the ammoniacal salts of copper are adapted for general use, and are, comparatively speaking, cheap; and the slightly increased outlay necessitated by their adoption would be more than compensated by the assurance of greater durability in the timber so prepared.

The French International Exhibition of 1878.—Regulations for Foreign Exhibitors.

The Commissioner General of the French International Exposition of 1878, to be held in Paris, has published the regulations for exhibitors. We extract the following from the articles relating to foreign contributions:

Article 5. Packages from abroad containing products destined for the Exposition must bear as distinctive marks the letters E. U., surrounded by a circle and traced by a brush. They are to be addressed to the commissioner of the exhibitor's country. Such packages will also bear the following indications, namely, the colors or emblems of their national flag. Foreign commissioners are expressly requested to inform the Commissioner General, at as early a date as possible, as to the form of address and special signs for recognition which each may adopt.

Article 6. Both French and foreign products will be admitted within the Exposition from January 1, 1878, to March 30, inclusive. These dates are subject to the revision of the Commissioner General.

Article 7. The Exposition is constituted a custom house depot. Foreign products entering under customs laws may do so up to March 15.

Articles 8 and 9. These relate to the building of structures for heavy machinery, etc., under the direction of the Commissioner General. Work thereon may begin by December 1, 1877, and must be finished by February 15, 1878.

Article 10. Everything must be in place and in order by April 15. This provision will be rigidly enforced, and the Commissioner General will dispose of all allotted space either not occupied or incompletely occupied on that date.

Articles 11 and 12. Packing boxes must be emptied at once, and removed. If the exhibitor does not do this, the Commissioner General will have it done. Exhibitors must also take care of their own boxes, no place for storing them being provided.

Article 14. All exhibits must be removed by December 15, 1878. After that date they will be stored at the exhibitor's expense; and if not then removed before June 30, 1879, they will be sold for the public benefit.

NEW BOOKS AND PUBLICATIONS.

THE USE AND ABUSE OF THE STEAM BOILER. By Stephen Roper, Engineer. Philadelphia, Pa.: Claxton, Remsen, & Haffelfinger, Publishers, 624 Market street.

The author says in his preface that "the great mistake of many writers on the steam boiler and steam engine is that they write too much." This is peculiarly his own error, and the unnecessary existence of the present book proves the fact. It appears to be devoted to advertising a well known boiler insurance company, several boilers in common use, and some of the author's inventions. Such practical information as is given is useful, but is obtainable in much more condensed form in other works. The book, however, serves one good purpose in reminding us that we have not received that amended copy of Mr. Roper's previous production, in which he promised to give credit to the SCIENTIFIC AMERICAN for extensive extracts taken from our columns without a word of recognition; nor has he yet explained why he publishes a notice which we wrote of one of his works, garbled with self-flattering interpolations of his own.

DAVID AND ANNA MATSON. By Abigail Scott Duniway. Price $2.00. New York city: S. R. Wells & Co., Broadway.

This is claimed to be a poem, and the author informs us that she has "sniffed the bland breeze of the broad Mississippi" and "listened all rapt to Niagara's groan." She now has an opportunity to "sniff," and listen to the groan of the public.

HOW TO SING. By W. H. Daniell. Price 50 cents. New York city: S. R. Wells & Co., Broadway.

The author, an experienced music teacher, has condensed into this little manual a great many useful suggestions on the development of the voice. The work is written in colloquial style, is pleasantly readable, and can be commended to vocalists of all grades.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED STONE-DRESSING MACHINE.

John C. Miller, Bridgewater, Va.—This has reference to a machine for grinding or dressing the ends or heads of grave and other stones into any required shape in rapid and convenient manner, without danger of injuring the slabs by cutting or otherwise. The invention consists of adjustable supporting pieces and holding planks, between which the stones are secured head downward, to be ground or dressed by a reciprocating trough with a metallic shaping plate containing sand and water.

IMPROVED LOCOMOTIVE.

William Holdsworth, Traverse City, Mich.—This is an improvement in the class of locomotives provided with wheels mounted on vertical axes and adapted to work in contact with a rail laid equidistant between the parallel rails, upon which the locomotive is supported in the usual way. The improvement relates particularly to parts for varying the pressure of the driving wheels upon the central friction rail, and for guiding and supporting said wheels while permitting their lateral and vertical adjustment.

IMPROVED SHIP'S WINDLASS.

Joseph L. Dickenson, Hempstead, N. Y.—This inventor makes the plug, which connects the chain wheel of a windlass (which reverses loosely on the shaft) with a fixed wheel, in sections. The object is to enable the movable wheel to be readily disconnected from the fixed wheel, so that the anchor may be easily let go, if need be, during the process of weighing.

IMPROVED ANTI-FRICTION BEARING.

James Warren and George Wilkes, Monroe, Iowa.—This consists of an arrangement of rollers of peculiar form, and bearing plates adapted to the rollers in such a way that the journals of the shaft to which they are applied will be relieved from end thrust, the object being to relieve the journals and steps, of vertical and other shafts that are subjected to end pressure, from strain and friction.

IMPROVED VALVE GEAR FOR STEAM ENGINES.

George E. Tower, Annapolis, Md.—This invention is designed for marine engines, but is applicable to others as well. It relates to a means for adjusting and working the main valves of an engine, whether the same be applied to the side or head of a cylinder. The chief feature of the invention is a shifting lever mounted on a rotating eccentric or crank, and connected with a rocking frame or equivalent device, which is capable of vibrating or remaining stationary while the engine is running. When the rocker is stationary the movement of the lever is least eccentric or irregular, and the valves cut off at about seven tenths of the stroke. But when the lever attains its greatest eccentricity, the valves cut off at about two tenths of the stroke. Between these limits the movement of the valves may be regulated at will. The variation in the position and movement of the lever is, in this instance, effected by an irregular cam, whose adjustment with the rocking frame shifts the point of connection between it and the lever, such point being stationary, or vibrating in the arc of a circle, correspondingly.

IMPROVED FEEDER FOR HORSESHOE MACHINES.

John W. Chewning, Jr., Shadwell Depot, Va.—This invention relates to certain improvements upon the horseshoe machine for which letters patent were granted the same inventor, August 29, 1876, and it consists in the construction and arrangement of a device for feeding the bar, from which the shoe is made, to the machine, whereby the operation of the same is rendered automatic.

IMPROVED LOCOMOTIVE.

John Westcott, Tocoi, Fla.—This invention relates to a novel construction of a locomotive for drawing cars which are supported upon swiveling pedals that slide in lubricated channeled rails, and it consists in pivoting the supporting pedals in laterally adjustable bars, whereby they are made to adapt themselves to the channeled rails so as to obviate binding, and whereby also they are adapted to roads of different gage.

IMPROVED HORSE POWER.

Isaac Joyner, Jonesborough, Miss.—This invention consists of a wheel with spider frames that support an interior drum or cylinder, of sufficient size for the horse to walk in, the power being transmitted by a friction wheel, in contact therewith. One of the radial frames supports an outermost circle that forms, with suitable levers and friction shoe, an effective brake mechanism.

NEW HOUSEHOLD INVENTIONS.

IMPROVED SAD IRON.

H. B. Evans, St. Charles City, Mo.—This invention consists in a self-heating sad iron, having a removable fire box or drawer, a detachable top, and an inner partition for throwing the heat in a downward direction, the main object of the invention being to heat the bottom of the iron and keep the top comparatively cool.

IMPROVED CARPET CLEANER.

Sarah B. Stearns, Duluth, Minn.—This consists of a number of alternately working spring arms, with beaters or whips fastened to the ends, which are operated jointly with revolving dusting brushes at the ends of radial arms. The dusting brushes may be detached and replaced by scouring brushes to be used in connection with a suds trough.

IMPROVED VENTILATOR.

Henry A. Buzzell, St. Johnsbury, Vt.—This consists of a drum attached to the stove pipe, the drum being connected by pipes and funnels with the story below and with the upper and lower part of the room, to draw off the air to the chimney.

IMPROVED CLOTHES DRYER.

John F. Jaques, Moline, Ill., assignor to himself and John W. Bartlett, of same place.—This is a folding frame of peculiar construction, provided with cords for supporting clothes, forming a convenient clothes rack, and which is capable of being folded into a small compass.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED CISTERN.

James Kennon, Jamestown, Ohio, assignor to Mary E. Kennon, of same place.—This is a walling for wells and cisterns, made of sections, or in one continuous piece of burned clay, with top covering, the upper edge or seat of the sections being made wider than the lower to support thereon the next, and form a kind of shoulder for the surrounding earth.

IMPROVED DOOR LOCK.

Gustav Winter, Denver, Colorado.—This consists of a door lock with two or more bolts and tumblers, which are so arranged in connection with the key hole guard plates, pivoted to the casing of the lock and operated by the bolts and key, that the key hole is closed at the side opposite to that from which the key is introduced.

IMPROVED CARRIAGE TOP.

George F. Knight, Carroll, Ohio.—This invention consists in making the top of a buggy or other vehicle of sheet metal, the same being fastened to an internal frame and braced by bolts, six in number, while the top is connected with the seat frame by front and rear braces, the latter being jointed and the former rigid. This construction is found to greatly facilitate the trimming of the top, as that can be done before the frame is bolted on, and therefore at much less cost than in the usual way.

NEW AGRICULTURAL INVENTIONS.

IMPROVED TOBACCO SUCKER GERM DESTROYER.

Joseph H. Knaus, John R. Harford, Walter C. Knaus, and Andrew J. Furr, Boonsborough, Mo.—The object of this invention is to improve the construction of the tobacco sucker germ destroyer for which letters patent were granted to Joseph H. Knaus and John R. Harford, January 11, 1876. In using the instrument, the handle is grasped in the hand, with the fingers beneath the cross bar, and the cavity between the arms is placed against the tobacco stalk, directly over the sucker germ, and is pressed against said stalk with sufficient force to cause a cutter to project against said germ. The cutter is then rotated, and cuts out and destroys the germ, so that it will not grow again.

IMPROVED FARM GATE.

William H. Richardson, Sheboygan Falls, Wis.—This is an improvement in that class of gates which slide open and shut over rollers, so that they may be operated with more facility, in less space, and not be so liable to get out of order. The invention consists in clamping two rim-grooved wheels to a gate bar so that each will revolve upon a rigid hollow bearing, through which the clamping bolt passes.

IMPROVED REIN HOLDER.

George W. Waters, Center, Mo.—This consists of a bar of wood having straps adjustably attached, for strapping the bar to the shoulders, and for connecting the reins to the bar, the object being to provide a device for guiding teams while plowing, or doing other similar work, which will permit of the free use of the hands and arms.

IMPROVED GARDEN RAKE.

Anna Maria Suydam, Waterloo, N. Y.—A blade of segment shape, with sharp edge, is bent in one piece with the tines, and forms a stiffening back for the same. It is made in line with the handle, and at about a right angle to the tines, and serves to clean and cut away the small patches of grass and bits of weed that are left in hoeing in the garden paths.

IMPROVED NOSE RING FOR SWINE.

Edmund S. Richards, Tripoli, Iowa.—The sharpened ends of a piece of wire are passed through the gristle of the hog's nose, bringing a roller on the wire just in front of said nose. Small leather washers are then placed upon the sharpened ends of the wire, and the said ends are bent down upon the outer sides of the said washers, securely fastening the ring to the hog's nose. When a hog with this device attempts to root, the roller turns upon the wire, and the hog can make no impression upon the ground.

IMPROVED HAY LOADER.

Joseph Richter, Laketown, Minn.—This invention relates to certain improvements in that class of devices which are designed for loading wagons with hay, straw, or grain. It belongs to that type of loaders in which an adjustable rake gathers up the hay and delivers it to an endless revolving apron provided with teeth, which apron is operated by a band and pulley connection with one of the driving wheels, and delivers the hay to the top of the wagon. The improvement consists in the particular construction, arrangement, and adjustments of the loading devices.

IMPROVED METHOD OF CHECKROWING CORN.

Charles B. Maclay, Delavan, Ill.—The convexity of the ground, passed over by a planter or seeder, necessarily modifies the distance between the hills planted. The gain or loss in this respect is noted, and may be corrected in this machine by means of an expansible wheel. A chain passes around this wheel and also a collar on the axle of the machine, so that the rotation of the wheel may cause the reciprocation of the seed slide. The wheel is expanded, more or less, to cause the slide to work more or less quickly, and thus drop the seed in hills a greater or less distance apart.

NEW TEXTILE MACHINERY.

IMPROVED PICKER CHECK.

Robert Davidson and John Richardson, Fall River, Mass.—This is an improvement in the class of friction devices designed for gradually arresting the picker staffs of power looms, in place of suddenly stopping them, as commonly practised. It relates to the means of attaching the friction strips to the shuttle boxes, and of adjusting the angle of the strips to each other, for varying the friction exerted on the picker staff. By means of adjustable brackets, the binders may be set nearer or farther from each other, and thereby the binding force of the check device increased or decreased.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED CROQUET MALLET.

Harry Malin, Pleasantville, Pa.—This is an improved croquet mallet that will not bruise the balls, and makes them last much longer, while it requires a lighter stroke in playing. It has rubber caps or facings at the ends.

IMPROVED PORTABLE FIRE ESCAPE.

Herbert R. Houghton, New York city.—This fire escape consists of a wire rope having a series of cross bars or rests interlaced and lashed thereto, the said rope having a loop formed at its upper end, with an extension end, for convenience of escape upon the main rope. The whole is suspended by a snap hook caught in an eye, which is screwed to the floor of a room. As its weight is only about five lbs., it is suitable for the use of travelers and residents in hotels, for whom it is especially designed.

IMPROVED MACHINE FOR MOUNTING PHOTOGRAPHS.

Robert Sheane, Listowell, Ontario, Canada.—This invention consists of a box of two parts hinged together so as to open and close together with uniform action. In the lower part is a glass plate resting on a rubber or other elastic cushion, and in the upper part is a follower with an adjusting screw. The cards on which the photographs are to be mounted are put in the upper part, and pressed down one after another on the pasted pictures lying back upon the glass, which are thus pasted to and mounted on the cards by closing down one part of the machine on the other.

IMPROVED POCKET BOOK FASTENER.

Daniel M. Read, New York city.—This invention is an improvement upon that for which the same inventor has already received letters patent, and relates chiefly to the construction of the fastening attached to the strap encircling the pocket book, which is composed of a flat sheet metal top plate and a channeled bottom plate. The top plate is provided with an end extension, which is bent back over the end of the flap of the pocket book, to cover, protect, and confine said end, and the bottom plate has a lengthwise depression or channel forming a corresponding raised portion, in which are formed three holes to receive the pin fixed in the base plate.

IMPROVED CIGAR HOLDER.

John Hutton, New York city.—This is a skeleton holder consisting of the mouth piece in combination with the spring arms and semicircular clips which grasp the cigar. It is made in one piece from hard rubber.

IMPROVED PROCESS OF LITHOGRAPHING TRANSFERS.

Charles R. Biedermann, St. Louis, Mo.—This invention consists mainly in dispensing with the preliminary treatment of the stone for causing it to absorb fluid matter beneath its surface, which is effected by hardening the copy on paper into a solid type by the application of nitric acid, and transferring, and fixing the hardened copy upon the stone by heating the same to blood heat, without chemical treatment of the stone.

IMPROVED COMBINED GAS METER AND CARBURETER.

John M. Cayce, Franklin, Tenn.—Mr. Cayce's present invention relates, first, to an improved gas-measuring apparatus, adapted for use, like other meters, in dwellings and other buildings, and also for performing the function of a secondary motor for operating an air-carbureting apparatus. The chief element of the apparatus is a bi-chambered wheel or cylinder, of what may be termed annular segmental form, which is partially immersed in water or other liquid, suitable for sealing its open ends, and is oscillated upon its axis by the passing current of gas required to be measured, each reciprocating movement thereof causing the vibration of a weighted lever, and thereby the reversal of a four-way cock, by which the gas current is caused to enter one chamber of the wheel while the other is discharging its contents, and *vice versâ*.

IMPROVED DRESS CLASP.

Alexander L. Fyfe, London, England.—This clasp is adapted to be attached to a chain provided with a hook for attachment to the waistband. The dress is held in a clip, which consists of a pair of jaws, cupped or hollowed, and having on one a spring pad or cushion which fits in the hollow of the other, and thus securely retains the dress. The pad consists of a disk of metal, cupped or hollowed, with a spiral spring behind it, and is fitted in the hollow of one of the jaws. The jaws are provided with a runner, so formed as to embrace and compress them firmly together at the point where the dress is held. The runner may be of any desired form, and the back of the jaws may be corrugated or roughened transversely to ornament them, and at the same time retain the runner more securely in position.

Notes & Queries

It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Enquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical enquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present. The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editor selects from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal nature, which should be answered by mail; in fact hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to enclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to enclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

R. B. L. will find directions for polishing pebbles on p. 138, vol. 30.—J. D. will find a description of a method of utilizing the waste heat from lime kilns on p. 290, vol. 32.—J. D. will find directions for tanning sheepskins with the wool on p. 233, vol. 26.—B. I. will find a good recipe for black ink on p. 250, vol. 34.—R. I. & U. K. should consult *The Hub*, published in this city.—L. A. F. will find an article on potash in corn cobs on p. 306, vol. 26.—J. B. P. will find a description of a spring power for sewing machines on p. 134, vol. 27.—F. L. will find a recipe for a balloon varnish on p. 74, vol. 32.—J. S. M. will find directions for painting magic lantern pictures on another page of this issue. For a recipe for jet black ink, see p. 250, vol. 34.—M. G. S. will find a recipe for Babbitt metal on p. 122, vol. 28.—W. F. S. will find the demonstration of his rule for finding the area of a triangle in any good book on trigonometry.—F. E. B. will find directions for ebonizing wood on p. 50, vol. 33.—J. W. B. will find directions for preserving cider on p. 11, vol. 31.—D. will find an explanation of the travel of car wheels on a curve on p. 268, vol. 35.—R. L. K. should put a tablespoonful of coarse brown sugar in a quart of flour paste, to fasten paper labels to tin cans with. This also answers F. F., who will find a recipe for a blue lacquer on tin on p. 75, vol. 32.—W. B. P. will find directions for gilding without a battery on p. 106, vol. 34. For silver-plating without a battery, see p. 250, vol. 31. For nickel-plating with a battery, see p. 151, vol. 30.—G. F. R. will find something on keeping water fresh on p. 156, vol. 31.—F. W. E. should galvanize his iron sink. See p. 346, vol. 31.—R. B. W. will find a recipe for a hair stimulant on p. 363, vol. 31.—W. will find directions for treating a corn on p. 202, vol. 34.—W. A. will find directions for making vinegar from cider on p. 106, vol. 32.—S. D. P. will find directions for waterproofing canvas on p. 347, vol. 31. For keeping cider, follow the directions on p. 11, vol. 31. For a recipe for bird lime, see p. 347, vol. 28.—J. S. P. will find an answer to his query as to rotary engines on p. 123, vol. 30.—J. H. R. will find a recipe for oroide metal on p. 347, vol. 30.—F. H. N. will find articles on compound engines on pp. 122, 260, vol. 30.—R. L. will find the dimensions of the propeller of the Baxter canal boat on p. 281, vol. 29.—R. A. C. is informed that Mr. Charles Darwin, the evolutionist, is living.—E. B. can drill china with a sharp, swiftly revolving steel drill. For coppering iron, see p. 90, vol. 31.—C. E. S. can line his cooking kettles with a porcelain coating by the process described on p. 382, vol. 32.—H. B. B. will find a scription of vulcan and rend-rock powders on p. 2, vol. 34.—E. T. B., G. M. W., J. A., G. F. S., A. W. A., G. D., P. G., 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) J. H. I. says: 1. Please give me a recipe for restoring the color to cloth, the color having been taken out by lime. A. Have you tried a little dilute muriatic acid? The most satisfactory method, perhaps, will be to have the cloth re-dyed. 2. How can I restore the color to a straw hat which has become yellow? A. Subject it to the vapor of a dishful of burning sulphur (sulphurous acid gas) in a tight box or closet.

(2) G. P. H. says: How can we make rawhide soft and pliable for hobbles, bell collars, lassos, etc.? Is it the glue in the hide that makes it so hard? What is the best method to soften it? Oil alone will not do it. A. The hides of animals, owing to their complex chemical structure and the large amount of nitrogenous principles which they contain, are very prone to rapid putrefaction when exposed to a moist air. In very dry climates they soon lose their natural suppleness and become stiff and hard by a process of desiccation. It was by the effort to overcome all these difficulties that the process of fixing the gelatinous bodies contained in the hide, that is, the system of tanning them, was first introduced. We do not know of a better one that we deem practicable in your case.

(3) E. G. W. says: I hear that a German society has offered $400 prize for a cheap and efficient way of extracting the carbonic acid from coal gas. Does petroleum gas contain the acid, and does the acid impair the light? A. Gas from petroleum contains only a very small quantity of carbonic acid. The quantity is so small that it may be altogether overlooked.

(4) H. C. asks: Would filtering vinegar through a common filter (that is composed in part of charcoal) change the color or injure the vinegar in any way? A. Make your filter of animal charcoal, or freshly or thoroughly burnt vegetable charcoal. If the charcoal has not been thoroughly burnt it may impart some unpleasant taste to the vinegar. If the vinegar be allowed to pass slowly through the filter, a part, at least, of the dark color will be removed.

(5) F. B. asks: How shall I bleach a silken fabric? A. Have you tried sulphurous acid? This is the usual bleaching agent employed for silk, but it requires some previous technical experience in the matter to be enabled to do it well. After being sulphured, the goods are passed through an extremely dilute solution of sulphuric acid, and washed.

(6) J. H. R. asks: What degree of heat does it require for calcining gypsum in an oven? The gypsum is broken about the size of hickory nuts. How long will it take to make good stucco out of it? A. If, as we understand you, you wish to ignite the gypsum in order to obtain plaster of Paris, it is necessary to remove the greater part of the water of crystallization by heating the mineral for some time at a temperature of about 300° Fah. If the temperature is allowed to rise above 360°, it will not, when moistened, resume its water of crystallization. There are numerous other precautions necessary to be observed, in order to obtain a good product. See p. 173, SCIENCE RECORD, for 1874.

(7) E. K. M. says: Our home-made hard soap, in drying, shrinks very much. What can we do to make it retain its shape? A. All recently made soap shrinks more or less in drying, from the loss of water. This cannot be avoided.

(8) C. D. asks: How are blank spaces obtained in an engraving produced by the photo-engraving process? I understand the method of photo-engraving (by means of the sunlight passing through a photographic negative and falling on a plate of glass coated with a film of gelatin and bichromate of potash, etc.); but I have never yet seen in any description of the process an explanation of the means employed to obtain the wide blank spaces in the engraving: spaces, say, from a quarter of an inch to an inch in width. Are such lights in the picture obtained by eating away the spaces between the reliefs with acids in the stereotype plate, or are the spaces cut out of the plate with the engraver's tools? A. See pp. 178, 235, 139, vol. 33, and pp. 95, 186, 169, 168, 185, SCIENCE RECORD for 1876. You will find, by examination, that the references to this and other similar processes have been very numerous in the back numbers of the SCIENTIFIC AMERICAN. 2. Do you know of any acid that will corrode or soften plaster of Paris, after the plaster has been mixed with water and has hardened, so that the parts touched by the acid may be brushed away with a moderately stiff brush? A. Sulphate of lime is soluble to some extent in hydrochloric and nitric acids, also in sulphate of ammonia. 3. What is the hight of the lines in relief in an engraving obtained by the photo-engraving method after the soluble film has been washed away from the glass plate? A. This depends altogether upon the thickness of the films, as well as their number and the length of time of exposure to the light.

(9) H. C. says: What composition can be applied to floors before laying carpets, to preserve them from the attack of moths? A. Use a dilute alcoholic solution of carbolic acid: about 1 part of the acid to 12 or 15 parts of alcohol.

(10) C. P. asks: 1. What is the best material to add to linseed oil while boiling, to give it the hardest drying quality? A. According to Barruell, Jean, Mulder, and others, the borate of manganese is the most excellent siccative. 2. How much of the dryer should be added? A. Use 1 part to 1,000 parts of the oil. 3. How can linseed oil, which has been darkened in boiling, be economically bleached, in considerable quantities? A. It is usually bleached by exposure to strong sunlight in shallow leaden trays (about 4 inches deep) covered with sheets of glass.

(11) J. L. A. asks: What will directly destroy a human tooth, in the mouth or out? A. There is no such substance or preparation known.

(12) H. P. I. says: I use a large wood tank to hold brine, which wastes by passing through the pores of the wood. Is there anything that can be applied to the wood that will fill the pores, and not be acted upon by the brine? Would soluble glass do? A. Perhaps a preparation of asbestos might answer your purpose; this may be obtained in this city, as you will see by consulting our advertising columns. Soluble glass we have not tested in that respect.

(13) R. K. P. says: I have a well in my cellar that is full of foul air. *How can I remove it?* A. Drop a pipe into it, within a few inches of the surface of the water, and then pump the air out. Fresh air will take its place.

(14) J. S. says: There is a wooden partition dividing two rooms. I wish to know if the sound of loud talking and laughing can be stopped, so that persons in an adjoining room can hear nothing but a humming or indistinct noise. Will caulking up the cracks and tacking soft carpet paper, $\frac{1}{12}$ of an inch thick, keep back the sound? A. Nail a few upright strips upon the face of the partition, and cover it with cloth, wet a little, stretched taut, and tacked to the strips. Now put a wall paper upon the cloth; at the same time fill *up the joints of the plank in the present partition* where open.

(15) C. A. asks: Can limestone, which has been put in a kiln, and has not been heated enough to extract all the carbonic acid (that is, it does not slake), be put again, after cooling, in another kiln, and make good lime if heated sufficiently? A. Yes.

(16) C. F. asks: I want to coat pump tubing *on the inside with coal tar*. The tar is to be boiled until all the water is evaporated and it becomes hard and brittle when cold. Would it affect the water so as to make it offensive for family use? A. Good asphalt or pitch might answer, but we cannot insure success in all cases. The method of charring the exposed surfaces of the wood is much more desirable and efficient than the one you suggest.

(17) L. N. says: 1. A man nearly lost his life by sleeping in an upper room of a house adjoining a lime kiln. When found, he was insensible, and could not be resuscitated for over an hour. The doctor says that the effect was produced by gas from the kiln. Some of us do not believe that, as there could not be much gas in the room. The house is about 30 feet from the kiln, and the gas must have entered by the window. A. The doctor's surmise is very probably correct. 2. How much gas must there have been to produce this result? A. Ten per cent of the gas in the atmosphere of a room is sufficient to produce asphyxia in a healthy person remaining for a short time in the room; but this is subject to wide variations, according to the age, physical condition, etc., of the person breathing the vitiated air.

(18) O. C. asks. Do the forces arising from the attraction of gravitation and from momentum depend on the same law for their effective action? To illustrate: If a force of 10 lbs on a given lever will raise 100 lbs., then double that force will raise 200 lbs. And if 60 lbs. steam will drive a saw 700 revolutions per minute through a 6 inch stick, then it will require (in theory) 120 lbs. to drive it at the same speed through two 6 inch sticks. In practice, I find that force on the lever has the same effect that it has in theory, but that steam has not. The amount of steam is not required to be doubled. One says that this is on account of the momentum, which is not governed, even in theory, by the same law that gravitation is governed by. I contend that it is on account of friction, which theory does not allow for, and that momentum and gravitation, as above illustrated, are governed by the same laws in theory. Am I right? A. You seem to have the right idea.

(19) J. F. D. says, in reply to A. E. & Co., who wish to augment the capacity of their flouring mill: You appear to be running the mill to a decided disadvantage. I would suggest that, instead of putting in another run of burrs, you run the ones you have up to their capacity. With the stones properly drafted and dressed, and run at proper speed, you ought to grind at least 15 bushels of wheat per hour on each run, and that will give the engine all it can do. I know it can be done, for I am averaging 20 bushels of wheat per hour on a 4 feet burr, and 35 bushels of corn on a 3½ feet, running both at once and making a yield of over 42 lbs. of flour per bushel. Our engine is about the same size as the one mentioned, but we have a rather larger boiler.

(20) G. E. T. says, in answer to H. S. G., who asked if the cloth would not absorb more sulphuric acid in the mixture of 80 gallons water and 2 lbs. sulphuric acid than in half that quantity. The cloth, if thoroughly agitated and of any considerable quantity, say from 10 yards up, would absorb nearly the whole of the acid. I do not think there would be a loss of 10 per cent more acid by using the larger quantity than the smaller.

(21) J. H. N. says, to W. H. J., who asks us to explain how car wheels get round a curve: 1. A car wheel is some 2 inches larger on the inside, or next to the flange; and so the car wheels, in going round a curve, always run up to the flange on the outside of the curve, which of course is the longest rail, and so bring the inside wheel to bear on its small end. A. It must be evident that, unless all the curves of a road have the same radius, the curving of the wheels will not prevent slipping in some cases. 2. Why do the wheels and rails on the east side of north and south roads wear out the fastest? A. Experienced railroad men believe that this does not happen when a track is kept in proper order.

(22) H. E. E. says, in answer to W. H. F., who asks which car wheel slips in going round a curve: Neither. I have often seen a distiller roll his barrels to a warehouse some 50 yards away on two poles laid parallel about 2 feet apart; the barrels swayed from side to side and adjusted themselves automatically, and kept the track, although at one place there was an abrupt angle of 15° or 20°, which is worse than a regular curve

on a railroad. If the barrel is placed on the track too far to the right, that part of the barrel where it touches the right rail is larger than the part where it touches the left rail, which causes the right hand end to roll faster than the left hand: and if it should roll too far over to the left, the same thing will take place on that side. And so it is constantly adjusting itself on the track, with no cause for either end to slip, even in turning a curve. Just so with the car wheels (which are conically shaped from the flange outward), provided a proper amount of lateral play is allowed by laying the track a little wider than the flanges on the wheels would indicate.

T. P. H. asks: How do dentists harden and polish their vulcanized rubber plates?—A. R asks: What will give a white porcelain finish, with glassy surface, to wood? It must be impervious to dampness.—S. Bros. ask: Is there a successful way of treating the material for pianoforte sounding boards in order to increase the volume and duration of sound?

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 Earth's Motion. By J. A. B.
On Light, Space, and Matter. By A. S.
On Spiritualism. By J. W. M.
On a Measure of Value. By B. M.
On the Bible and Progressive Thought. By P. F. P.
On Cotton and Wool. By A. R. L.

Also inquiries and answers from the following: G. H.—D. L.—W. B.—T. J. L.—R. & B.—J. T. C.—E. C.—L. O.—A. J. W.—C. S.—W. S.—J. D. H.

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 buys ores of antimony? Who makes spiral springs? Who makes electric engines? Who makes flexible shafting?" 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.]

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[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, ncluding 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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DISCLAIMERS.

3,609.—Plow.—G. Watt, Richmond, Va.
157,425.—Vehicle Spring.—R. M. Stivers, N. Y. city.

DESIGNS PATENTED.

9,593.—Cooking Ranges.—A. P. Corse, Troy, N. Y.
9,594.—Statue.—J. B. Crawford, Rochester, N. Y.
9,595 to 9,597.—Embroidery.—E. Crisand, New Haven, Ct.
9,598.—Hats.—A. D. Foster, Chicago, Ill.
9,599.—Boa.—M. Freytag, Chicago, Ill.
9,600.—Show Card.—J. Fuld, New York city.
9,601, 9,602.—Stove.—J. Mager *et al.*, Chelsea, Mass.
,603.—Fork Handle.—G. Wilkinson, Providence, R. I.

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Horseshoe nail clincher, J. Slautterback ... 181,871
Hydrant for watering stock, J. Compton ... 183,751
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DISCLAIMER.

115,115.—SINKING SHAFTS, ETC.—J. Shelly, Mahanoy, Pa., *et al.*

DESIGNS PATENTED.

9,604.—TYPE.—D. W. Bruce, New York city.
9,605.—MIRROR ETC.—W. Clapp, South Bend, Ind.
9,606, 9,607.—TYPES.—J. Herriet, New York city.
9,608.—TYPES.—J. Herriet, New York city.
9,609.—BREASTPIN.—J. Wilkinson, Mount Vernon, N. Y.
9,610.—EAR RING.—J. Wilkinson, Mount Vernon, N. Y.

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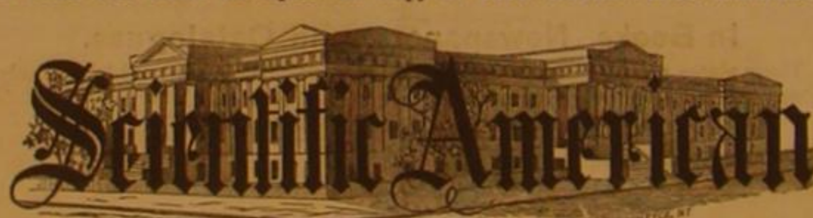

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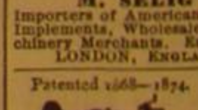

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