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Automatic Damper Regulator.

A simple and reliable damper regulator for steam boilers, sensitive to slight variations of pressure, and durable in all its parts, has long been sought. Various devices have been introduced at different periods since the invention of the steam engine for the purpose of controlling and regulating the draft of the fires, which have failed to effect the desired purpose on account of friction, rigidity of parts, etc. The rubber diaphragm answered the purpose in all respects, except that the protection of the rubber diaphragm, in its changes of form and motion, offered difficulties which it is claimed the invention herewith illustrated has fully obviated.

We are assured that it has been fully tested, both as a constant economizer of fuel and a positive security against explosions or damage from excess of pressure, and that for both these purposes its operation is satisfactory.

It is simple in construction, apparently not liable to derangement, practically frictionless in all its parts, and entirely protected from the obstructive effects of dust and dirt. The operation of the machine is as simple as its construction.

The rubber diaphragm, B, Fig. 1, being protected by triangular flat metal plates, C, hung on knife-edges communicatiug motion to the lever by the same means as shown in in Fig. 1 at D and E, makes the machine sensitive to the slightest variation of pressure, and at the same time the diaphragm is relieved from any undue strain whatêver through its extremes of motion. The lever, F, with its counter poise, H, has a knife-edged bearing, shown at G. Steam is admitted under the diaphragm at A.

When the machine is attached to the boiler, and connections made with the damper-rod, the weight on the lever is placed at the point that will balance the required pressure, the position of the damper in the pipe being partially closed.

Any additional pressure will of course close the damper entirely, thereby shutting off the draft and preventing the heat from escaping out of the smoke pipe, until the steam pressure decreasing the weight gradually descends, and opens the damper, admitting sufficient draft to the fire to keep the steam at the required pressure.

Thus whatever the irregularities of demand upon the boiler, this automatic damper regulator would, without doubt, control the consumption of fuel more perfectly than even a careful engineer could do it, acting independently of steam gage or safety valve, and, at the same time, adding to the economy in the use of steam, and safety from explosions.

Patented, October 4, 1870, by James H. Murrill, assignor to himself and Lewis B. Keizer. Address, for further particulars, Murrill & Keizer, 44 Holliday street, Baltimore, Md.

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Important Patent Decision.

The case of Whitely *vs.* the Commissioner of Patents, recently decided by the Supreme Court of the District of Columbia, is of general interest.

One Bethea made application for a reissued patent, which was duly allowed and issued; when, after the patent had gone out, Whitely appeared and produced an assignment of he invention to him, executed before the issue of the patent to Bethea, but not recorded until afterward, and demanded that a second patent should issue to him as assignee. The Commissioner of Patents refused, and Whitely appealed to a Judge of the Supreme Court, who ordered the Commissioner to issue the second patent as prayed, antedated to the date of surrender. The Commissioner refused to obey the order, and Whitely brought suit against him for $50,000 damages. Upon full hearing by all the Judges, it was decided:

1. That the patent could not be issued or antedated as prayed for.

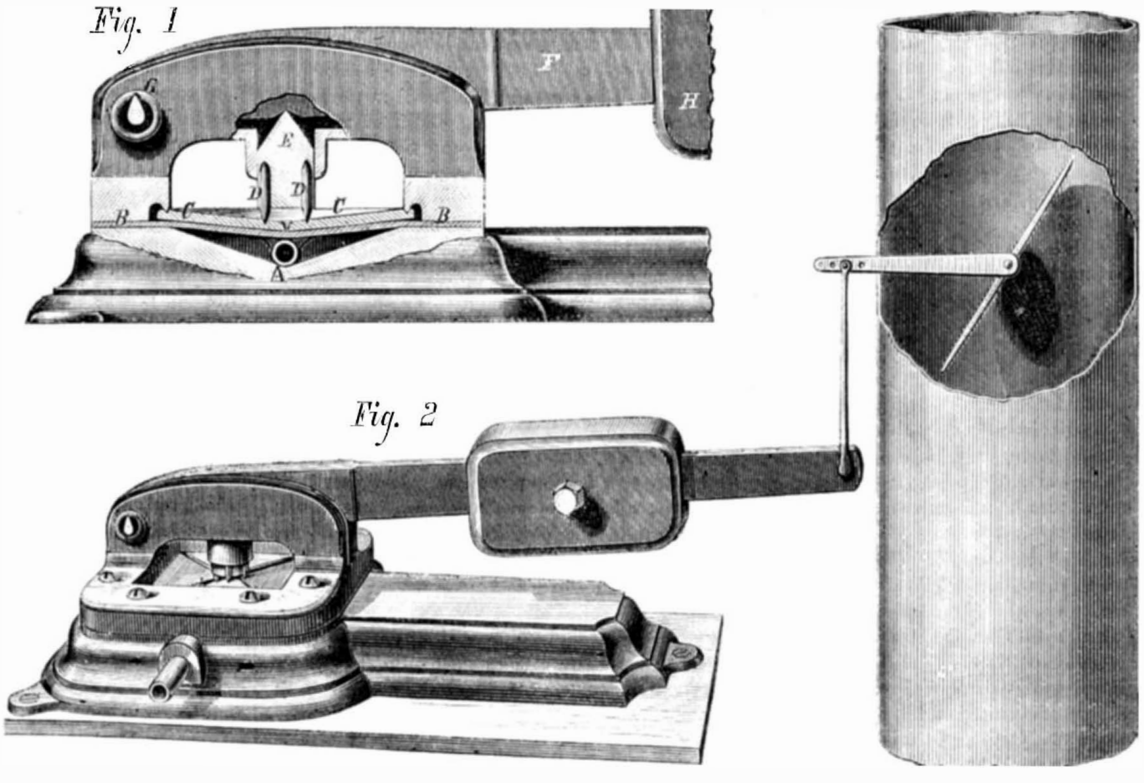
2. That the jury had no jurisdiction of the question upon appeal, and that his order to the Commissioner was null and void, and

3. That the Commissioner could not be sued for refusing to issue a patent, as he was not the issuing officer under the law. Even if a cause of action existed it was not against him, but against the Secretary of the Interior.

This disposes of a similar suit brought by the same party, under the same circumstances, against the Commissioner, in which the damages are laid at one million dollars.

Ague Poison.

M. P. Bolestra has communicated to the French Academy some observations on ague poison. He says, that in examining marsh water he always finds, in proportion to its degree of putrefaction, a granular microphyte, somewhat resembling in form the *Cactus Peruvianus*. It is always accompanied by a considerable quantity of small spores $\frac{1}{1000}$ of a millimeter in diameter, greenish yellow and transparent, and also by sporangia or vesicles containing spores from $\frac{2}{100}$ to $\frac{2}{300}$ of a millimeter in diameter, and of very characteristic form. This plant grows on the surface of the water; when young, it is rainbow-like in tints, and looks like spots of oil. At the low temperature of cellars and in water containing no vegetation, it develops slowly, but in contact with air and exposed to solar rays, it grows fast, disengaging small gas bubbles. A few drops of arsenious acid, sulphite of soda, or, still better, neutral sulphate of quinine, stops its vegetation at the surface of the water, the spores become thin and transparent, and the sporangia alter so that they would not be recognized. These changes may be seen under the microscope. M. Bolestra states that these spores can be found in marsh air. He caught agues twice during his researches—once after having been exposed to air from water in fermentation covered with fresh algæ in full vegetation, mixed with an extraordinary quantity of spores. He thinks these spores constitute the ague poison.



MURRILL'S AUTOMATIC DAMPER REGULATOR.

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TRIPLER'S RAILROAD TIE.

The railroad interests of this country have assumed such colossal proportions that any improvement relative thereto is looked upon with interest. One of the most important features in the construction of a railroad is the cross-tie, upon the quality of which depends much of the speed and safety of travel.

Fig. 1

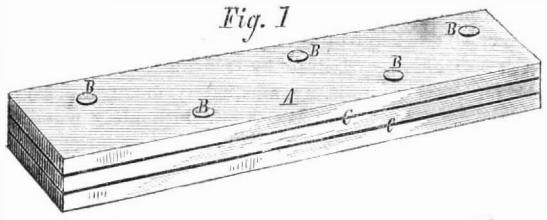


Fig. 2

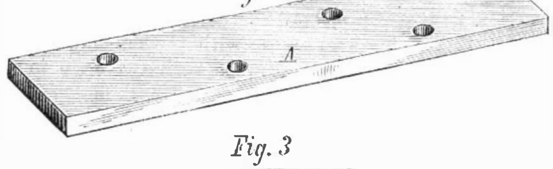
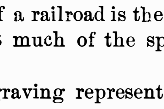


Fig. 3



The accompanying engraving represents a new feature in the construction of ties, known as the "Tripler" tie, which introduces, so far as we are aware, a novel form of construction, for which the inventor claims many advantages.

This tie is constructed in sections or slabs, A, fastened together with dowel pins, B. Each slab is coated with a vulcanite antiseptic compound, making, when united, antiseptic division walls, C, between each slab, rendering it indestructible. It presents a perfectly even surface for the rail. The antiseptics used are claimed to prevent the rust of the rail as well as the spike, while the dowel pins, being also coated with the antiseptic, the tie is claimed to be as compact as a solid one.

The tie being in sections, gives an elasticity which lessens the jar on locomotives and carriages, reducing wear and tear of the rolling stock, besides giving greater comfort to the traveler.

It is claimed that in an economical point of view these ties, on account of the durability alone, are worthy of general adoption. There are now in use one hûndred and eighty millions of cross-ties, which have to be replaced every six to ten years, at a cost of $90,000,000. The claims for durability in the Tripler tie is, therefore, if substantiated, a matter of great importance, especially as it is claimed that the expense of construction is but little over those now in use. Each tie is made to the exact measure, requiring no fitting or dressing to receive the rail, and can be laid in a much shorter time than is required for the ordinary hewn tie, thus making a saving, it is claimed, of more than their additional cost.

The Tripler tie is now manufactured in the South, and we are informed that a number of roads are adopting the improvement.

This invention is protected by patents in the United States and foreign countries. For further information address Upperman & Johnson, Washington, D. C., S. Marx, New Orleans, La., or F. B. Kenner, Philadelphia, Pa.

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Importance of Patenting Trade-Marks.

Watches manufactured in the United States bear certain trade-marks known to the trade, and having a definite value protected by statute laws, the infringement of which is severely punished. Imported watches, however, may still be brought in with these trade-marks, the law which severely punishes the native forger being powerless against the foreign offender. Our people are thus largely swindled by cunning inferior imitations of American watches by foreign manufacturers.—*N. Y. Tribune.*

There is a remedy against such infringers in the Statute on Trade-marks, enacted July 8, 1870, which manufacturers of all kinds would do well to heed. Letters patent for trade-marks are now issued for thirty years, and may be extended thirty years more, on expiration of the first term, at a small expense A few patent-medicine compounders and others, have already availed themselves of the privilege extended them under the new law, and obtained patents on the name, vignette, or emblem used to distinguish their manufactures from those of others. But large manufacturers of fabrics familiar to the trade, like "New York Mills" and "Wamsutta Shirtings," "Merrimack Prints," etc., seem slow to avail themselves of the advantages of the protection offered them under the new law. Full particulars in writing, and copies of the law on trade-marks, may be had gratuitously on application to this office.—EDS.

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THE SURRENDER OF METZ together with the army of Bazaine amounting to 173,000 men, has left the French without an organized army. Paris is so closely besieged that no supplies can reach its inhabitants, and the cry of distress is already heard. The case of France is utterly hopeless, yet, notwithstanding all this, Gambetta and his associates, who are unable to stay anywhere very long for fear of being caught by the Prussians, are urging the people to rise *en masse* to expel the invaders; but when asked for arms these crazy leaders are obliged to confess that they have none. Such folly and madness the world has not often witnessed.

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KNOTS AND SPLICES.—A correspondent says: "The issue of this week of your paper, containing the drawing of various knots, is worth the yearly subscription price. Will you, or some of your readers, favor us with the different kinds of useful splices. The subject is equally interesting."

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The universe never loses material nor energy.

SCIENTIFIC USE OF THE IMAGINATION.

John Tyndall, LL.D., F.R.S., before the British Association.

I carried with me to the Alps this year the heavy burden of this evening's work. In the way of new investigation I had nothing complete enough to be brought before you; so all that remained to me was to fall back upon such residues as I could find in the depths of consciousness, and out of them to spin the fiber and weave the web of this discourse. Save from memory I had no direct aid upon the mountains; but to spur up the emotions, on which so much depends, as well as to nourish indirectly the intellect and will, I took with me two volumes of poetry, Goethe's "Farbenlehre," and the work on "Logic" recently published by Mr. Alexander Bain. The spur, I am sorry to say, was no match for the integument of dullness it had to pierce.

In Goethe, so glorious otherwise, I chiefly noticed the self-inflicted hurts of genius, as it broke itself in vain against the philosophy of Newton. For a time Mr. Bain became my principal companion. I found him learned and practical, shining generally with a dry light, but exhibiting at times a flush of emotional strength, which proved that even logicians share the common fire of humanity. He interested me most when he became the mirror of my own condition. Neither intellectually nor socially is it good for man to be alone, and the griefs of thought are more patiently borne when we find that they have been experienced by another. From certain passages in his book I could infer that Mr. Bain was no stranger to such sorrows. Take this passage as an illustration. Speaking of the ebb of intellectual force which we all from time to time experience, Mr. Bain says: "The uncertainty where to look for the next opening of discovery brings the pain of conflict and the debility of indecision." These words have in them the true ring of personal experience.

The action of the investigator is periodic. He grapples with a subject of inquiry, wrestles with it, overcomes it, exhausts, it may be, both himself and it for the time being. He breathes a space, and then renews the struggle in another field. Now this period of halting between two investigations is not always one of pure repose. It is often a period of doubt and discomfort, of gloom and ennui. "The uncertainty where to look for the next opening of discovery brings the pain of conflict and the debility of indecision." Such was my precise condition in the Alps this year; in a score of words Mr. Bain has here sketched my mental diagnosis; and it was under these evil circumstances that I had to equip myself for the hour and the ordeal that are now come.

Gladly, however, as I should have seen this duty in other hands, I could by no means shrink from it. Disloyalty would have been worse than failure. In some fashion or other—feebly or strongly, meanly or manfully, on the higher levels of thought, or on the flats of commonplace—the task had to be accomplished. I looked in various directions for help and furtherance; but without me for a time I saw only "antres vast," and within me "deserts idle." My case resembled that of a sick doctor who had forgotten his art, and sorely needed the prescription of a friend. Mr. Bain wrote one for me. He said: "Your present knowledge must forge the links of connection between what has been already achieved and what is now required."

In these words he admonished me to review the past and recover from it the broken ends of former investigations. I tried to do so. Previous to going to Switzerland I had been thinking much of light and heat, of magnetism and electricity, of organic germs, atoms, molecules, spontaneous generation, comets, and skies. With one or another of these I now sought to re-form an alliance, and finally succeeded in establishing a kind of cohesion between thought and light. The wish grew within me to trace, and to enable you to trace, some of the more occult operations of this agent. I wished, if possible, to take you behind the drop-scene of the senses, and to show you the hidden mechanism of optical action. For I take it to be well worth the while of the scientific teacher to take some pains, and even great pains, to make those whom he addresses copartners of his thoughts. To clear his own mind in the first place from all haze and vagueness, and then to project into language which shall leave no mistake as to his meaning—which shall leave even his errors naked—the definite ideas he has shaped.

A great deal is, I think, possible to scientific exposition conducted in this way. It is possible, I believe, even before an audience like the present, to uncover to some extent the unseen things of nature, and thus to give, not only to professed students, but to others with the necessary bias, industry, and capacity an intelligent interest in the operations of science. Time and labor are necessary to this result, but science is the gainer from the public sympathy thus created.

How then are those hidden things to be revealed? How, for example, are we to lay hold of the physical basis of light, since, like that of life itself, it lies entirely without the domain of the senses? Now, philosophers may be right in affirming that we cannot transcend experience. But we can, at all events, carry it a long way from its origin. We can also magnify, diminish, qualify, and combine experiences, so as to render them fit for purposes entirely new. We are gifted with the power of imagination, combining what the Germans called *Anschauungsgabe* and *Einbildungskraft*, and by this power we can lighten the darkness which surrounds the world of the senses.

There are tories even in science who regard imagination as a faculty to be feared and avoided rather than employed. They had observed its action in weak vessels and were unduly impressed by its disasters. But they might with equal justice point to exploded boilers as an argument against the use of steam. Bounded and conditioned by co-operant reason, imagination becomes the mightiest instrument of the physical discoverer. Newton's passage from a falling apple to a falling moon was a leap of the imagination. When William Thomson tries to place the ultimate particles of matter between his compass points, and to apply to them a scale of millimeters, it is an exercise of the imagination. And in much that has been recently said about protoplasm and life we have the outgoings of the imagination guided and controlled by the known analogies of science. In fact, without this power our knowledge of nature would be a mere tabulation of co-existences and sequences. We should still believe in the succession of day and night, of summer and winter; but the soul of force would be dislodged from our universe; casual relations would disappear, and with them that science which is now binding the parts of nature to an organic whole.

I should like to illustrate by a few simple instances the use that scientific men have already made of this power of imagination, and to indicate afterwards some of the further uses that they are likely to make of it. Let us begin with the rudimentary experiences. Observe the falling of heavy rain drops into a tranquil pond. Each drop as it strikes the water becomes a center of disturbance, from which a series of ring ripples expands outwards. Gravity and inertia are the agents by which this wave motion is produced, and a rough experiment will suffice to show that the rate of propagation does not amount to a foot a second.

A series of slight mechanical shocks is experienced by a body plunged in the water as the wavelets reach it in succession. But a finer motion is at the same time set up and propagated. If the head and ears be immersed in the water, as in an experiment of Franklin's, the shock of the drop is communicated to the auditory nerve—the *tick* of the drop is heard. Now this sonorous impulse is propagated, not at the rate of a foot a second, but at the rate of 4,700 feet a second. In this case it is not the gravity but the *elasticity* of the water that is the urging force. Every liquid particle pushed against its neighbor delivers up its motion with extreme rapidity, and the pulse is propagated as a thrill. The incompressibility of water, as illustrated by the famous Florentine experiment, is a measure of its elasticity, and to the possession of this property in so high a degree the rapid transmission of a sound-pulse through water is to be ascribed.

But water, as you know, is not necessary to the conduction of sound; air is its most common vehicle. And you know that when the air possesses the particular density and elasticity corresponding to the temperature of freezing water the velocity of sound in it is 1,090 feet a second. It is almost exactly one fourth of the velocity in water; the reason being that though the greater weight of the water tends to diminish the velocity, the enormous molecular elasticity of the liquid far more than atones for the disadvantage due to weight. By various contrivances we can compel the vibrations of the air to declare themselves; we know the length and frequency of sonorous waves, and we have also obtained great mastery over the various methods by which the air is thrown into vibration. We know the phenomena and laws of vibrating rods, of organ pipes, strings, membranes, plates, and bells. We can abolish one sound by another. We know the physical meaning of music and noise, of harmony and discord. In short, as regards sound we have a very clear notion of the external physical processes which correspond to our sensations.

In these phenomena of sound we travel a very little way from downright sensible experience. Still the imagination is to some extent exercised. The bodily eye, for example, cannot see the condensations and rarefactions of the waves of sound. We construct them in thought, and we believe as firmly in their existence as in that of the air itself. But now our experience has to be carried into a new region, where a new use is to be made of it.

Having mastered the cause and mechanism of sound, we desire to know the cause and mechanism of light. We wish to extend our inquiries from the auditory nerve to the optic nerve. Now there is in the human intellect a power of expansion—I might almost call it a power of creation—which is brought into play by the simple brooding upon facts. The legend of the Spirit brooding over chaos may have originated in a knowledge of this power. In the case now before us it has manifested itself by transplanting into space, for the purposes of light, an adequately modified form of the mechanism of sound. We know intimately whereon the velocity of sound depends. When we lessen the density of a medium and preserve its elasticity constant we augment the velocity. When we highten the elasticity and keep the density constant we also augment the velocity. A small density, therefore, and a great elasticity are the two things necessary to rapid propagation.

Now light is known to move with the astounding velocity of 185,000 miles a second. How is such a velocity to be obtained? By boldly diffusing in space a medium of the requisite tenuity and elasticity. Let us make such a medium our starting point, endowing it with one or two other necessary qualities; let us handle it in accordance with strict mechanical laws; give to every step of our deduction the surety of the syllogism; carry it thus forth from the world of imagination to the world of sense, and see whether the final outcrop of the deduction be not the very phenomena of light which ordinary knowledge and skilled experiment reveal. If in all the multiplied varieties of these phenomena, including those of the most remote and entangled description, this fundamental conception always brings us face to face with the truth; if no contradiction to our deductions from it be found in external nature; if, moreover, it has actually forced upon our attention phenomena which no eye had previously seen, and which no mind had previously imagined; if by it we are gifted with a power of prescience which has never failed when brought to an experimental test; such a conception, which never disappoints us, but always lands us on the solid shores of fact, must, we think, be something more than a mere figment of the scientific fancy. In forming it that composite and creative unity in which reason and imagination are together blent, has, we believe, led us into a world not less real than that of the senses, and of which the world of sense itself is the suggestion and justification.

Far be it from me, however, to wish to fix you immovably in this or in any other theoretic conception. With all our belief of it, it will be well to keep the theory plastic and capable of change. You may, moreover, urge that although the phenomena occur *as if* the medium existed, the absolute demonstration of its existence is still wanting. Far be it from me to deny to this reasoning such validity as it may fairly claim. Let us endeavor by means of analogy to form a fair estimate of its force.

You believe that in society you are surrounded by reasonable beings like yourself. You are perhaps as firmly convinced of this as of anything. What is your warrant for this conviction? Simply and solely this, your fellow-creatures behave as if they were reasonable; the hypothesis, for it is nothing more, accounts for the facts. To take an eminent example, you believe that our president is a reasonable being. Why? There is no known method of superposition by which any one of us can apply himself intellectually to another so as to demonstrate coincidence as regards the possession of reason. If, therefore, you hold our president to be reasonable, it is because he behaves *as if* he were reasonable. As in the case of the ether, beyond the "*as if*" you cannot go. Nay I should not wonder if a close comparison of the data on which both inferences rest caused many respectable persons to conclude that the ether had the best of it.

This universal medium, this light-ether as it is called, is a vehicle, not an origin of wave motion. It receives and transmits, but it does not create. Whence does it derive the motions it conveys? For the most part from luminous bodies. By this motion of a luminous body I do not mean its sensible motion, such as the flicker of a candle, or the shooting out of red prominences from the limb of the sun. I mean an intestine motion of the atoms or molecules of the luminous body. But here a certain reserve is necessary. Many chemists of the present day refuse to speak of atoms and molecules as real things. Their caution leads them to stop short of the clear, sharp, mechanically intelligible atomic theory enunciated by Dalton, or any form of that theory, and to make the doctrine of multiple proportions their intellectual bourne. I respect the caution, though I think it is here misplaced. The chemists who recoil from these notions of atoms and molecules accept without hesitation the undulatory theory of light. Like you and me they one and all believe in an ether and its light-producing waves. Let us consider what this belief involves.

Bring your imaginations once more into play and figure a series of sound waves passing through air. Follow them up to their origin, and what do you there find? A definite, tangible, vibrating body. It may be the vocal chords of a human being, it may be an organ-pipe, or it may be a stretched string. Follow in the same manner a train of ether waves to their source, remembering at the same time that your ether is matter, dense, elastic, and capable of motions subject to and determined by mechanical laws. What then do you expect to find as the source of a series of ether waves? Ask your imagination if it will accept a vibrating multiple proportion—a numerical ratio in a state of oscillation? I do not think it will. You cannot crown the edifice by this abstraction. The scientific imagination, which is here authoritative, demands as the origin and cause of a series of ether waves a particle of vibrating matter quite as definite, though it may be excessively minute, as that which gives origin to a musical sound. Such a particle we name an atom or a molecule. I think the imagination when focused so as to give definition without penumbral haze is sure to realize this image at last.

To preserve thought continuous throughout this discourse, to prevent either lack of knowledge or failure of memory from producing any rent in our picture, I here propose to run rapidly over a bit of ground which is probably familiar to most of you, but which I am anxious to make familiar to you all.

The waves generated in the ether by the swinging atoms of luminous bodies are of different lengths and amplitudes. The amplitude is the width of swing of the individual particles of the wave. In water waves it is the hight of the crest above the trough, while the length of the wave is the distance between two consecutive crests. The aggregate of waves emitted by the sun may be broadly divided into two classes, the one class competent, the other incompetent, to excite vision.

But the light-producing waves differ markedly among themselves in size, form, and force. The length of the largest of these waves is about twice that of the smallest, but the amplitude of the largest is probably a hundred times that of the smallest. Now the force or energy of the wave, which, expressed with reference to sensation, means the intensity of the light, is proportional to the square of the amplitude. Hence the amplitude being one hundred-fold, the energy of the largest light-giving waves would be ten thousand-fold that of the smallest. This is not improbable. I use these figures, not with a view to numerical accuracy, but to give you definite ideas of the differences that probably exist among the light-giving waves. And if we take the whole range of solar radiation into account—its non-visual as well as its visual waves—I think it probable that the force or energy of the largest wave is a million times that of the smallest.

Turned into their equivalents of sensation, the different light waves produce different colors. Red, for example, is produced by the largest waves, violet by the smallest, while green is produced by a wave of intermediate length and amplitude. On entering from air into more highly refracting substances, such as glass or water or the sulphide of carbon all the waves are retarded, but the smallest ones most. This furnishes a means of separating the different classes of waves from each other—in other words, of analyzing the light. Sent through a refracting prism, the waves of the sun are turned aside in different degrees from their direct course, the red least, the violet most. They are virtually pulled asunder, and they paint upon a white screen placed to receive them "the solar spectrum."

Strictly speaking, the spectrum embraces an infinity of colors, but the limits of language and of our powers of distinction cause it to be divided into seven segments: Red, orange, yellow, green, blue, indigo, violet. These are the seven primary or prismatic colors. Separately, or mixed in various proportions, the solar waves yield all the colors observed in nature and employed in art. Collectively they give us the impression of whiteness. Pure unsifted solar light is white; and if all the wave constituents of such light be reduced in the same proportion, the light, though diminished in intensity, will still be white. The whiteness of Alpine snow with the sun shining upon it is barely tolerable to the eye. The same snow under an overcast firmament is still white. Such a firmament enfeebles the light by reflection, and when we lift ourselves above a cloud-field—to an Alpine summit, for instance, or to the top of Snowdon—and see, in the proper direction, the sun shining on the clouds, they appear dazzlingly white. Ordinary clouds, in fact, divide the solar light impinging on them into two parts—a reflected part and a transmitted part, in each of which the proportions of wave motion which produce the impression of whiteness are sensibly preserved.

It will be understood that the conditions of whiteness would fail if all the waves were diminished *equally*, or by the same absolute quantity. They must be reduced *proportionately* instead of equally. If by the act of reflection the waves of red light are split into exact halves, then, to preserve the light white, the waves of yellow, orange, green, and blue must also be split into exact halves. In short, the reduction must take place, not by absolutely equal quantities, but by equal fractional parts. In white light the preponderance as regards energy of the larger over the smaller waves must always be immense. Were the case otherwise, the physiological correlative, *blue*, of the smaller waves would have the upper hand in our sensations.

My wish to render our mental images complete causes me to dwell briefly upon these known points, and the same wish will cause me to linger a little longer among others. But here I am disturbed by my reflections. When I consider the effect of dinner upon the nervous system, and the relation of that system to the intellectual powers I am now invoking; when I remember that the universal experience of mankind has fixed upon certain definite elements of perfection in an after dinner speech, and when I think how conspicuous by their absence these elements are on the present occasion, the thought is not comforting to a man who wishes to stand well with his fellow creatures in general, and with the members of the British Association in particular. My condition might well resemble that of the ether, which is scientifically defined as an assemblage of vibrations. And the worst of it is that unless you reverse the general verdict regarding the effect of dinner, and prove in your own persons that a uniform experience need not continue uniform—which will be a great point gained for some people—these tremors of mine are likely to become more and more painful. But I call to mind the comforting words of an inspired though uncanonical writer, who admonishes us in the Apocrypha that fear is a bad counsellor. Let me then cast him out, and let me trustfully assume that you will one and all postpone that balmy sleep, of which dinner might, under the circumstances, be regarded as the indissoluble antecedent, and that you will manfully and womanfully prolong your investigations of the ether and its waves into regions which have been hitherto crossed by the pioneers of science alone.

(To be continued.)

THE POWER OF MODERN SKILL IN THE MECHANIC ARTS.

The great camp of Chalons had just been completed, a whole city of soldiers spread over the rolling plain of Mourmelon, and all Paris, ever thirsting after "something new," was full of anxiety to enjoy the brilliant spectacle. The military authorities at the capital deplored the distance that separated them from the army; the contractors were often behind in their supplies, and the committees sent down to examine many important questions were seriously hampered by the remoteness of the camp from their books and their colleagues. The Emperor, aware of these inconveniences, determined to connect the camp with Paris by a railway, and never was imperial order executed more promptly and triumphantly.

Fortunately, the Great Eastern Company, which had a line of railways running from Paris to Strasbourg, and approached the camp at the station of Chalons within a distance of about sixteen miles, was one of the richest and best-organized companies of France. It owned already then (in 1860) more than five hundred locomotives and twenty thousand cars, and the central administration in Paris, which had spent over one hundred million dollars on the road, could well afford to gratify the Emperor when he expressed a wish to have a branch railway built not only in a short time, but more quickly than the like had ever been known before. The directors at a glance perceived the advantage that would accrue to them from such an addition to their great work; and although the Emperor allowed them only ten days for surveys and preparatory labors, they at once assumed the contract.

The difficulties were by no means trifling, although the railway was so short. It had to cross the valley of the Marne at a considerable hight above its level, then the river itself and a canal running parallel to it, and, after several very short curves, to span once more a deep valley in which the Vesle flows, till it reached in a straight line of about two miles the camp itself. All this involved necessarily very heavy works, three bridges, and high enbankments.

On the 10th of July, in the evening, the representatives of the company laid before the Emperor—who took a great personal interest in the matter—the complete plans for the work. They expected, of course, that not much time would be allowed them for the execution, but they were not a little taken aback when Napoleon asked them if they would undertake to have the railway ready in two months. They consulted a few minutes with each other, during which they were left alone, but soon the Emperor returned and demanded their answer. They claimed that the difficulties were very great and the time too short; nevertheless they engaged to do the Emperor's will, if he, on his part, would order the authorities, from the Minister of Public Works down to the district officials, to dispense with all but the most necessary formalities.

The promise was given, and on the very next day, early in the morning, they received the contract duly authenticated, thus giving an earnest on the part of the Government that everything should be done to aid them in their remarkable enterprise. At noon a meeting of the directors took place, at which matters were generally arranged, and when the sun set that evening the first spade had been struck in the ground near Chalons.

The first trouble—for troubles there were, many and grievous—was the want of laborers. The best and most experienced hands were sent for by telegraph from all the different works of the Great Eastern Company; they appeared in every express train from Loraine, Burgundy, and Alsatia—others were imported from Belgium, Westphalia, and Prussia; they received the highest wages, but were also required to do full work and in the best manner. Thus a force of twenty-four hundred first-class workmen was gathered in a few days around the first mile.

Next, all the powerful engines and machinery of the whole line were put into requisition; steam-rams, track-engines, circular saws set to work along the line, and torches, bonfires, and electric lights supplied the light of day during the short summer nights, so that relays of laborers could succeed each other without interruption. The company, moreover, provided for their food in the most careful manner. A famous Paris restaurateur, Chevet, was engaged to furnish cooked provisions for the little army of workmen, and a couple of days after the beginning of the marvelous work, his movable kitchens were seen along the line, furnishing a supply of excellent dinners, from six francs for the higher employes down to ten cents for the workmen.

All these interesting features—the almost magic rise of a railway in a heavy chalk soil, the wonderful activity of thousands of skillful laborers on so short a distance, and the almost fairy-like illumination at night—attracted immense numbers of Parisians, who came by day and by night to witness the strange sight, and brought a rich reward at once to the enterprising company.

High and large enbankments were of course out of the question under such circumstances, and the company adopted, therefore, our own system of trestle-work instead, planting immense piles by means of hundreds of steam-rams, which went to work at one and the same time, strengthening them simultaneously by heavy cross timbers, and laying the track without delay on the solid structure. One such trestle bridge, two thousand feet long, crossed the valley of the Marne, a second, of only five hundred feet, that of the Vesle, and a third, of six hundred feet, the lowlands of a smaller stream. When the whole line was completed, these trestle-works were filled up with earth, and at leisure changed into huge embankments. The principal bridge, however, was from the first placed upon solid béton foundations.

The construction began, of course, at Chalons, so as to remain constantly in direct communication with Paris, from which all the material and the supplies had to be obtained. An electric telegraph line was likewise erected along the route, with a station at every thousand yards, so that not a moment was lost by the sending of messages and orders, and directions could be issued at once to every part of the line. The track spun out like a ribbon, with all the necessary additions of crossings, turnouts, barriers, fencing on both sides, station buildings; in fact, everything that belongs to the most complete outfit of a first-class railway; and as soon as the rails were laid down, locomotives came up cautiously with new material and supplies for the workmen. The country through which the new line passed was fortunately not very rich, and hence the owners of land, struck by this unheard-of display of energy and capital combined, willingly ceded their rights and offered their assistance in every available shape.

It was said then, and it has since been confirmed by the Emperor's own admission, that he suggested this exploit in no wanton desire to prove his power and to excite wonder and admiration, but with a view to ascertaining what could be done under similar circumstances in time of war by the aid of the absolute power of a commanding general. He attained his end in the most satisfactory manner. On the fifty-sixth day after the first blow had been struck, the locomotive passed over the whole line from the station at Chalons to the terminus in the center of the camp; during the next five days the station buildings, restaurants, and waiting rooms were completely finished, and on the sixty-first day the Emperor opened the new railway in person, expressing his high satisfaction at the unexpected success in the most impressive words, and bestowing brilliant rewards upon the chief agents in the great enterprise.—*Lippincott's Magazine.*

Iron Plated Steamer "Captain."

The Naval Court appointed to investigate the causes which led to the loss of the iron-plated ship *Captain*, noticed on page 186 of this volume, have concluded their labors, and have returned a satisfactory verdict.

We, says *Engineering*, expressed plainly our opinion that the calamity which befel the *Captain* arose purely from the want of stability inherent in vessels of her particular class, while we further stated that the vessel "was built in opposition to all scientific principles, and in deference to a newspaper outcry, of which the loudest notes were uttered in the *Times;* and these views are fully corroborated by the verdict just returned, and by the evidence laid before the Court. Briefly stated, the plain facts of the case appear to have been these: Captain Coles advocated the construction of a sea-going turret ship, with a low freeboard, and he complained that in the *Monarch* and other turret ships built under the direction of the Admiralty, his plans had been by no means fairly carried out. Meeting with advocates of his plans in some members of Parliament, and in the conductors of certain newspapers, he was enabled, at length, to bring such an amount of pressure to bear upon the Admiralty that, in direct opposition to the advice of Mr. Reed and his department, an order was given for the construction of the *Captain* in strict accordance with Captain Cole's design. The contract for the construction of the *Captain* was taken by Messrs. Laird, and it appears to us to be proved, beyond all doubt, by the evidence offered at the court-martial, that on Messrs. Laird and Captain Coles, jointly, the entire responsibility of the non-success of the *Captain* rests. In saying this we have no desire to affirm that either Messrs. Laird or the late Captain Coles are alone responsible for the fearful loss of life to which the construction of the *Captain* has led. This responsibility we consider to have been shared by those under whose orders the ship was placed in commission. The *Captain* was acknowledged, on all hands, to be a purely experimental vessel, and, considering that she was built in direct opposition to the strongly-expressed opinions of Mr. Reed and his department, it would only have been reasonable to suppose that, before sending her on a cruise, experiments should have been made to determine what her stability really was, and, in fact, every practicable means taken to ascertain, as far as possible, what her performance at sea might be expected to be.

It has been hinted in some quarters that Mr. Reed was to blame in not having himself taken means to prove experimentally the unseaworthiness of the *Captain*, and in not having caused official information of her presumed want of stability to be conveyed to Captain Burgoyne. In this view we cannot agree. Mr. Reed opposed the construction of the *Captain* both publicly and privately, and when, in spite of his opposition, and that of Sir Spencer Robinson, it was resolved that the vessel should be built, he and the Controller considered that they ceased to be responsible. In fact Mr. Reed said in evidence, "so strongly did I feel that we were clear of all responsibility, that I forbade my assistants to ever use the word 'approved' even for the most minor details, and directed them never to use a stronger phrase, even with regard to the smallest details, than 'that no objection would be offered.'" Moreover, although Mr. Reed had many objections to the *Captain*, he does not appear to have apprehended any imminent danger from the vessel being sent to sea. To quote his own words, he thought "she would have the highest possible reports to begin with; that she would be very carefully nursed through her early career, admissions of her deficiencies being slowly made; and that before she got through her commission she would be utterly condemned as unfit for the naval service." His evident opinion was that the defects of the vessel would have been discovered by those in charge of her, before any danger resulted from them, and having freely expressed his opinions of her unseaworthiness, he felt that he could do nothing until the correctness of his opinions was acknowledged. Unfortunately the eyes of those under whose auspices the *Captain* was called into existence only became opened by the sad story of her having foundered; and thus in place of the nation having to sustain a mere monetary loss, as would have been the case had the Captain been condemned as unseaworthy, it has, in addition to this loss, to mourn the death of Captain Burgoyne and his gallant crew. The fate of the *Captain* conveys a lesson which we trust that the Admiralty will take to heart, and this lesson is that it is dangerous to disregard warnings founded on scientific knowledge. It is a false system which places the man on whom the whole responsibility of the designing of the vessels of our navy presumably rests in a position subservient to those who, however great their administrative powers may be, possess no knowledge whatever of naval construction; and we trust that some day a reform may be effected.

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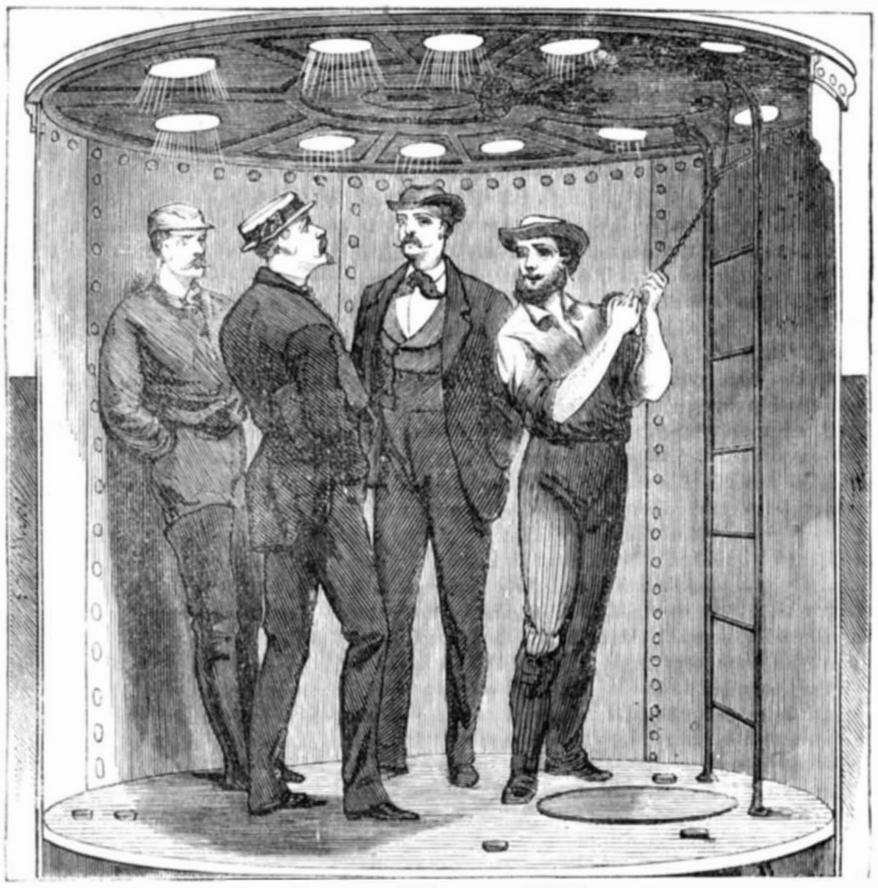
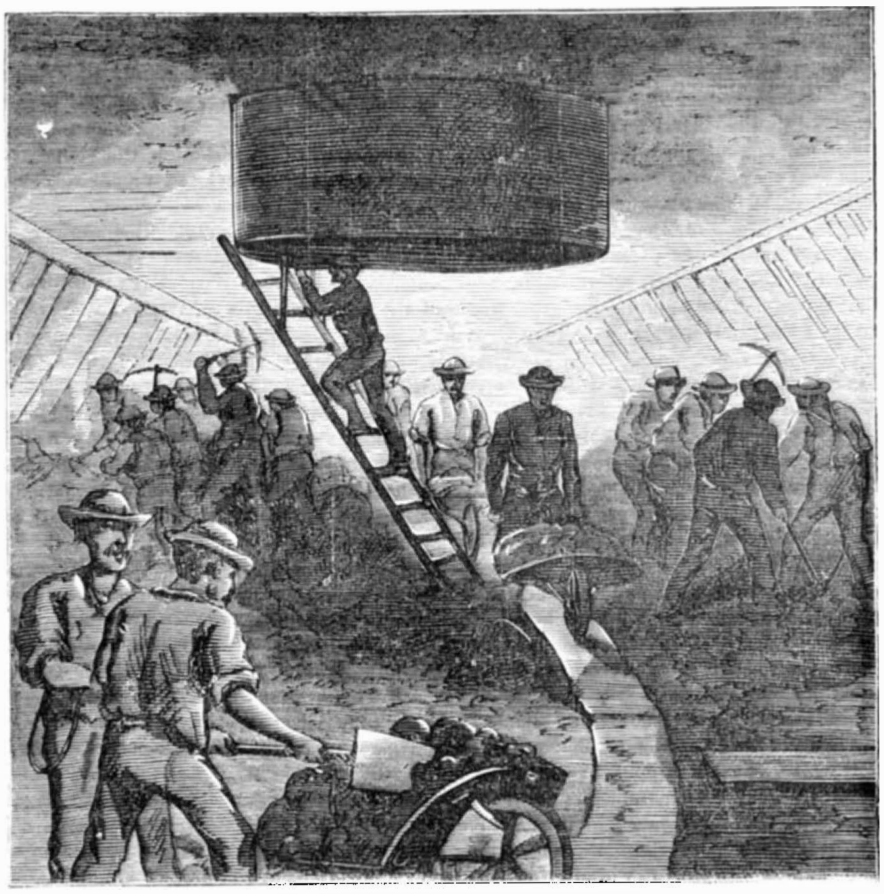
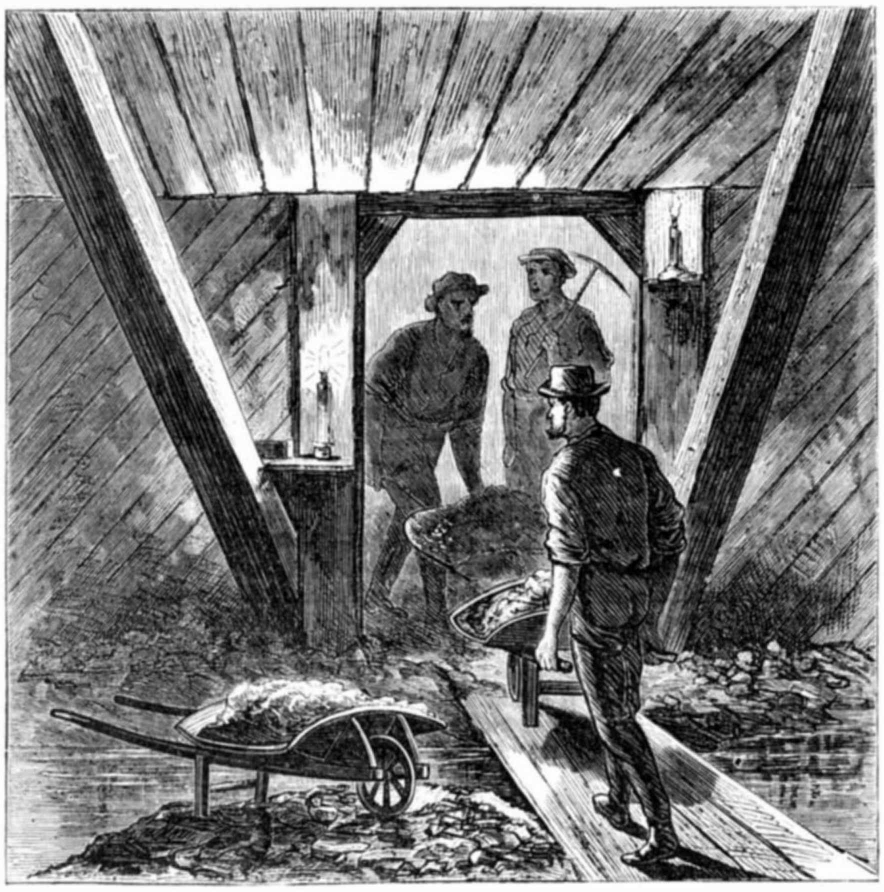
IRON for ships is rapidly superseding wood in English ship yards. In 1865 there were 806 wooden ships built in England. In 1869 but 324. In 1868 the tunnage of iron ships built was 235,937, against 66,977 wooden, and 24,121 of composite. Iron ships are more durable, require less repairs and stand heavier storms than those of wood, and it will not be long till the latter must be entirely superseded.



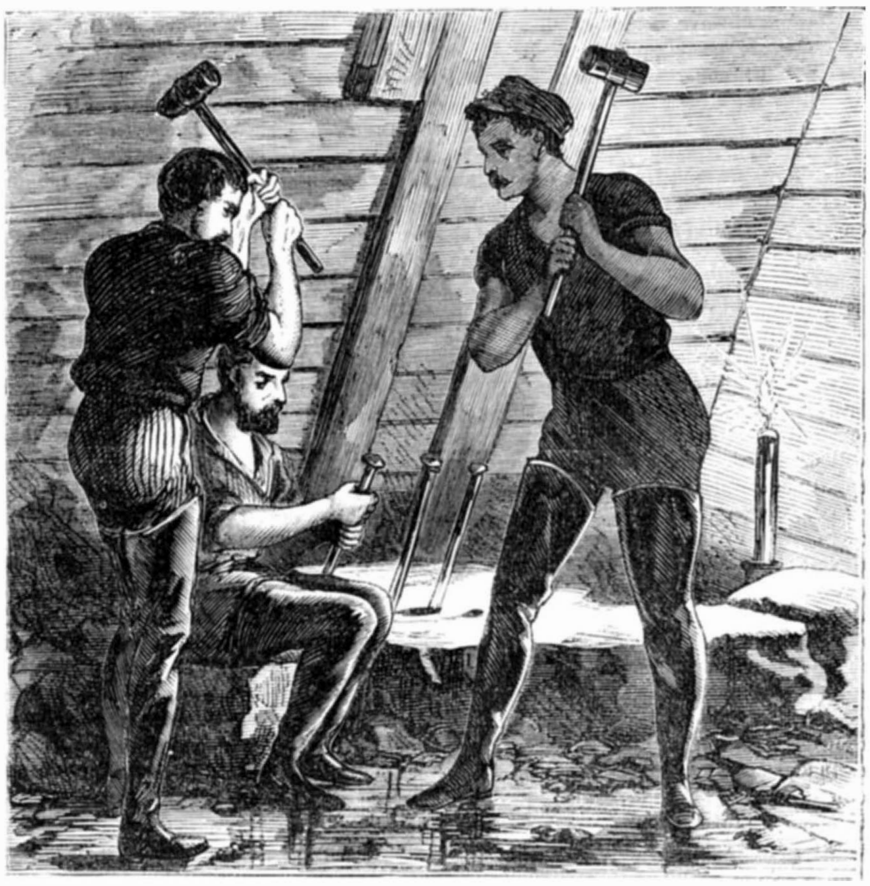
1.—ENTRANCE TO THE AIR LOCK OF THE CAISSON.



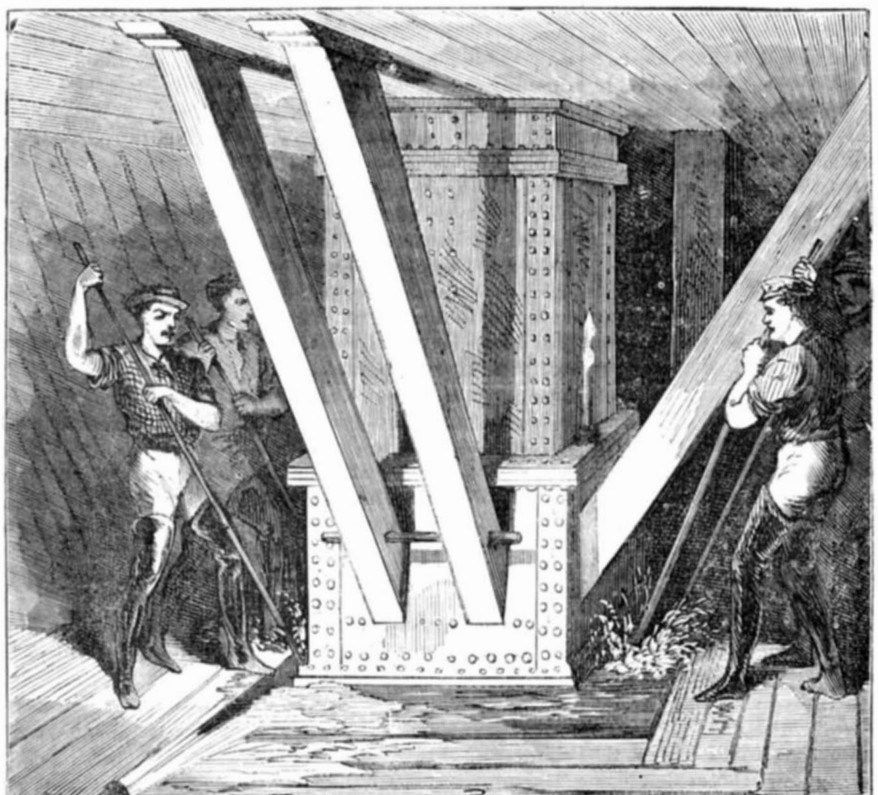
2.—MOUTH OF THE CAISSON AIR LOCK,



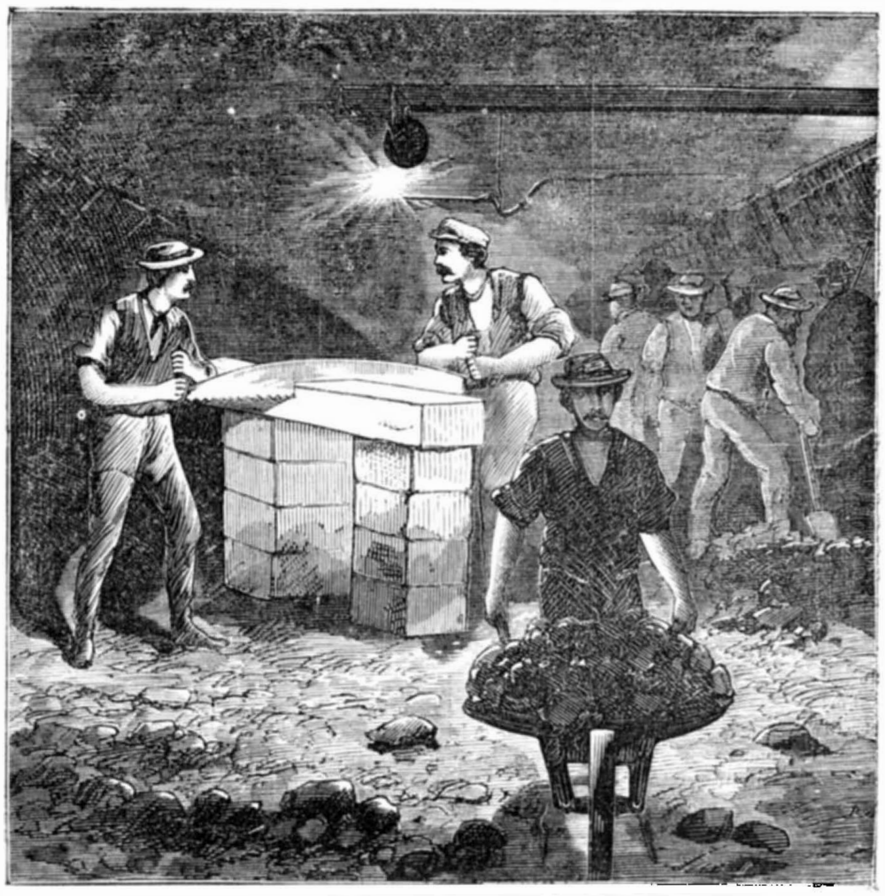
3.—DOOR THROUGH PARTITION, SHOWING DIFFERENT APARTMENT IN THE CAISSON.



4.—DRILLING THE ROCK AT THE SHOE OF THE CAISSON.



5.—FEEDING THE POCKET OF THE WATER SHAFT IN THE CAISSON.



6.—WORKMEN SAWING TIMBER FOR WEDGES.

INSIDE VIEWS OF THE EAST RIVER BRIDGE CAISSON, BROOKLYN, N. Y

THE GREAT SUSPENSION BRIDGE BETWEEN NEW YORK AND BROOKLYN---PROGRESS OF THE WORK ---ITS PRESENT CONDITION---SOME ACCOUNT OF THE METHOD OF PROCEDURE.

We give herewith some engravings, showing various operations in the interior of the caisson at the Brooklyn terminus of the East River Bridge.

This caisson is now only nine feet from its permanent bed, and the sinking is progressing at the rate of about one foot per week. The interior is lighted by the oxyhydrogen light, or rather a light produced by the burning of jets of oxygen, and common illuminating gas in contact with pencils of magnesia.

Col. W. A. Roebling, the Engineer-in-Chief, informs us that these lights are almost absolutely essential to the rapid progress of the work, as they emit neither smoke nor odor, and the air in the caisson is in consequence kept pure and wholesome.

Three gangs of men—one hundred in each gang—and working eight hours each, are employed in the caisson, and the work proceeds without intermission night and day.

It will be just one year on the 1st of January since the first ground was broken, and the rapidity with which the work has proceeded is evidence that it is conducted by a man who is fully competent to conduct this greatest engineering feat of modern times to a successful issue. It is hoped that before the extreme cold weather of mid winter the caisson will have been sunk as low as necessary.

The caisson for the new York side is about one third done, and will be placed in position as soon as possible after completion.

Our readers have already been made acquainted with the nature and use of the caisson. It may be said to be a huge diving-bell from which the water is excluded by forcing into it air from a series of powerful air pumps worked by steam.

In this bell the men work in safety and comfort, excavating and blasting, and sending the broken and excavated material to the surface in a manner hereinafter to be described.

Fig. 1 represents the entrance to the caisson. It is a hollow iron shaft, having a vestibule or chamber communicating with the external air through à hatchway. Upon entering this vestibule the hatchway is closed, and the air from the caisson admitted through a hatchway in the floor of the chamber. To those unaccustomed to it, the pressure produces a series of very disagreeable sensations, which diminish somewhat after remaining a short time within the caisson. The lower end of the entrance shaft or "air lock," as it is technically called, is shown in Fig. 2.

The caisson in its descent requires the removal of a hard yellow clay in which are embedded large boulders which have to be broken up by blasting. Fig. 3 shows the workmen drilling one of these boulders situated under the shoe of the caisson. It not unfrequently happens that these boulders project some distance beyond the external edge of the shoe, and necessitate the passing out of workmen beyond this edge. This is done without danger, as the superimposed earth is of sufficient thickness to sustain the water resting upon it, the shoe of the caisson being now a considerable depth below the bottom of the river.

Our readers have been informed in previous articles, and in the report of Col. Roebling published in this journal in our issue of July 2, 1870, that the interior of the caisson is separated by partitions into chambers, from either of which the water may be expelled independently of the others.

Fig. 4 represents the interior of one of these chambers and the door which leads from it to an adjoining chamber of similar character. Through these doors the broken stone and soil are wheeled over plank-ways to the mouth of the water shaft at the bottom, shown in Fig. 5.

This shaft extends to, and below the general level of the bottom, a hole or "pocket" being dug out around and beneath it, and filled with water by hose. The pressure of air in the caisson causes the water to rise in the shaft, and the dredges are lowered through this water to clutch and scoop up the material to be removed, the clay, broken stone, and earth being dumped from the barrows into the pocket, and shoved under the foot of the water shaft by men with iron bars, as shown in Fig. 5.

The caisson with its load of masonry, now weighing upwards of 20,000 tuns, does not rest upon its shoe, and is only in part sustained by its floating power. The greater portion of the weight is sustained by timber frames, the uprights of which are sustained by blocks and wedges. To lower the caisson the wedges are driven partly out, and as the impact of the enormous weight in its descent often crushes the blocks and wedges, it is necessary to supply their place by new ones. This necessitates the use of considerable timber, which is sawn by hand in the interior of the caisson, as shown in Fig. 6.

The interior of the structure, with its manifold operations, all progressing with the utmost regularity, the whole illuminated by the brilliant oxyhydrogen light, forms a scene which, once seen, will not soon be forgotten.

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Extraction of the Perfume of Hyacinths.

At a meeting of the Polytechnic Society of Berlin it was mentioned that the extraction of perfume from the flowers of southern France was at the present time only rarely effected by means of rectified bisulphide of carbon, and then only in the case of very fine perfumes, as in that of hyacinths, which cannot be extracted in any other way.

In all others the old process is still in use. Large plates of felt saturated with olive oil are put one above the other and covered every morning with the flowers, while the oil absorbing the perfume drops into a vessel below, the strength or the concentration of the perfume depending on the time during which the oil had been exposed to the flowers. It is strange that until now no perfume could be extracted from the flowers of mignonette.

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

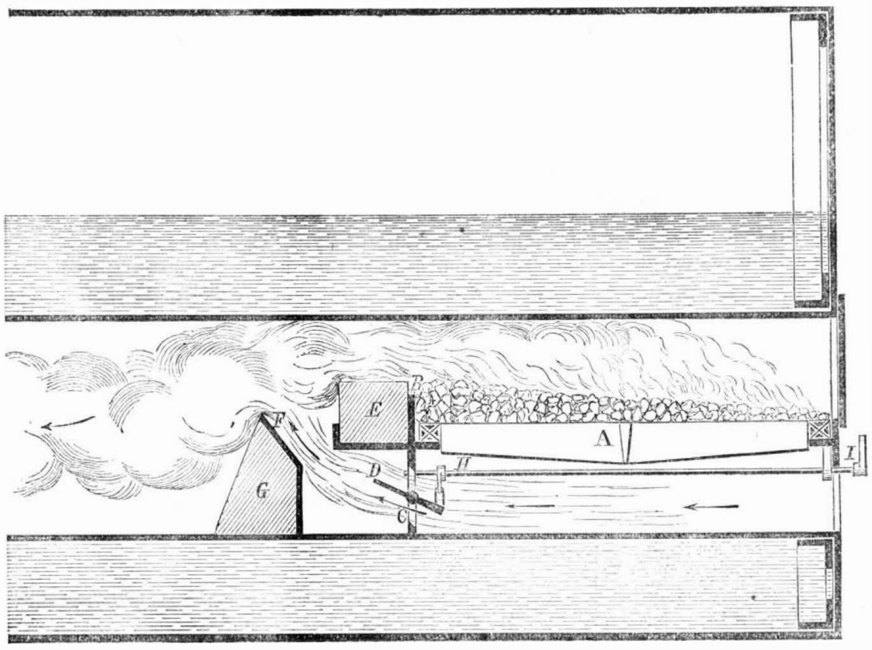
Smoke Consumption.

Messrs. Editors:—In No. 17 of your paper you refer to the importance of a cheap and simple device for preventing smoke in furnaces and for the consumption of the same.

The accompanying sketch shows a simple and effective apparatus for this purpose, which I personally attached to a great number of boilers in Lancashire and Yorkshire (Eng.) a few years ago with perfect success.

The main feature of this smoke consumer is the admittance of warm air behind the fire-bridge, and at an angle to the smoke that comes from the fuel, when combustion of the smoke and gases takes place, and a colorless gas passes from the top of the chimney.

The following is a description of the drawing: A is the grate, the bars resting at each end on bearers. In the rear of the grate bars is secured a cast-iron plate, B, having an opening, C, in its lower part. A movable damper, D, turns around a central pivot, by which arrangement fresh, warm air gets access to the space behind the fire-bridge, E.



Behind the bridge, E, is another cast-iron plate, F, the upper part of which is inclined so as to throw the fresh, warm air from C, suddenly into intimate contact with the smoke and gases from the fireplace. The combustion of the smoke and gases takes place immediately after the contact with the warm air, the result being an almost colorless gas.

By means of a simple lever arrangement, H and I, the damper, D, is connected to the hinge pin on the fire-door in such a manner that when the door is opened for the purpose of stoking up the fire or throwing in additional fuel, then is also the damper, D, opened automatically, and closed gradually, as it is found that a greater amount of air is necessary when fuel is added than what is needed when the coals are thoroughly ignited.

With this simple contrivance I have cured some of the worst smoking chimneys in Liverpool and Manchester (Eng.) from emitting black smoke, thus preventing a grievous nuisance besides saving from 10 to 15 per cent of fuel. Two men can easily fit an old flue with this apparatus in six hours.

Alban Andren, Constructing Engineer.

Boston, Mass.

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Deflection of Beams.

Messrs. Editors;—On page 230 of the current volume of the Scientific American, is a quotation from the *Builder*, in which the writer says that "Beams or girders of any kind, are acted upon by weights placed on them at stated places, inversely as the *squares* of the distances of such places to the supports."

Now every educated engineer in Christendom knows that the strain on beams and girders, resulting from a weight laid on them, at different points, varies as the *rectangle* of the segments into which the weight divides the length of the beam.

[By the former proposition, the strain on a beam, resulting from a weight at one fourth of the length of the beam from one of the supports, would be to that of the same weight on the middle of the beam as *one* to *four*; while modern engineers would tell us the strain at the two points would be as *three* to *four*, which makes a wide difference.

Again, in the next paragraph the *Builder* gives us to understand that the *strength* of beams varies inversely as the *square* of the length, while all writers and experimenters on stress and strength of materials, concur in telling us that the *strength* of beams varies (the other dimensions remaining the same and alike) as the *length*, inversely—not as the square of the length. By the *Builder*, a beam ten times the length of another, of the same size in other respects, would have but $\frac{1}{100}$ of the strength of the shorter one; whereas by the principle now unanimously recognized by all educated engineers, and which are as thoroughly established by experiment and analysis as are any of the truths of experimental philosophy, the strength of the longer beam would be $\frac{1}{10}$ that of the shorter one.

Can the *Builder* explain his anomalous statements?

Ferrysburg, Mich. H. C. Pearsons.

[The criticisms of our correspondent on the statements made in the article from which he quotes, are just, and anticipate some remarks we intended to make on the subject, but which by mistake were not published in connection with the article referred to at the time of its publication. As Mr. Pearsons has covered the ground fully, we recommend a careful comparison of his statements with the false teaching of the *Builder*.—Eds.

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Auroral and Magnetic Periods.

Messrs. Editors:—In the Scientific American of Oct. 22, you quote from Prof. Langley the statement, that the magnetic needle moves responsive to the great changes that transpire in the sun; and that our winter sky is lit up by auroras more frequently when the solar action is most violent. The fact, he says, is certain, though the cause is still wholly unknown to science. That is, we have Prof. Langley for authority, that the scientific world regard the fact as established, that auroras depend upon, or are, in some way, influenced by physical disturbances in the sun, and that the magnetic needle is, also, directly or indirectly influenced by the same cause. But how this influence is produced, he says, is as yet wholly unknown to science. It may not be amiss, therefore, to attempt a possible explanation or answer to the question.

How do physical changes in the sun produce auroras, and influence the magnetic needle on the earth?

Light and heat are now universally admitted to be sensations produced by vibratory motion of a material body, the luminiferous ether; and, from the known phenomena of light and heat, we infer that this body, the ether, possesses elasticity and inertia, but not gravity. (See "Brande's Encyc., Art. "Light.")

We may assume, therefore, that infinite space is pervaded by an inert, but non-gravitating, elastic fluid; and that it is through the medium of this fluid that all our knowledge of the universe, outside the little world we inhabit, is derived; and, also, a very large portion of the knowledge we get of our immediate surroundings. The ether being inert, elastic, and non-gravitating, will, necessarily, be less dense within and immediately around revolving bodies, than at a distance from them; for, being inert, it will, from centrifugal force, recede from the center of rotation; there will, therefore, be a continual tendency to the formation of an ethereal vacuum along the axis of rotation, and an equilibrium along the center of rotation can only be sustained by an in-flowing current of ether from the polar regions of the revolving body. We have, therefore, of necessity, within and about all revolving bodies, not only the phenomena of light and heat, from ethereal vibrations, but, also, an ethereal motion of translation, and this motion of translation will always be outward about the equator and middle latitudes, and inward about the poles. We might, *a priori*, be led to expect some tangible indication of this ethereal motion of translation about the earth, as the earth has a tolerably rapid rotary motion. Have we any such indications? I answer, we have in the phenomena of magnetism and the auroras.

Science has hitherto failed to assign any rational cause for the phenomena of magnetism. In order that we may understand how a motion of translation of the ether may produce the phenomena of magnetism, we must assume that, though the vibratory motion of the ether is arrested or reflected by all opaque bodies, yet, in its motion of translation, it passes freely through most bodies, but the molecules of a few bodies, such as iron and steel, may be so arranged as to be impervious to the ether in one direction, and yet transmit it freely in a direction at right angles with the impervious axis. Let such a body be balanced on a pivot, and, like a vane, it would indicate the direction of an ethereal current by the impervious axis assuming a direction at right angles with such current. We have here, obviously, a possible physical explanation of magnetism.

When the atmosphere flows through a forest of trees, we hear an audible sound, which is the result of vibratory motion of the air produced by interference with the trees. So in the upper regions of the atmosphere, an ethereal current might encounter sufficient interference from the molecules of the atmosphere to produce vibratory motion of the ether of sufficient intensity to be recognized by the eye as the auroras.

Let it be granted, now, that we have assigned the true cause of magnetism and the auroras, should we expect these phenomena to indicate any great physical movements in the sun?

In attempting to answer this question, I will have to assume as a fact an hypothesis that I have heretofore announced (see *Boston Journal of Chemistry* for Sept., 1869), but which is, as yet, unsupported by any positive facts. The hypothesis, however, is plausible, and as it does not conflict with any department of science, I will not attempt to argue it here, but will simply assume that ether is the primary or ultimate state or condition of ponderable matter. I have elsewhere attempted to show that the phenomena of attraction, or ponderability, would necessarily result from the action of the ether upon aggregated forms of matter (see *Iowa S. Journal* for Oct., 1868), and that it is, therefore, convertible into ponderable matter.

In the stupenduous chemical changes which take place in the sun, and which are indicated by the immense cyclones that are visible, even to the naked eye, at the distance of 95,000,000 miles, I assume that a vast amount of ether is absorbed by the sun; that is, converted into ponderable matter; the result of which would be a motion of translation of the ether in the surrounding space toward the sun; and as the elastic force of the ether about the earth was just in equilibrium with its centrifugal force, this increased current toward the sun would necessarily diminish the elastic force, and the centrifugal force would, for a time, and until the equilibrium is restored, increase the tendency to a vacuum about the axis, and, consequently, increase the polar currents, and we should have the phenomena of auroras and increased magnetic force.

As this article has already run out to a greater length than I had intended, I will merely add, that I have elsewhere (see *Boston Journal of Chemistry* for Dec., 1868), attempted to show that this etherial hypothesis accounts satisfactorily for the zodiacal light, another phenomenon that science has hitherto utterly failed to explain. J. E. Hendricks.

Des Moines, Iowa.

Balancing Cylinders, Saw Gates, etc.

Messrs. Editors:—If the subject is not already overdone, I would add a few hints on balancing.

In the case of thrasher cylinders see that the staves, if of wood, are of uniform thickness and out of the same batch of timber. Turning the heads and staves will not assist much in balancing, and in the case of some cast-iron heads turning is rendered impossible by their polygonal form. After the shaft is turned, the heads bored and keyed on, and the bands drilled and bored for the teeth, and in their places, put the cylinder into the centers of an "iron" lathe, leave the binding screw of the tail center loose, put on a dog, and set the lathe on quick speed. Fix a sharp-pointed tool in the tool post, and with the screw advance it cautiously until it touches the shaft near the tail center. If it touches all round that end of the cylinder is in balance. If it touches on one side, that will indicate that the counterpoise is to be put in opposite the scratch. Turn the cylinder end for end, and repeat the process. Having brought the cylinder to balance, see that the teeth are of uniform dimensions, nuts the same size and thickness, put them in, and repeat the balancing by putting more or less washers under the nuts.

In the field, where a lathe cannot be had, loosen the caps, set the machine going until it "shakes," throw the belt off, and hold a sharp-pointed file or scratch-awl, so as to mark the heavy side on the shaft at both ends and apply the balance opposite.

The above means of testing, answer well for planing-machine cylinders, the balancing to be done by drilling out the metal on the heavy side.

In the case of saw mills and steam engines no attempt should be made to balance such reciprocating parts, as the piston with its rod, cross-head, and portion of connecting rod in engines, or the saw, gate, etc., and a portion of the pitman in saw mills.

All attempts to balance these parts by adding counterpoise to the crank or fly wheel will make matters worse for the crank shaft and its boxes. The only admissible counterpoise on the crank is what will balance the crank, crank-pin, and that portion of the rod or pitman which enters into the rotary motion and adds to the centrifugal force around the crank shaft.

The exact amount of counterbalance may be formed by placing the rod or pitman in a horizontal position with the cross-head or noddle-pin end resting upon a knife-edge support exactly at the center, and the other end resting upon the crank-pin also at the center, place the crank and shaft bearings on parallel bars and add just so much counterbalance as will hold the crank in a horizontal position in line with the rod or pitman. "Only this, and nothing more."

Syracuse, N. Y. Benjamin F. Wilson.

Shoemakers' Measure.

Messrs. Editors:—"No. 1 is $4\frac{1}{8}$ inches in length, and every additional number $\frac{1}{8}$ of an inch."

Thought I, on reading the above on page 259 of your paper, that is worth preserving, and I copied it at once into a book I keep for transcribing any valuable information I find in your and other papers. But after a little reflection I thought I would test your rule. My shoe is a No. 10; its outside length is $11\frac{5}{8}$ inches. If No. 1 is $4\frac{1}{8}$ inches and each additional number is $\frac{1}{8}$ of an inch, my foot should be just $7\frac{1}{8}$ inches long. As it is $4\frac{1}{2}$ inches longer than that, please explain whence the discrepancy arises.

Constant Reader.

[The item referred to was copied from a book professing to give accurate information, and was not as critically examined as our correspondent seems to have done with it. If it be incorrect, will some one state what is the true "shoemakers measure."—Eds.

Popular Errors Regarding the Watch.

Messrs. Editors:—Stealing jewels is an elephantine hobby on which many people ride a tilt against defenseless watch-makers. They say, "some villainous tinker has stolen some of the most valuable jewels from my watch;" this accusation comes oftenest from those who seem to know others better than they know themselves; and is one of the popular prejudices born of ignorance and suspicion, which is no more akin to truth, than an ignis fatuus is to fire. The fact is that the jewels in watches are valuable only in the good office they subserve in ministering largely to the correct performance and durability of the watch, and their cost is wholly made up of the labor bestowed on their construction; out of their place in the watch to which they are individually fitted, they are of comparatively no value. Piano-tuners might with quite as much reason, be accused of stealing the steel strings from a piano, and substituting iron, as to accuse a watch-maker of pilfering jewels which he must replace with something, or the watch will never make another tick. He must substitute metal holes at an expense of at least a one day's hard labor, in place of the jewels removed, and for his pains he would only get what he could have bought for a few shillings, and to make them of any value to him he must spend another half day fitting them to some watch which happens to need such as he may have stolen; also, he must wait months, or perhaps years, for an opportunity to use the fruit of his dishonesty. Many people are very prone to suspect rascality in any transaction where they are conscious of being at the mercy of another, they cannot think otherwise of human nature than as totally depraved, and that when the opportunity to be dishonest occurs, there is no one able to resist the temptation. Of course, the trade has its proportion of dishonest members, but I cannot persuade myself that a natural born thief (no other could be guilty of such profitless pilfering) would ever select the trade of a watch-maker for an occupation; if he did, he would soon abandon it, for the stealings are fearfully costly. The patrons of the craft need have no apprehension of their jewels being stolen, so long as it is much easier and more profitable to steal their money, not directly, or course, but indirectly; what the community should guard against, is the fearful loss of money, and damage to watches, which it suffers by the employment of incompetent workmen; where one dollar is lost by dishonesty, hundreds are lost through the ignorance of those who pretend to be watch-makers

Cleveland, Ohio. R. Cowles.

Artificial Stone.

Messrs. Editors:—Under this heading I notice an interesting article in the Scientific American of October 22.

I desire to give my experience in the use of grindstones, manufactured from sand, under the Ransome process, and also to throw out some suggestions which may be of use to those engaged in that particular manufacture, which I believe to be yet in its infancy.

In the locality where I was using large quantities of grindstones a company was engaged in manufacturing stone under the Ransome process. I became satisfied that grind stones could be made under that process, and ordered a few for trial. They were made, and proved fully up to my expectations as a trial, yet lacked uniformity in hardness. Another lot was made, and proved somewhat better, so that I was encouraged to still continue the trial.

The first stones were about 40 inches in diameter, and 4 to 6 inches in thickness. Others 5 feet in diameter and 7 inches thick were made, and some of each lot were superior stones, being hard clear through, and doing excellent service. Others were hard on the outside, and gradually softened towards the center. Others had spots where the sand never united, but fell out loose. This lack of uniformity existed throughout the entire lot, both large and small. I found some of them very hard, so that I satisfied myself that they could not be made too hard for use, and that the kind of sand used made all the difference in the quality of grit.

One kind of work that I was doing required a fast-cutting stone for grinding on the flat surface of tempered steel (saw plates), this required a stone that would not glaze. I procured hard white sand, and a soft bank-sand. I made a stone of each. The hard sand would glaze, and the soft bank-sand had a dead cut, and wore away too fast.

I then combined the two sands mixing half and half, and made a few stones with astonishing results. My theory proved in practice all that I expected. The softer sand kept worn down below the harder, allowing the corners of the hard sand to protrude, so that the stone never wore to a smooth surface. I have used every kind of grindstone in the market, having worn out thousands of tuns, and never used any natural stone that the cutting quality would compare with these artificial stones when we got one that was hard enough. But here was the great trouble—not one in five was hard enough for use, and even when half a dozen stones were made on the same day, of the same sand, and with the same material, there was the same lack of uniformity. Neither did the length of time that they were kept after being made seem to make any difference; they neither seemed to harden nor soften by age. Some of the centers of worn-down stone I submitted to freezing and thawing, and they stood the test perfectly well, better even than some natural stones. From the experiments made I became perfectly satisfied that grindstones could be successfully manufactured of every grade desired, and that nearly every locality possesses sand suitable for the purpose. Whoever can devise a cheap and efficient means by which grindstones can be manufactured at our large works using them; such as for grinding edge tools, saws, springs, etc, etc., will find an abundant field to work in.

In the trial that I made, I was obliged to abandon their use on account of the great lack of uniformity; and the company failed even to make stone for other purposes for the same reason. J. E. E.

A Water Cooler.

Messrs. Editors:—A Natchez correspondent in a late number, calls upon one of the thousands of American inventors to perfect a machine whereby families can supply themselves with cold water without the use of ice.

The following is the manner in which I rendered myself independent of the ice dealers, and secured a constant and abundant supply of Croton as pure and cold as spring water. The plan can be adopted in any city or town having public water works. Having procured an iron tank holding 40 gallons, similar in shape to the boilers used in our kitchens (any size or shape will do), I tapped a half-inch hole on the top for the inlet pipe, and another 12 inches from the bottom for the outlet pipe; then having dug a hole 12 feet deep in the sub-cellar of the house (making 22 feet deep from the surface of the street), the tank was lowered to the bottom, and the connections with the Croton pipe made. The hole was then filled up and paved, and the job was done, and being well done will probably last for 30 years.

During the hottest part of last summer we drew water from the tank at a temperature of 53 degrees, while that drawn from other parts of the house indicated 82 degrees, and in connection with a filter attached to the faucet, we enjoyed the luxury of drinking cold Croton without the impurities which much of the ice supplied to our citizens imparts to the water.

Generally a depth of 15 to 18 feet will be sufficient to produce an agreeable coldness in the water.

New York city. A. T.

Balancing Saws.

Messrs. Editors:—I give you the result of years of thought and practice (twenty years engaged in saw milling) which is this:

A balance equal in weight to the pitman, gate or sash, saw, etc., placed equally distant from center of shaft to center of crank pin, would be and is a perfect balance only at the two perpendicular points in the circle described by the crank. But at the two points on the horizontal line, you would have this balance make the same centrifugal pounding which the sash or gate originally caused on the perpendicular line, less the centrifugal force of the lower end of the pitman. Hence my formula for balancing is to lessen the centrifugal force by dividing it at the different points, viz:

To the total weight of pitman, sash or gate, saw, etc., add the weight of the end of the pitman attached to the crank, divide the sum by two, which gives the weight, the center of gravity of which placed the same distance from the center of shaft, as the crank pin is, will make the truest balance practicable. Edw. Shippen.

The Health Habits of Young Men.

A very curious and interesting table might be made by a thoughtful physiologist and hygienist, showing each person where his strength goes; and I am not sure that a young man could do a better service for himself than to seek the counsel of some wise physiologist, tell him frankly all his habits, and have such a table prepared, not only to guard him against excess, but to show him his weak places, and point out where he will be most likely to fail. Some of these tables would, no doubt, read very much as follows:

Spent in digesting a big dinner, which the body did not need, sufficient force to raise thirty tuns of matter one foot.

Spent in getting rid of several drinks of wine and brandy, force sufficient to raise twenty tuns one foot high.

Spent in smoking six cigars, force sufficient to raise ten tuns one foot high.

Spent in keeping awake all night at a spree, force sufficient to raise twenty tuns one foot high.

Spent in breathing bad air force sufficient to raise fifteen tuns one foot high.

Spent in cheating a neighbor out of $30 in a business transaction force sufficient to raise fifteen tuns one foot high.

Spent in reading worthless books and newspapers force sufficient to raise five tuns one foot high.

Spent in hesitation, doubt, and uncertainty, force sufficient to raise five tuns one foot high.

Total—120 tuns one foot high.

Left for practical and useful labor only enough to raise fifty-five tuns one foot high, or to do less than one third of a day's work.

Sometimes there would be a draft on the original capital of considerable force, so there would not be enough to keep the body warm, or the food well digested, or the muscles plump and full, or the hearing acute, or the eyes keen and bright, or the brain thoughtful and active.

Very often a single debauch would use up the entire available power of the whole system for a whole week or month.

There is no end to the multitudinous ways in which we not only spend our working capital, but draw on the original stock, that ought never to be touched, and the result is imperfect lives, rickety bodies, no ability to transmit to our children good health and long life, much physical suffering and premature decay, with all the ends of life unaccomplished. How sad is all this! How terrible to be born into this world and leave it without adding something to its wealth, its virtue, and its progress.—*Herald of Health.*

In front of Krupp's establishment, shells of the largest caliber are to be seen lying. They are in the form of a pointed cylinder, and are 3 feet long and 14 inches in diameter. When filled with the charges (76 lbs. of powder) they weigh 739 lb. A hundred of these explosive projectiles have been ordered to be forwarded to Paris as speedily as possible.

BLACKBOARDS.

We have been quite often lately questioned as to the best plan for constructing school blackboards in rural districts. We find these queries fully answered in the following, condensed from the *Minnesota Teacher :*

HOW TO MAKE A BLACKBOARD.

Select seasoned pine lumber of the first quality and good width. Plane it well, joint nicely, and glue a sufficient number of boards together to make the required blackboard four feet in breadth. For end pieces use scantling which will dress two by three inches; saw them a few inches longer than the proposed width of the board ; cut a slot through the pieces on the flat side so as to admit the ends of the board, with an inch to spare at the top ; into this spare space insert a key, and drive home. To hold the end pieces in position the board may be dovetailed at its lower edge. Form a chalk trough by nailing a strip of half-inch stuff, five inches wide, to the lower edge of the board, and nailing to this strip, on its outer edge, a similar one two and one half inches wide. Bevel or round off the inner edges of the end pieces in a workmanlike manner, and smooth the surface of the board with fine sand paper before painting. The board may be supported by leather straps attached to the top. No nails or screws are used, because they compel the forming of cracks whenever there is shrinkage, by holding the several boards apart ; by leaving the whole free to slide in the slot, and following up all shrinkage with a key, occasionally tightened, a perfect surface is secured.

DIRECTIONS AND RECIPES FOR PAINTING.

No paint in which there is oil should be used. Holbrook's, Sherwood's, and "Eureka" liquid slatings are first-class paints. They come in pint, quart, and gallon cans, and are ready to use at any moment, and can be kept for years if tightly corked. One gallon will paint 250 square feet, and costs $10 to $12. Any school-furnishing house will fill orders.

The following is taken from Wickersham's "School Economy":

"To make one gallon of paint take 10 ounces pulverized pumice stone, 6 ounces pulverized rotten stone, ¾ pound of lamp-black, and mix with alcohol enough to make a thick paste. Grind the mixture thoroughly, and then dissolve 14 ounces of shellac in the remainder of the gallon of alcohol. Stir the whole together and the paint is ready for use."

The composition named below has been tried upon old boards and new with excellent success. Dissolve gum shellac in alcohol, and mix with it lamp-black and flour-of-emery. No more lamp-black and flour-of-emery should be used than is necessary to give the required black and abrading surface, and sufficient gum to hold the materials together, and confine the composition to the board. The thinner the mixture the better. The lamp-black should first be ground with a small quantity of alcohol to free it from lumps. Apply with a common painter's brush, and when dry smooth with pumice stone.

A still cheaper preparation, though hardly as durable, may be made and applied by any school-teacher before nine o'clock on a summer morning, and used in a half hour thereafter. For fifty square feet of board take 4 ounces of common glue, 3 ounces flour-of-emery, and just lamp-black enough to give an inky color to the preparation. Dissolve the glue in ¾ of a quart of warm water, put in the lamp-black and emery, and stir until there are no lumps, then apply to the board with a woolen rag smoothly rolled. Put on two or three coats, evenly, and you have a nice surface at a cost of about thirty cents for material. You may call this the "Poor District's Paint."

Caution. No pupil should be allowed to erase with his hand, or a wet eraser, from this or any other board.

PLASTER BLACK WALL.

Nearly or quite all black walls in this portion of the State, made within wooden buildings, have failed to stand. The mortar seems of poor quality, and the lath constantly springing beneath the pressure of the hand while marking, causes the plastering to crack and fall in a very short time. To prevent this the room should be sheeted inside the studding, furred and lathed on that, and the first coat of plastering pressed in against the sheeting with great care. A very firm wall is thus secured. The black belt should be four feet wide, and come within 2½ feet of the floor. It should surround the room. A chalk trough should extend its entire length, and it should be bounded at its upper edge by a simple molding.

Quoting again from Wickersham : "A cheap and serviceable black surface may be made by the following recipe : 4 pecks of white finish or white coating ; 4 pecks of fine sharp sand ; 4 pecks of ground plaster ; 4 pounds of lamp black ; 4 gallons of alcohol or good whisky. This quantity will make a mixture sufficient to cover twenty square yards. A little flour-of-emery will prevent the mixture from "setting" immediately, thus giving time to put it on the wall with the necessary care. If emery be not used, only a small quantity of the mixture can be put on at a time, and this is, perhaps, the better way.

The wall which is intended to be covered with the black surface should be plastered like the rest of the room, with the exception that the black mixture takes the place of the white coating, and is put on in the same manner. After the black surface is on the wall it must be carefully dampened and rubbed in order to fill up the pores, and make the surface hard and smooth. If the old surface be well moistened, a new surface, composed of the same mixture, may be applied. It must be remembered that the black surface requires much more working with the smoothing trowel than the white finish.

PAPER BLACK SURFACE.

When care has been taken to secure a good wall, strong Manilla paper, which is manufactured for the purpose, may be smoothly pasted on "hard finish," and then painted with liquid slating. It has proved durable in some instances, its durability depending, however, very largely on a smooth surface beneath.

Saturn.

Saturn, which is next to Jupiter in distance from the sun, is also next to it in size, having a volume nearly one thousand times that of the earth. Its day is not half so long as ours, but it is 29½ of our years in making one complete revolution in its orbit.

Saturn, which is belted like Jupiter, is surrounded not only by eight moons, but by a series of rings, the innermost one of which is transparent. Seven of the moons were known for sixty years before the eighth was discovered. The equator of Saturn, unlike that of Jupiter, is greatly inclined to the ecliptic ; transits, eclipses, and occulations of the satellites, the orbits of which for the most part lie in the plane of the planet's equator and rings, happen but rarely.

It is to the rings that most of the interest of this planet attaches. We may imagine how sorely puzzled the earlier observers, with their very imperfect telescopes, were, by these strange appendages. The planet at first was supposed to resemble a vase ; hence the name *Ansæ*, or handles, given to the rings in certain positions of the planet. It was next supposed to consist of three bodies, the largest in the middle. The true nature of the rings was discovered by Huyghens in 1655, who announced it in this curious form :

"aaaaaaa ccccc d eeeee g h iiiiiii llll
mm nnnnnnnnn oooo pp q rr
s ttttt uuuuu."

These letters, placed in their proper order, read : "*Annulo cingitur tenui plano, nusquam cohærente, ad eclipticam inclinato.*"—"It is surrounded by a thin, flat ring, nowhere attached to its surface, inclined to the ecliptic."

There is nothing more encouraging in the history of astronomy than the way in which eye and mind have bridged over the tremendous gap that separates us from this planet. By degrees the fact that the appearance was due to a ring was determined ; then a separation was noticed, dividing the ring into two ; the extreme thinness of the ring came out next, when Sir William Herschel observed the satellites "like pearls strung on a silver thread ;" then an American astronomer, Bond, discovered that the number of rings must be multiplied we know not how many fold. The transparent ring was next made out by Dawes and Bond, in 1852 ; then the transparent ring was discovered to be divided as the whole system had once been thought to be ; last of all comes evidence that the smaller divisions in the various rings are subject to change, and that the ring-system itself is probably increasing in breadth, and approaching the planet.

The ring-system is situated in the plane of the planet's equator, and its dimensions are as follows :

	Miles.
Outside diameter of outer ring	166,920
Inside " "	147,670
Distance from outer to inner ring	1,680
Outside diameter of inner ring	144,310
Inside " "	109,100
Inside " dark ring	91,780
Distance from dark ring to planet	9,760
Equatorial diameter of planet	72,250

So that the breadths of the three principal rings, and of the entire system, are as follows :

Outer bright ring	9,625
Inner bright ring	17,605
Dark ring	8,660
Entire system	37,570

In spite of this enormous breadth, the thickness of the rings is not supposed to exceed one hundred miles.

Of what, then, are these rings composed ? There is great reason for believing that they are neither solid nor liquid. The idea now generally accepted is that they are composed of myriads of little satellites, moving independently, each in its own orbit, round the planet ; giving rise to the appearance of a bright ring when they are closely packed together, and a very dim one when they are most scattered. In this way we may account for the varying brightness of the different parts, and for the haziness on both sides of the ring near the planet, which is supposed to be due to some of the satellites being drawn out of the ring by the attraction of the planet.

Although Saturn appears to resemble Jupiter in its atmospheric conditions, its year, unlike that planet's, and like our earth's owing to the great inclination of its axis, is sharply divided into seasons. Saturn's seasons, however, are marked by something else than a change of temperature ; we refer to the effects produced by the presence of its ring appendage. To understand these effects, its appearance from the body of the planet must first be considered. As the planet of the ring-system lies in the plane of the planet's equator, an observer at the equator will only see its edge, and the rings will therefore look like a band of light passing through the east and west points and the zenith. As the observer, however, increases his latitude either north or south, the surface of the ring-system will begin to be seen, and will gradually increase in width. As it widens, it will also recede from the zenith until in latitude 63 degrees it is lost below the horizon ; and between this latitude and the poles it is altogether invisible.

Now, the plane of the rings always remains parallel to itself, and twice in Saturn's year—that is, in two opposite points of the planet's orbit—it passes through the sun. It follows, therefore, that during one half of the revolution of the planet one surface of the rings is lit up, and during the remaining period the other surface. At night, in the one case, the ring-system will be seen as an illuminated arch, with the shadow of the planet passing over it, like the hour-hand over a dial ; and in the other, if it be not lit up by the light reflected from the planet, its position will be indicated only by the entire absence of stars.

But if the rings eclipse the stars at night, they can also eclipse the sun by day. In latitude 40 degrees we have morning and evening eclipses for more than a year, gradually extending until the sun is eclipsed during the whole day—that is, when its apparent path lies entirely in the region covered by the rings. These total eclipses continue for nearly seven years, and eclipses of one kind or another take place for 8 years 292 days. This will give us an idea how largely the apparent phenomena of the heavens, and the actual conditions as to climates and seasons, are influenced by the presence of the rings.

As the year of Saturn equals 29½ of our years, it follows that each surface of the rings is in turn deprived of the light of the sun for nearly 15 years.—*Lockyer's Astronomy.*

Water Cisterns---How to Make them.

In many parts of the country where good water cannot be had from wells, or where such springs are remote from the house and farm buildings, resort is had to cisterns, which receive and retain the rain water that is caught from the roofs of the dwelling and out-houses. It is soft and healthy to drink, especially when pure, or made so in the way presently described. There are, indeed, many places where such cisterns would be found advantageous even though the supply of water from springs and wells may be sufficient for the ordinary uses of the family and the stock in the farm. Sometimes, for instance, the supply is intermittent, varying greatly with the season, and occasionally cut off altogether by a protracted drought. At other times it may be so strongly impregnated with lime or other substances as to render it, especially to some constitutions, injurious to health. But wherever a cistern is needed the first consideration is as to how it ought to be made so as to combine permanency with cheapness. The *Maryland Farmer* gives the following practical directions on this important subject :

"Where the soil is loose and friable the sides of the cistern should be built up of stone or brick. If these are not to be had, a concrete may be made of gravel and cement, or very coarse sand and cement molded into blocks, like the *béton* now so frequently used in France for the construction of walls and bridges. In molding these blocks, a thin layer of the soft concrete is put into the mold and rammed carefully, another layer of a few inches thick is then put in the mold and rammed in the same manner, then another and another, until the mold is full. The concrete block is then turned out on a clear open space and left for several weeks to dry and harden. But where stone is to be had, no matter of what kind, this trouble is avoided. All such stone should, however, be carefully laid in cement, and when the work is done the whole of the inside of the cistern should also be plastered with cement, and, as it soon hardens, it can at once be put to use. But it often happens that underlying even very light sandy soils there is a stiff clay ; and when this turns out to be the case the building of an excellent cistern is very easily and cheaply accomplished. It is only necessary, under such circumstances, to slope the side walls like an inverted cone, cut off squarely at the bottom. The slope need not be more than one foot in three ; or, in other words, just sufficient to allow the cement to adhere to it while in the process of hardening. The cement is applied directly to the surface of the slope, and if stopped short of the point at which frost descends into the soil, will hold water admirably. Over this cistern there should be a cover resting on the clay, the surface soil of sand being removed for that distance on purpose to receive it, and care should be taken to guard against the surrounding sand being washed into the cistern during heavy rains.

"One part of cement to three parts of clear coarse sand are the proper proportions for making the cement mixture with which the walls of the cistern are to be plastered.

"But the best cistern of all is one to which a filter is attached. This is formed very simply. It is only necessary to divide the cistern by a partition across it into two unequal parts—the filter occupying, say, one fourth of the space. The partition may either be made of stone or concrete—composed of gravel and cement or broken brick and cement, and the bottom of the filter should be about a foot above the bottom of the cistern proper, and the sides of the filter next the cistern, and nearly at the bottom of the filter, should be pierced with holes filled with coarse sponge, through the water percolates into the cistern—or, in a rougher way, minute holes may be made in the lower side of the filter and the sponges dispensed with. Now lay at the bottom of the filter a foot or more of coarse clean sand, and over this again a layer of pounded charcoal two feet in thickness, and over this again a layer of small pebbles or very coarse sand to prevent the charcoal from being stirred up as the water, during rains, comes pouring in. Thus formed, the filtering apparatus is complete, but access must be had to the filter by means of a close-fitting trap, for the materials of which the filter is composed will require to be taken out occasionally and cleansed, as the suspended impurities are left behind on the charcoal and commingled with the upper stratum of sand or gravel ; but this cleansing process will not be required more than once or twice in a season. Every one who requires pure drinking water, bright, sparkling, and healthy, should, by all means, if a cistern is used, make provision also for a filter."

R. J. GATLING, inventor of the Gatling gun, has returned home. It is understood that the English Government will adopt his gun.

Autographic Printing Press.

The annexed engraving represents a new printing press, designed to take the place of the lithographic press, and, through certain improvements described below, claimed to be adapted to common as well as the finest work.

The lithographic press now in use has two strong side frames, which sustain all the working parts of the machine, namely: The box for the scraper, the long pressure-screw, a strong iron bed running on twelve iron rollers, a tympan, a long lever, and a very strong iron roller giving motion to the iron bed on which the lithographic stone rests. These attachments make the press very heavy, and its management requires experience and skill.

The press herewith illustrated consists of a wood or iron frame (according to its size), a weight of five pounds acting on a combination of two levers, two connecting rods, a printing cylinder, and a curved stone.

It will be seen that the old flat stone is replaced on this press by the curved stone, on which it is claimed the finest work is obtained with great facility by unskilled attendants, as well as by a practiced hand. It is also claimed that the difficulty arising from the liability of the stones to break on the old press, is entirely obviated in this press whatever may be the pressure to which the stone is submitted.

The reasons assigned for this are that the ordinary presses give an unyielding pressure. The scraper must pass, or the stone will be broken; while with the new press the pieces are not so rigid, all the parts are mobile and flexible, and the levers raise or fall, adapting themselves to all irregularities in the stone although the pressure remains constant on all points. Practical printers will at once understand the nature and value of the adantage thus secured.

The absence of a tympan results in a saving of seven motions required for an impression out of the eight motions required for the same on the old-style press, and it is claimed that a young boy can take off with it one hundred and fifty impressions per hour, without difficulty.

In the use of the old press the regulation of the pressure on the stone is a source of great perplexity and trouble, as a slight mistake in this regard may break a stone on which a costly work is prepared. This difficulty is not encountered with the press under consideration. All the attendant has to do is to push forward or backward the five-pound weight of the first lever to a point which will give the pressure required.

This press may be shipped in a condition to use immediately on its arrival at its destination, thus obviating expense and trouble in setting it up. It weighs only one fourth as much as the ordinary press designed to do the same work, and it can be run by either hand or by steam power—a thing impracticable with the old press.

In consequence of the peculiarities of construction described the stone can be about the length of the press, say for a No. 1 press about twenty-four inches by twelve inches.

It is claimed that the simplicity of this press and the fine work it is capable of performing adapt it particularly for office use by companies, architects, lawyers, schools, copyists, artists, clergymen, and business men generally, who often want a number of fac-similes of circulars, letters, price lists, music, drawings, plans, and documents.

The invention is covered by two patents obtained through the Scientific American Patent Agency, bearing date respectively February 28, 1868, and May 24, 1870, by C. Maurice, whom address for further information, at 160 William street, N. Y.

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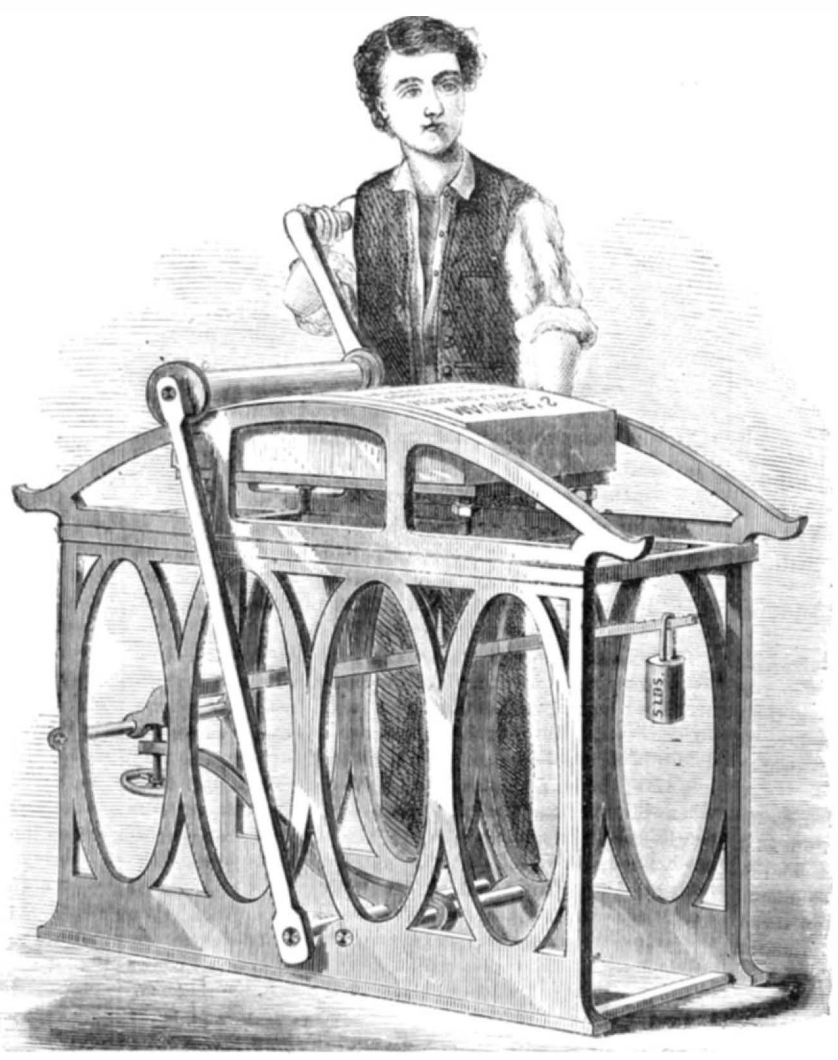
Barometric Prediction of Weather.

The barometer corresponds by no means with the tumultuous changes of the weather, but with those of its average quality. What, then, is the period of time for which the averages should be taken to obtain results corresponding most closely with those of the barometer? Numerous trials showed that period to be about twelve hours, and the correspondence of a curve drawn on that principle with the barogram was fairly satisfactory. The flexures of the two curves are, on the whole, simultaneous, since neither curve habitually anticipates the other, but they are seldom absolutely simultaneous. They correspond in the extreme positions as closely as in near ones, proving that it is not the absolute hight of the barometer but the variation in its successive hights which indicates change in weather. The superior influence of the wind upon the barometer over both temperature and damp was remarkably apparent. Lastly, the influence of temperature and damp were shown to conform to the already described period of twelve-hour averages. A simple formula of prediction was constructed on these data. It included (1) the difference between the first and second of two barometric readings, six hours apart; (2) that between the average velocity of the wind during two periods, which we may call *c* and *a*, of six hours each, *c* succeeding the last barometric reading, and *a* preceding the first reading, the intermediate period *b* necessarily disappearing from the formula; (3) half the difference between the average temperatures during *a* and *c*; (4) the same as regards vapor tensions. Then it was shown that (1) was equal to the sum of the remainder, when the barometer and vapor tensions are reckoned in hundredths of an inch, the velocity in miles per hour, and the temperature in degrees Fah. The reason why the barometer is influenced by the weather in a twelve-hour period of average, and why it may predict coming weather, was illustrated by supposing a similar instrument to be plunged into troubled water, in which case its movements would not sympathize with each ripple that passed above it, but with the mean level of a considerable area, and therefore it would feel the influence of an approaching wave as soon as it had reached the area in question whenever the wave was one of exceptionable magnitude. A calculation was made with the above formula to determine the average velocity of the wind for a large number of six-hour periods, and the predictions were compared with facts. It was found that the average error of the predictions was one-third larger than if the observer had simply guessed that the average wind velocity would continue unaltered for the next six hours. The reason why the errors are so large is, first, that correctness in the result depends upon the correctness of all the elements of the formula, but the values of these are only true on the average, while in each particular, and in each case, there will be more or less deviation from that average; secondly, any error in the expectation of the twelve hours' average is, on the whole, doubled in the six hours' prediction, because the difference between what is expected of the whole, and what was fulfilled in the first half of it is heaped on to the second half, which has therefore to bear an additional burden of error equal to what rightly belongs to it. The fame of the barometer is due to its success in predicting a type of storm very rarely met with in the British Isles, but frequently in hurricane latitudes, where the fall of the mercury far outstrips the increasing severity of the weather. In ordinary gales, and much more in ordinary weather, the author considered the barometer to be absolutely useless as a guide when it is consulted without a knowledge of what is occurring at adjacent stations —in short, without such information as is supplied by the daily weather report.

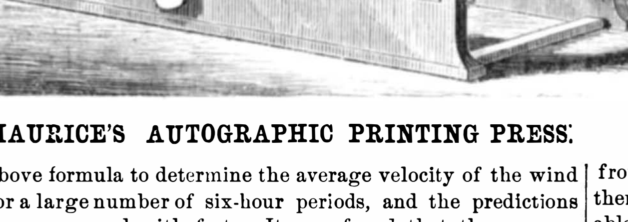


MAURICE'S AUTOGRAPHIC PRINTING PRESS.

◆

HUTCHINSON'S LOCKING GRATE BAR.

Our engraving illustrates an improved form of grate bars, which are kept in their relative positions to each other and prevented from warping by one or more sectional rods or bars passing through the grate bars crosswise of the furnace, thus locking all the grate bars together, and keeping the upper edges of the same all on a common level. This constantly maintained level surface facilitates the cleaning and slicing of fires, which can only be done imperfectly on an uneven grate.



The bars are made thin and rounded at the top to secure the greatest amount of air space possible. Thin bars, properly supported, do not suffer so much from heat as thick ones, as they are more rapidly cooled by the air currents.

By this arrangement it is possible to change the air spaces between the bars for burning different sizes of coal. This is done placing between the bars slotted pieces of metal, corresponding in shape to the lugs upon the sides of the grate bars. These pieces rest upon and partly embrace the cross bars, and adjust the grate bars to the proper width of space These bars can be put in any common furnace without alteration.

Patented, Sept. 27, 1870, by R. A. Hutchinson, Nos. 95 and 97 Liberty street, New York Whom founderymen and others desiring State, county, or shop rights may address for further information.

◆

Mahogany Cutting in Honduras.

Mr. E. G. Squier, in his "Honduras Descriptive, Historical, and Statistical," says:

"Of all occupations known to man, that of the mahogany cutter is perhaps the wildest in its nature, and yet among the most systematic in its arrangements. When the cutter has fixed upon the valley of some river as the field of his operations, he makes a depot for storing provisions, and for securing and embarking the wood. Here he maintains a little fleet of pitpans for carrying supplies and keeping up relations with the "works" proper, the sites of which are determined chiefly by the abundance of trees, their accessibility, and the means that exist for feeding the cattle which it is necessary to use in "trucking" the wood. To these points it is often necessary to drive the oxen through thick and untracked forests, and to carry the chains and trucks, by means of small boats, against strong currents, or over shallows and rapids, which are only surmounted with infinite labor. The site once definitely fixed upon, the next step is to erect temporary dwellings for the men—a task of no great difficulty, as the only requisite is protection from the sun and rains, which is effected by a roof thatched with long grass from the swamps, or with "cahoon" leaves, or the branches of the thatch-palm. A hammock swung between two posts, two stones to support his kettle, and the hut of the cutter is both finished and furnished!

"The mahogany season, which last some months, commences in August of each year, it being the opinion of cutters that the wood is not then so apt to split in falling, nor so likely to 'check' in seasoning, as when cut from April to August, in what is called 'the spring.' Furthermore, by commencing at this period, the cutter is enabled to get down his wood, and prepare it for trucking by the setting in of the dry season.

"The laborers are divided into gangs or companies of from twenty to fifty each, under the direction of a leader styled 'a captain,' who directs the men in his company, assigns them their daily tasks, and adds to or deducts from their wages in proportion as they accomplish more or less than what is supposed to be a just day's work. Each gang has also one person connected with it, who is called a hunter, whose duty it is to search the 'bush' for trees proper to be cut. His work, therefore, commences somewhat earlier than that of the others, and as it involves activity and intelligence, he is paid much higher wages than the mere cutters. His first movement is to cut his way through the thickest of the woods to some elevated situation, where he climbs the tallest trees he finds, from which he minutely surveys the surrounding country.

"Around Belize the mahogany-cutters are chiefly negroes, descendants of the slaves who were formerly employed there. But in Honduras they are principally Caribs, who, in activing and strength, are said to excel the negroes; they are also more intelligent, and require less care and superintendence. Many of them go annually to Belize, and hire themselves for the season, returning to their homes at its close."

◆

Tempering Carriage Springs.

A correspondent of the *Coach-Makers' International Journal* writes: In setting up old springs where they are inclined to settle, I first take the bed leaf and bring it into shape; then heat it about two feet in the center, plump to a cherry red; then cool it off in cold water, as quick as possible. This will give the steel such a degree of hardness, as to be liable to break, if let fall on the floor. To draw the temper, hold it over the blaze, carrying backwards and forwards through the fire, until it becomes so hot that it will sparkle when the hammer handle is drawn across the edge; then cool off, or not, just as you please.

Another mode, I use sometimes, is to harden the steel, as before stated, and draw the temper with oil or tallow: tallow is the best. Say, take a candle, carry the spring as before, through the fire, and occasionally draw the tallow the length hardened, until the tallow will burn off in a blaze, then cool.

I have no difficulty in making springs stand up. Every leaf is served alike.

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LINSEED OIL only should be used in drilling carriage work

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NEW YORK, SATURDAY, NOVEMBER 12, 1870.

Contents:

(Illustrated articles are marked with an asterisk.)

To Advertisers.

The circulation of the SCIENTIFIC AMERICAN is from 25,000 to 30,000 copies per week larger than any other journal of the same class in the world. Indeed, there are but few papers whose weekly circulation equals that of the SCIENTIFIC AMERICAN, which establishes the fact now generally well known, that this journal is one of the very best advertising mediums of the country.

◆

To Inventors.

For twenty-five years the proprietors of this journal have occupied the leading position of Solicitors of American and European Patents. Inventors who contemplate taking out patents should send for the new Pamphlet of Patent Law and Instructions, for 1870.

RATING STEAM ENGINES.

It scarcely needs any argument to convince an intelligent mind that all statements of fact are valuable only as they are definite. The present system of rating steam engines by horse-power is, however, as indefinite as can well be conceived. When a manufacturer rates an engine at eight horses' power or ten horses' power, he generally has in his mind some general average of pressure in the boiler, and some regular speed of piston, but as both these factors are variable, his rating may be below or above what the engine will do in practice. Care is generally taken to rate engines below their capacity.

The old term, nominal horse-power, is still adhered to, particularly in rating marine engines, and though this gives some idea of the dimensions of the parts of a steam engine, it gives no idea of its real power.

Of a surety this indefiniteness is a disgrace to so accurate a science as that of steam engineering, in which everything else is now reduced to the finest possible measurement; and there is not the slightest valid reason why it should exist a day longer. There need not, it seems to us, be any difficulty in agreeing upon some standard pressure and number of revolutions, or, what is the same thing, speed of piston per minute, at which the power should be computed. This would at once remove the uncertainty of which we complain, as the power for higher or lower speeds and pressures would then be easily determinable.

We suggest as a convenient standard of initial pressure in the cylinder sixty pounds, and one hundred as a standard number of revolutions per minute. Engines could be then rated as to the number of revolutions above standard they could be run, and this, with the pressure the boiler can safely carry, would enable the purchaser to at once calculate the maximum power available with an engine of a given rating.

There is also no necessity for adherence to the horse-power as a unit. The foot-pound is the adopted unit of work in all modern treatises on physics, and the expression of the power of engines in foot-pounds saves one division in the computation. We think it is time that "nominal horse-power" and "actual horse-power" should become obsolete terms. For all scientific and practical purposes the foot-pound is by far the most convenient.

These standards of measurement being once generally adopted, purchasers would have something tangible to guide them. There need be no mistakes made, as is now often the case, such as purchasing an engine of too great capacity for the steam producing power of the boiler designed to supply it, or the buying of engines of insufficient capacity to do the mork desired. On the contrary, accurate guarantees of power wight be demanded and given.

POWER OF PRIME MOTORS.

Perhaps in no department of mechanical practice are blunders more frequent than in the calculation of the power of prime movers necessary to perform the work of driving machinery. In our experience we have met with many such mistakes, and although these mistakes are not made by expert engineers, and though the proper method of procedure on the part of inexpert persons in erecting mills is to employ experts to make the proper calculations, an unwise parsimony, or an ill-founded self-confidence, often leads such people to rely on themselves and the rule of thumb, in selecting engines and water wheels, only to find in the end, that a larger expense is necessary to rectify their mistakes, than would have been necessary to avoid them.

To determine the power necessary to drive a given number and variety of machines, it is first necessary to ascertain the power requisite to drive each to its maximum speed. Happily here we have a large amount of recorded experience to guide us with reference to those machines which have been much used; but it often happens that machinery of an entirely new pattern is to be driven, and then books of reference fail us, and resort must be had to experiment.

The dynamometer is the instrument relied upon for such experiments, and as there are several in market which answer the purpose sufficiently well, we shall not refer to any one in particular, but confine ourselves solely to a brief discussion of the principles upon which they, as a class, act to determine the two things they may be instrumental in determining; namely, the power transmitted by rigid or flexible connectors to different machines or sets of machines driven from a common shaft, and also the power required to drive any machine or set of machinery.

Let it be remembered that the dynamometer only can measure power transmitted. Hence it cannot directly determine the power of a prime motor. It may do so, however, indirectly, when such a motor is running at a regular speed, and transmitting its maximum of power through the dynamometer to shafting or other machinery, or exhausting this power in overcoming the friction of a brake. The latter is an instance of transmission of power and the conversion of work into heat.

The dynamometer, of whatever style or construction, only indicates static pressure, and the power transmitted through the instrument is estimated by multiplying this pressure in pounds by the number of feet through which it is overcome per minute. The product will be in the denomination of foot-pounds per minute, which is reduced to horse power in dividing by 33,000.

Mistakes are often made by those not accustomed to the use of dynamometers in confounding mere pressure with power. It is only a short time since we had quite a long argument with an intelligent mechanic who asserted that a dynamometer whose pointer indicated a heavy pressure on a slowly moving shaft, was driving more than one on a rapidly revolving shaft, the indication of which was much less. It was only by the application of the above rule, and a *resumé* of the subject of mechanical power that we succeeded in convincing him that the rapidly revolving shaft was transmitting the greater power, notwithstanding the lesser indication of the dynamometer. There seems to be a difficulty in the minds of some in making and maintaining a clear distinction between pressure and power, and many make this error in thought who never make it in actual practice, their calculations being made from prescribed rules and formulæ, which they use without mental analysis, and the full force of which they therefore fail to apprehend.

Brakes are merely instruments for taking off power from motors that it may be measured. The measurement is accomplished by a lever and a weight, on the principle of the steelyard. The brakes gripping the shaft or pulley, as the case may be, are tightened till their resistance is sufficient to absorb the power so that the motor shall run at the required speed. The weighted lever is used to hold the brakes, the weight suspended therefrom being of sufficient magnitude to keep the brakes from turning with the shaft. The weight in pounds multiplied into the leverage gives the number of pressure to which the shaft is submitted. This multiplied into the distance in feet through which the pressure is overcome per minute, is the number of foot-pounds the motor will raise per minute, which, divided by 33,000, is its horse-power.

The measurement of power rests upon these few and simple principles. It nevertheless requires skill and experience to apply them in such a way as to secure accuracy, and it is consequently advisable for those who lack skill or experience to employ competent engineers for such work.

We have been led to these remarks from frequent queries which cannot well be answered in our column devoted to correspondence of this kind. We trust we have now met these inquiries by as full a response as is possible without going into details, which would be a mere compilation from standard authorities on this subject.

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THE PEOPLE WHO ATTEND FAIRS.

We know of no place where men—and women—do congregate in which one may study human nature to better advantage, or see more phases of many sided individuality than at mechanical fairs. To make such a study both profitable and amusing, however, one must have a broad sympathy for the feelings, and charity for the foibles of others, and a keen sense of the humorous, as well as power of philosophical analysis.

To enter one of these shows is to enter among a set of men who have, most of them, given birth to something which, in their opinion, is of great importance to mankind.

Some of them have good and sufficient grounds for this belief. Such a belief is the parent of an enthusiasm which shows itself, in the features of each exhibitor, in his gestures, in the adjustment of his dress, and in his speech. Enthusiasm born of conviction is a hard ghost to lay, and so, though cavilers may object to this, or throw cold water on that, the exhibitor, nothing daunted, rises superior to the occasion, and soars to the sublime hights of triumph at the first breath of praise.

See him as he stands waiting for the approach of some one who wishes to examine his device. Watch his eye kindle at the query, "How does it work?" With what expert haste he sets wheels and levers in motion and points out the action of each. Listen while he expatiates upon the advantages secured. See his lip curl in pitying contempt at the ignorance which seems to doubt that any detail may prove insufficient. Hear the outburst of eloquence with which weak objectors are utterly vanquished and driven ignominiously from the field. Surely if you please you may find something here which will reward your observation.

Then there is the man who objects to everything, whether good, bad, or indifferent, and who always looks on the bad side. He is the dread of the exhibitors. In the middle of their most successful harangues, when credulous minds are just on the verge of full belief, and old women have had their feelings wrought up to the "du tell" point, this objector elbows himself into the crowd, and with a word brings down the enthusiasm of orator and audience to zero. A hot discussion results. Out comes the exhibitor's pocket-book, and Mr. Objector is asked to name the extent to which he will back his statement, an invitation he rejects with much dignity. He is not a betting man. He objects to betting on principle, just as he objects to everything else, but he has spoiled the play, and the crowd disperses to other attractions.

Then there is the large family of meddlers always to be found in all places, but who always gather in force at fairs. They must smell every flower, touch all the fruit, turn at least once every winch belonging to churn or washing machine, pull every rope—in short, apply inquisitive—we are sorry to say sometimes acquisitive hands, to everything movable or immovable within the reach of their digits. The face of a marble statuette must feel their caressing and besmirching touch. Beauties in paintings are pointed out by the ends of their perspiring fingers. Nothing is sacred from their profane handling, and wherever they pass, irate looks and impatient words of annoyance follow them. Yet their faces are full of sweetness. They admire equally all things; and fancy they are doing their utmost to make all things as lovely and pleasant as possible.

Then, here and there, you shall note the aimless wanderer, always of the male gender, with melancholy eyes and pendant, overhanging eyebrows, thin, sallow, and dyspeptic, who, with hands in pockets, strides slowly up and down, looking at nothing, and almost unconscious of any external existence. What ever induced him to go to a fair? Give it up? So have we. It is a conundrum too deep for our solving.

And the sewing machine exhibitors. Ah! those men who send them here are shrewd old chaps, and know well enough that a sewing machine never looks so well as when a pretty and intelligent woman sits behind it, eloquent in looks, in nimble fingers, in tidy and tasteful dress, as well as in words. It is astonishing, indeed, how many young and even old men are interested in sewing machines. One finds out this singular fact at fairs, who else might forever remain ignorant of it. And the pretty exhibitors are certainly the instruments for the elucidation of this fact, for it is never apparent in the vicinity of a machine exhibited by a man. Being, therefore, instruments for the discovery of fact, they ought not to be excluded from notice in a review of a fair for a scientific journal. Far be it from us to exclude them. As an attractive feature of a well-conducted fair they are as important as brass bands or an opening speech from Mr. Greeley. We regard the men who employ them as public benefactors, deserving the gratitude and veneration of all who delight in fairs.

So we might go on, picking out and classifying character *ad libitum*, for whatever is lovely or hateful in human nature, conciliating or aggressive, high or low; whatever is opposite and extreme; whatever goes to make up the great current of humanity floating on towards the sea which will ultimately engulf all, you shall find it at one of these fairs if you seek it. Try it once, dear reader, after you have gone the rounds of the machinery and the various other displays, and find yourself with an hour to spare that you can fill in this way. Take our word for it, it will pay.

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THE WORLD'S WORK, AND ITS MORAL NECESSITY.

"In the sweat of thy brow shalt thou eat thy bread," was a curse pronounced upon mankind for the original sin, if we are to accept the common orthodox interpretation of the mystic history of Adam's fall. We have, however, a modern saying no less true, but the sentiment of which somewhat conflicts with the popular idea that the sentence of work was designed to be a curse, the import of which is, that the devil employs the idle. The evil of idleness is, however, a trite subject which we do not mean to discuss.

The present age is emphatically the working age. In no other period recorded in the history of man, was there ever any approach to the amount of work now in progress. Not only is mankind throughout the civilized world exerting all its powers of mind and muscle in work, but the stored up brute forces of nature are harnessed to the chariot of progress, to an extent never before known. That there is a moral necessity for just the state of things which exists, is easily demonstrable.

The moral necessity for work is perhaps most strongly indi cated by the fact, that notwithstanding man struggles by his inventions to shift the burden upon the brute forces, still the world's work grows and accumulates. Man constructs labor-saving machines, which, while they lessen the labor required to produce individual articles, always increase the aggregate demand for its class, in a far greater ratio than the labor on each article is diminished, and so the aggregate work of the world is swelled by each mechanical improvement. The efforts of mankind to emancipate the race from the necessity of labor, are, therefore, or at least have been as yet utterly futile. The most that has been accomplished, has been to remove some of the heavier and more disgusting features of labor, and redeem toil in some measure from its original severity.

That such efforts will continue futile in spite of the predictions of optimists who dream of a time to come, when at least the toil of man shall become altogether directory and supervisory in character, is in our opinion a fact based upon the very nature of man.

The desire to appropriate to personal use anything which renders life more luxurious or desirable, will always prevent men from contenting themselves with the minimum of labor necessary to merely afford comfortable subsistence. There is in mankind a hunger for other and higher enjoyments than are found in the simple satisfaction of the desires for simple food, drink, clothing, and shelter, and out of the desire to appease this hunger, has sprung all civilization. The production and the use of articles decorated by art, the refinements of cookery, the ornaments of person and residence by which taste is cultivated and gratified, are among the most conspicuous of the external marks of civilization.

The moral necessity for these things is the result of this natural craving. The rudest savage manifests in some rough way the existence of this taste, the cultivation of which starts him at once from barbarism on the road toward civilization.

The world's work now consists mainly in the supply of the necessities of taste. The proposition may at first seem startling, but its truth will become apparent upon a comparison of the personal effects and requirements of savages, with those of civilized people. We say necessities of taste. That is always a necessity, which, being attainable, cannot be dispensed with, except by the sacrifice of an enjoyment, more to be preferred than the saving of money or effort requisite to its attainment. For such an object there is as positive a force compelling man to attempt its procurement as hunger, thirst, or sexual desire. It presses men on into a hard struggle for the acquisition of wealth, that through wealth they may secure the gratification of their tastes. Not one man in a thousand seeks money for money's own sake. Misers are morbid outgrowths—exceptions which only establish the general rule.

And this mental and physical appetite, for all the appetites are mental as well as physical, is no more permanently satisfied by enjoyment than any other. It has often been asserted in derogation of the grosser appetites and passions, that it is impossible ever to attain their full and permanent satisfaction; but instead of this being any reason why the gratification of any natural and healthy appetite should be held in contempt, it is to be regarded as a beneficent provision for the perpetuation of enjoyment. Did we once cease to desire, we should cease to enjoy. All enjoyment is the temporary fulfillment of desire. Absolute content is neither desirable nor attainable.

In all this we see clearly indicated, the moral necessity of work. Could every luxury now enjoyed by the most wealthy and refined, be placed, without any exertion on the part of the recipient, within the reach of every man, woman, and child on the face of the globe, they would still yearn for more, and work to get it.

DEATH OF THREE DISTINGUISHED CHEMISTS.

DR. AUGUSTUS MATTHIESSEN.

One of the youngest and at the same time most ardent and successful of chemists has just cut short his career by taking poison. Augustus Matthiessen was born in London, January 2, 1831. He early went to Germany, and became a favorite pupil of Professor Bunsen, whom he greatly aided in the preparation of the rare metals of the alkalies and alkaline earths, by electrolysis. His first paper on this subject, in 1856, was one of the most important contributions to our knowledge of the rare metals that has ever appeared; and the research begun in Bunsen's laboratory was continued long after his return to England.

Dr. Matthiessen has greatly enriched our knowledge of the electric conductivity of the metals, and the laws he has deduced are now in constant use by practical electricians. He had so many wires running through his laboratory that they closely resembled an immense spider's web. He was a man of great sensitiveness, and of unquestionable purity of character, and his conscientiousness gave to his scientific statements peculiar value.

He was accused of false pretenses in reference to some of the rare metals, and intimations were expressed that they were not what they purported to be. This and other charges trumped up against him, seem to have unsettled his mind.

He was found dead in his room, having taken poison "while in a state of temporary insanity."

In a note referring to the false charges, he says: "Although I am innocent, it blights all my future prospects, and I have therefore resolved to resign all."

WILLIAM ALLEN MILLER.

We recently noticed the death of this distinguished man, and recur to the subject again for the purpose of adding some details of his life.

Since the time of Faraday there is no man whose loss will be so much mourned and regretted. He was born at Ipswich, in Suffolk, on the 17th of December, 1817, and died of apoplexy at Liverpool, on the 30th of September, 1870.

About a year ago he lost his wife, to whom he had been tenderly attached. This so affected his mind that he never fairly recovered from the blow. He left London on the 13th of September, to attend the meeting of the British Association, and was taken ill on the journey. His family, consisting of a son and daughter, were sent for, and every effort was made to restore him to health. The first attack was brain fever, which terminated in apoplexy, and suddenly cut short his life.

Professor Miller, like nearly all of the scientific men of England, had sprung from moderate circumstances. He was reared among the Society of Friends, and the impressions of his early youth were retained throughout his subsequent career, for we have rarely met with a man of greater urbanity, kindliness of manner, tender sympathies, greater cheerfulness of disposition, and unselfishness. He was ever ready to lend a helping hand to young students, and his loss will be keenly felt by this class.

The early contributions of Professor Miller were in the direction of the electrolysis of compounds. Subsequently he took up the study of spectrum analysis, and was one of the first to give us the composition of the light proceeding from the stars. His text-book on chemistry will be an enduring monument to his fame. There is nothing equal to it in the English language.

ALEXANDER POMPEJUS BOLLEY.

Professor Bolley died in Zurich, on the 3d of August, 1870, at the age of fifty-eight. He was a native of Heidelberg, and graduated at that University, and became the assistant to the celebrated Gmelin. In consequence of his sentiments in favor of a united Germany, he was obliged to quit his home and seek refuge in Switzerland, where he received an appointment at one of the Canton schools, and finally became the Director of the Polytechnic School, at Zurich.

In the department of technology Professor Bolley has had no superior. His text-books are the best we have on that subject. As a man and teacher he resembled Faraday and Miller. Full of life, of humor, of enthusiasm, of kindness, of organization, of originality, he was the great favorite of professors and pupils, and the influence he was able to exert was of the most beneficent character in the circle where he lived.

On the morning of August 3d, he lectured as usual to his class. Being somewhat fatigued, he rested for half an hour in his study, and then started for a little exercise. It was his last walk, for he was attacked with disease of the heart, and dropped dead in the street.

Thus have passed away three of the most distinguished of our chemists, whose places can with difficulty be filled.

TRANSPORTATION OF FRESH MEATS AND FRUITS, ETC., THROUGH LONG DISTANCES---THE DAVIS REFRIGERATOR CAR.

As our readers are aware, we have taken a deep interest in the solution of the great problem of how to transport all sorts of commodities, perishable when exposed to the action of air at ordinary temperatures, from places where such commodities are cheap and plentiful to where they are scarce and dear. The satisfactory solution of this problem would result in inestimable benefit to the human race, enabling those remote from a market to realize profits on what is now comparatively of little value, and cheapening the necessaries of life in densely populated centers of civilization.

The subject of refrigeration is therefore at the present time compelling the most earnest attention of practical and scientific men, and is second in importance to none other with which inventive genius is at present grappling.

Our attention has been called several times of late to paragraphs from Western papers relative to what is called the "Davis Refrigerator Car," which is claimed to be able to convey meats and fruits in a perfectly fresh unchanged condition over any distance, and for any reasonable or required length of time. These statements, however, were so vague and indefinite in details of construction that we preferred to await the time when it was announced that the car would itself be in New York with a freight of fruit brought from California, and to base what we might say upon personal examination.

Having learned on the 29th October that the car had arrived, we visited the Hudson River Railroad Depot and examined both the car and its contents, and found, so far as we could judge, that its load of grapes, peaches, and pears was in as good a condition as when shipped. The fruit certainly exhibited neither mold nor decay to any noticeable extent. The packages were perfectly dry; there was no odor of decay or any other indication that the fruit—which we were informed had been twenty-four days in the car—would not keep for as many days longer.

Several packages selected at random were opened in our presence, and appeared in uniformly good condition, and was found of good full flavor when tasted.

Our readers will be interested in the construction of this car, which, though strictly in accordance with scientific principles, is extremely simple.

The shell of the car consists exteriorly of the ordinary wood casing. A second wooden shell is made smaller than the first, and placed within it, so as to leave an air space or chamber entirely around the top, bottom, and sides of the car. Within this second shell is placed a layer of hair, about two inches in thickness, and this again is lined with an interior wooden shell. This construction makes a non-radiating and non-conducting compound shell or case, of great power to resist the action of external heat, and renders the expenditure of ice quite small to maintain the required depression of temperature, after the interior of the car and its contents have been cooled down to the proper point, say from 34° to 38° Fah.

The refrigeration is accomplished in the following manner: Along the sides of the car are placed sheet-metal tanks shaped like the frustra of very gradually tapering wedges. They extend from the top to the bottom of the car, and are about five inches thick at the top and two and one half inches at the bottom. These tanks communicate at the top with the exterior of the car through funnel or hopper shaped openings and at the bottom through drip-pipes which convey away the moisture. The funnel-shaped openings at the top are used for putting in the refrigerating mixture consisting of broken ice and salt, and are provided with air-tight covers. The car is entered through a hatchway at the top through which its freight is also introduced. This hatchway is also provided with a tight-fitting cover, made non-radiating and non-conducting like the sides of the car.

The store of ice and salt for the trip is contained in a separate department in one end of the car, so that its contents can be reached, and the refrigerating tanks supplied without opening the freight room.

The freight is placed in the car on strips of board, strips of board also preventing its coming in contact with the walls of the refrigerating tanks. The packages are also so placed as to leave interspaces through, between, and around each. During the process of refrigeration the air circulates around the packages and along the sides of the tanks like water in a steam boiler the colder air falling, and the warmer air rising to the top, becoming chilled in its passage along the sides of the tanks, and depositing its moisture on the tanks till their sides are covered with a thick stratum of congealed water or hoar frost. Thus the air is not only cooled but dried, no accession of moisture being derived from the external air or from the ice in the tanks, with either of which the interior of the car has no communication so long as the car is kept closed.

The two essentials for the preservation of substances liable to ferment, namely, absence of heat and of moisture, are thus secured in a very perfect manner, and the arrangement of the tanks is such that the space within the car for the storage of freight is not materially reduced. Some addition to the refrigerative mixture in the tanks is made each day, and the temperature is easily regulated and kept at the desired point by the addition of more or less salt in proportion to the charge of ice.

The proprietors express the utmost confidence that they can ship meat or fruit from any part of the continent to any other place, no matter how remote, and not only have it in good condition when taken from the car, but in a state which will guarantee its keeping after removal therefrom as long as it would have done previous to its shipment, under the same conditions. Certainly what we have seen goes far to warrant this confidence, and for the sake of humanity at large, we sincerely trust future experiments will prove as successful as the one we have described, and as others, which we have not seen, are represented to have been.

CHEMISTRY AT THE FAIR OF THE AMERICAN INSTITUTE.

In a large show case we saw some billiard balls, rings brooches, knife handles, and other objects resembling ivory, which, upon close inspection, proved to be made of gun-cotton. Here was the application of Schönbein's discovery that the original inventor could never have anticipated. The solubility of gun-cotton in a mixture of alcohol and ether has long been known, but that a tincture of camphor would produce the same effect has not been suspected until recently. It now appears that moist camphor and cotton pulp are mixed together, and put under an hydraulic press, when the mass so closely resembles ivory that it can be made into billiard balls, buttons, and, in fact, everything for which ivory is employed. The cotton can be colored without injury to its texture. It is a curious fact that the vapor of camphor decomposes gun-cotton with evolution of red fumes—in fact, the cotton is decomposed explosively. What the action of the camphor is on the gun-cotton has not been explained. It would appear as though the nitrogen of the pyroxyline was expelled by it in the form of binoxide, and this in turn took oxygen from the air and became nitrous acid. The matter is worthy of investigation, as perhaps offering important applications in the arts.

By the side of this show-case was a modest display of silvered glass, equal to the best productions in this line of industry that we have ever seen. From the card attached to these articles, it appears that they are manufactured by an improved process patented by H. Balen Walker, in 1869. The inventor claims that his method is an improvement on Liebig's, as it does not require to be backed by varnish or copper. There are many reasons why silver mirrors ought to be substituted for the mercury glasses so long in vogue. We will state a few of them. The silver reflects nearly 90 per cent of the light that falls upon it, and it also gives back a true image, whereas the ordinary quicksilver absorbs half of the light, and throws back a yellow and imperfect image. Silver is incomparably superior to mercury.

Another advantage possessed by silver is a sanitary one—it is perfectly safe and harmless to the workmen, while quicksilver is the occasion of much disease and suffering to those who are obliged to live in its fumes. In some parts of Germany, especially near Nuremberg, a large proportion of the population are engaged in making toy mirrors. They are furnished by dealers with the requisite tin foil and mercury, and actually manufacture millions of the small glasses required for toys. It was in consequence of witnessing the disease and suffering from poison among these people that Liebig was first induced to turn his attention to a silvering process.

In a visit which we paid to him in 1859, he exhibited some remarkably fine specimens, and gave us some that have retained their brilliancy to the present day. He informed us at the time that the toy dealers were prepared to adopt the new process. The unfortunate war in this country so affected the trade in toys as to lead to a suspension of the manufacture in many places, and thus the new method of silvering mirrors was never adopted. For use in optical instruments there is an extensive demand for silvered mirrors, and if the American process can overcome many of the difficulties hitherto encountered, it ought to prove to be valuable to the inventor.

The specimens of nickel plating are exceedingly interesting. It is only recently that attention has been called to this new industry, but the success that has attended its introduction is most gratifying. If, as is claimed by the company, nickel can be deposited so much cheaper than silver, we see no reason why it should not be generally adopted. As it does not oxidize or rust, or become tarnished by fumes of sulphur, and is hard and will wear for a long time, it would find favor even if the cost were the same as that of silver. The company claim that "the cost of nickel plating is from twenty to thirty per cent cheaper than silver, presents a more stable and uniform brilliancy, and lasts four times as long as silver plating of like thickness." We should suppose that nickelizing would be advantageously employed as a substitute for galvanizing for metals used on board ships; it can also be used to advantage on guns, harness, carriage trimmings, surgical and philosophical instruments, reflectors, knives, forks, machinery of all kinds, and all models that require to be protected from the oxidizing or corroding action of the air or water. As nickel is a magnetic metal it cannot be used about the ship's compass, but on the state-room doors and ornamental hinges and knobs it can have no bad effect.

We should have been pleased to see specimens of the new alloy of manganese and copper that has been made in considerable quantity in Connecticut, but did not discover any specimens at the Fair. This alloy closely resembles German silver, and could be substituted for it in many instances.

Sufficient attention has not been paid in this country to the uses to which papier mache can be applied. There are some articles on exhibition, but very few persons can understand what are their merits. For pails and vessels to hold acids, alkalies, chemicals of all sorts, for moldings, copies of casts, ceilings, statuary, artificial wood, and all kinds of utensils, there is a great use of papier maché. If the material were to be extracted with paraffine it could be made impervious to the action of most liquids, and its durability would be greater than that of wood. We are surprised that more use is not made of this composition.

Gelatin in the form of glue for household use has hitherto been put up in liquid form under the name of mucilage. We now have it ground or comminuted ready for immediate use. Glue in this form is easily acted upon by water, and retains its adhesive strength, as it is kept by until required, and consequently is not liable to decomposition. The specimens at the Fair were exhibited by Milligan & Higgins.

We were gratified to find at the Fair this year a fine display of leather. This is a result of chemical knowledge that is of the greatest importance. The chief progress in the tanning of leather has been in the application of sumac, in the use of chemicals to hasten the process, in the extraction of tannin under pressure, and incidentally in the invention of a grate for burning the wet tan bark. Messrs. Rutter & Simmons show a considerable variety of leather for carriage makers, furniture covering, and dress purposes, that is finely colored. If the coloring matter employed is permanent, these specimens must reflect great credit upon the firm that exhibits them. In the dyeing of leather there has been great improvement of late years, but the permanency of the colors has not been in proportion to the increase in the variety and beauty. It is a serious drawback to aniline colors that they are apt to fade, and we are aware that some of them are used in dyeing leather.

The extracts of beef at the Fair are of various kinds. We have the beef itself partially cooked in Texas, and afterwards hermetically sealed in cans. It is said to remain fresh for years. There is nothing new in this process. We obtained some cans of meat put up in this way at the Paris Exhibition of 1855, and on opening one of them fifteen years afterwards found that it had remained perfectly fresh and good. But notwithstanding this testimony there appears to be a prejudice against using such articles of food, and it is only on shipboard or long journeys that a demand is created for it.

The other form of condensed meat is the beef extract of Liebig. We have had frequent occasion to speak of the merits of this article. It is one of the most valuable inventions ever made by chemists. No family would be without a jar of this concentrated food if they understood and appreciated its merits. The specimens at the Fair are exhibited by E. Fougera in the same case with numerous nutritive preparations, about the value of which we are not prepared to speak with the same certainty as we are in the case of the Liebig extract.

Several forms of the earth closet are on exhibition, one of which is remarkably simple and costs from six to ten dollars. An earth-closet commode is an article indispensable to every household, and in the country there ought to be a law compelling everybody to use this system of disinfection. The amount of disease and suffering engendered by the traditional out-house and open privy in the country cannot be estimated. It is the very nursery of fevers, pestilence, cholera, and malaria. Modern science has shown that there is nothing so dangerous as decomposing fecal matter, and the same science has taught us that dry earth and loam are the best disinfectants that could be employed. We are sure that nothing but ignorance stands in the way of the universal adoption of the earth-closet system, and we have not failed to contribute our part towards the dissemination of correct knowledge on the subject. The display of chemicals made by L. and J. W. Feuchtwanger in a modest little case was overlooked by us the other day. The peroxide of manganese is evidently nearly pure, and the silicate of soda, in solid and liquid form, placed side by side with chloride of calcium and chloride of magnesium, suggests the admirable cements that it is possible to make from these articles. The magnesium cement has especial interest, and has been recently described in this journal.

DIAMOND MINING IN SOUTH AFRICA.

A California miner who emigrated to the Cape of Good Hope in August last, writes a letter to the *Alta California* from the diamond fields of South Africa, in which he relates the following experience: "We left Colesburg on the 1st of July, and arrived at the headquarters of the diamond fields on the 5th—200 miles. We found plenty of grass and bush for the animals, but water was scarce, and at several farms we had to pay one shilling for water for ourselves and stock; this water had been collected in a kind of hole formed by damming up a ravine or depression in the plain; the dams are filled during the rainy season, and last through the dry season. The road is excellent all the way from Colesburg to the diamond fields.

AT THE MINES.

"Arrived at the diamond fields, a Californian scene of early days presented itself. The river was lined with rockers, tents, and miners of all kinds, color, sex, and size, for a mile on both sides. At least 800 miners were at work, whole families, men, women, and children, having left their homes, either in the Transvaal Republic, Orange Tree State, or Cape Colony. The men were picking, shoveling, and washing the dirt, while the women and children were sitting around tables, and sorting the pebbles that have been washed, for diamonds. Before crossing the Vaal River, we applied to Mr. Kallenburg, the missionary, for permission to dig on the Pruel Farm, but he refused, as we were strangers to him. He only allows those whom he knows to mine on the estate, and he makes them give him one fourth of the proceeds of their finds. There were about 200 people on the estate when we arrived, and they had found, on an average, about twenty-five diamonds a day of from $\frac{1}{4}$ to 5 carats each; no large diamonds had been found on this estate up to the time of our arrival, but several have been found since—one of 10 carats, one of 17 carats, and one of 43 carats.

SELECTING CLAIMS.

"We crossed the river on the 5th of July, and camped for the night near the head-quarters tent. On the 6th we signed the Minors' Rules and picked out our claims—twenty feet square for each partner. We took a claim on the third capie, or hill, down the river; the first capie is where the Vaal and King Williamstown parties took out 172 diamonds from a triangular space of about fifty paces in circumference, and from six inches to twenty-four inches in depth. Other parties had taken at least 150 diamonds from near this triangle on the same capie. The second capie had proved rich since, and about 100 diamonds had been taken from it. The third capie had just been opened, and about twenty diamonds had been taken from it up to the time of our arrival. At the first capie the diamonds were from $\frac{1}{4}$ to 10, 30, and 40 carats; at the second from $\frac{1}{4}$ to 9, 17, 29, and 63 carats, and from the third from $\frac{1}{4}$ to 6, 10, and 18 carats. I saw 90 diamonds belonging to the King Williamstown party from $\frac{1}{4}$ to 3, 5, 9, and $30\frac{1}{2}$ carats, the lot valued at £6,000. The Natal party have a 40-carat diamond worth £9,500. They obtained 52 in all, but larger than the other parties, and the value of the lot is about £20,000. We found about 600 miners on this side; they had elected a commandant (Mr. Parker, who was formerly a trader) and a Committee of Safety, consisting of twelve miners. The ownership of the country was in dispute between the Transvaal Republic, Orange Tree State, and several native chiefs, but the miners do not recognize either of these parties, and they speak strongly of erecting a 'Diamond Republic' of their own.

HOW THE DIAMOND MINERS WORK.

"Most of the miners work in this manner: They first dig the gravel to the bed or to clay (generally from six inches to three feet in depth), then with a meal sifter they sift the dirt and throw out all large stones. The middling dirt, or pebbles, they cart to the Vaal River, about, on an average, 500 yards from the mine, and there wash it in a California gold cradle; they then lay the washed pebbles on a table, and carefully sort a handful at a time with a scraper; by this means they get through about two cart-loads of sifted 'cascalho' a day. Some carry the water up to the mine, and after the dry sifting of the dirt, they dip the sieve in the water and wash the pebbles.

THE CALIFORNIAN IMPROVEMENT.

"A few days after our arrival, I invented a shaking table for dry sifting, the top sieve of $\frac{1}{4}$-inch holes, and the bottom sieve of $\frac{3}{16}$-inch holes; the top sieve is inclined one way about twenty-five degrees, so that all the large stones will fall off by the shaking. The bottom sieve is longer than the top one, and inclined twenty-five degrees in the opposite direction; the dirt and gravel that pass through the top sieve fall on the second one, and the dirt passes through and the gravel to wash passes out at the end, and is carted to the river for washing. I could put through sixty cart-loads a day with this medium, and concentrate it to twenty cart-loads of gravel—but two men can only sort out four cartloads of gravel in ten hours after it has been washed, and we do not put more than twelve cartloads through in a day in consequence of this. We are now teaching some of our negroes to 'sort,' and we will put more ground through presently.

WHAT THE ROUGH DIAMOND LOOKS LIKE.

"We find that the blacker the negro is the more honest he is; whenever they get a little white blood in them they will steal; we try them by dropping a piece of cut alum into the machine, and it exactly resembles a rough diamond. We can tell who is honest and who is not by the return or non-return of it on the tables. On the first day of our washing we obtained a $1\frac{5}{8}$-carat diamond, slightly off-colored, but good shaped and nearly round, valued at £8. We worked this claim out and got nothing more. We tried our several other claims on that side of the river with no success, although diamonds were found all around us. We worked three on that side of the river without further success, and then having obtained permission from Mr. K., the missionary, to mine on the Pruel farm, we moved over here, and the first day's washing we found two beauties of $\frac{3}{4}$ and $\frac{1}{2}$ carats. I also discovered a secret in diamond mining on this side of the river, that I shall divulge only to the company that is being raised in New York to work a certain diamond farm by a wholesale system. I am quite satisfied with this side of the river and the claim that I have. All that I need now is a 'sorting machine,' that will 'sort' as fast as I can put the 'cascalho' through the washer."

The Lumber Pile on the Roof.

We watched with painful interest last summer, the erection of the Mansard roof on the Grand Central Hotel, recently erected on Broadway between Bleecker and Amity streets. It is an immense pile of combustible material, and should it ever take fire, it will burn like tinder. Apropos of this and other similar errors in building which are constantly committed, we find the following forcible remarks in *Major and Knapp's Illustrated Monthly*, which we commend to the attention of architects, real estate owners, and underwriters:

At the recent conflagration in Chicago, which destroyed the Farwell block of buildings, the chief of the fire department is said to have exclaimed, as the flames burst forth from the immense Mansard roof, "Great God! when will the people of Chicago stop putting such lumber piles on the top of their fine buildings!" The flames had possession of the most combustible as well as least accessible part of the building. From the foundation to the cornice, the walls were of incombustible material. Above the cornice the "lumber pile" of ornamental roof was furiously blazing.

Investigation into the construction of this building and the reasons for it, revealed the fact that the suggestion had been made to the architect to run the walls up to the top of the roof, instead of putting on the uppermost story of "Mansard." But he and the people for whom he was designing the edifice, agreed that it would not look so well in that way. Accordingly the combustible arrangement was decided on, erected, and eventually consumed.

There are hundreds of fine looking buildings in great cities which are in this respect nothing but tinder boxes. The foundations are deep, the walls are solid, of stone, brick, or iron, and in many cases with costly and elaborate decorations of carving, casting, or sculpture. But, surmounting all this elegant and substantial pile, is a timber roof after the Mansard pattern, stretching up into the air to the extent of one or two stories, sometimes capped with an observatorial tower or turret. Lightly framed, covered with weather-boarding, and veneered with pieces of slate beautifully arranged in squares, crescents, stars, or other devices, the external appearance of such a roof is graceful, and gives appearance of incombustibility. But it has proved the destruction of many a building which it has ornamented.

If people must have Mansard roofs, why should they not be of incombustible material? Instead of being framed on light timber, let the frame work be of iron. Instead of using weather-boarding, covered with shingles, slate, or tin, let large slabs of slate be attached to the iron frame work. This would give the requisite strength, solidity, and beauty. Such a roof would be somewhat more costly than one of the objectionable tinder box kind, but would be worth something. The tinder box sort is not only worthless, but is an element of danger to the building of which it is a part, and of the surrounding buildings.

Situated as the roofs of our high buildings are, out of reach of most of the streams of water which can be thrown in case of fire, it is of the first importance that they should be constructed of absolutely incombustible materials.

The same is true of cornices. A stone cornice is both heavy and expensive. A substantial stone building is often finished with a wooden cornice, nicely painted to match the stone it is intended to imitate. The counterfeit escapes detection when viewed from the street; but in case of fire the hollow thing is soon in flames, sometimes carrying destruction far beyond the building in which the fire has originated, and involving the combustion of a whole block of buildings, where the flames might otherwise have been stayed with the destruction of one.

Fire insurance companies cannot be too careful about taking risks on buildings which have these incendiary roofs and cornices. To avoid them altogether would exercise a wholesome influence on builders. Galvanized iron furnishes such a practical and inexpensive substitute for a wooden cornice, and slate makes such a good roof, that there is no apology for surmounting our high building, or indeed any building, with tinder boxes which, in case of fire, are sure to deal out death and destruction to all who are near them.

How to Make Good Butter in Winter.

We find in the *Prairie Farmer* the following directions for making good butter in winter, an operation which is seldom performed in the country.

The month of June, says that journal, all things considered, is regarded as the best month in the year for manufacturing butter. This is due to a combination of circumstances. Drought seldom commences that early in the season ; accordingly, both feed and water are abundant. The grasses, which are the natural food of cattle, are then in a state to furnish, not only the most food, but that of the best quality for producing rich milk. The insects which are so troublesome later in the season have not made their appearance in large numbers. The air is not tainted with bad odors, as it is later in the season. The temperature is very favorable to the rising of cream ; neither so warm as to cause the milk to sour quickly, nor so cold as to prevent the separation of the oil globules.

Another season very favorable to the production of good butter is the early fall. At this season we ordinarily have rains that bring up the grasses to something like the plenteousness they gave us in the spring. Many of the insects so plenty in mid-summer have disappeared, and the temperature throughout the day is more uniform. When winter arrives, however, the quantity of the butter is greatly lessened, and in quality much inferior. In truth the chemical composition of the butter is considerably changed. The ingredients are different, not in kind, but in quantity. Olein, which is the softer fat in butter, is much more plentiful in summer butter than in that made in winter. The color of winter butter is also different from that made in summer. The former is almost white, while the latter is golden.

The unfavorable condition and appearance of winter butter are partly owing tocauses that we cannot control and partly to causes that we can, in a measure, obviate. Dry food will produce less olein than fresh green food. We, however, can prevent a very great diminution of this fat, by cutting our grasses earlier and curing them so that they will retain all their natural juices and their aromatic qualities. We can prevent the lessening of the quantity of milk to the extent that usually happens by keeping our cows as well supplied with food and drink as they are in summer when they can feed at will, and can procure water whenever they wish. Giving cows food and drink only after long intervals of fasting have a most injurious effect on the secretion of milk.

The cause of butter being light colored in winter is, doubtless, due to two causes. The olein is of darker color than the other ingredients of the butter, and the more scanty it is, the paler will be the color. The chief cause, however, of winter butter being so light colored is due to the cream becoming bleached before the butter is churned. Cream has its richest color when it first rises to the surface, and if it is churned in that condition the butter will be yellow. If it remains, however, exposed to the light, particularly if the temperature changes, the rich yellow color disappears, until it will be found to be impossible to produce golden butter from white cream. Let any one try the experiment of taking some yellow cream with a little milk below, and let this remain for two days more in a glass vessel, and mark the changes that take place in the color. At first the line between the cream and milk is very distinctly marked; but after a little the cream has become bleached to such an extent that it cannot be distinguished from the milk in color. Winter butter is white, then, because the cream is ordinarily kept too long before it is churned. It is very hard to obviate this difficulty in small dairies, particularly when the cows are so poorly provided for that their milk becomes very scanty. It is, doubtless, better even if the supply of cream be small, to churn as often as we do in summer, using a churn proportionately smaller.

Winter butter has a poorer flavor than grass butter from a variety of causes. The food the cows eat is devoid of the agreeable taste common to the grasses while growing or in blossom. Besides this, the milk is too often kept in a room the atmosphere of which is foul from the odors arising from cooking. The milk, at such times, acts the parts of a disinfectant, and carries the stench of the kitchen into the cream pot, and from thence to the butter jar.

Good butter can be, and often is, made in winter ; but it is only done by having all the circumstances surrounding the cows—the milk-room and churning—as nearly as possible like those in summer. The cows must be fed on food rich in sugar, and never be stinted in amount. The milk must be set in a room, the air of which is pure, and the temperature of which does not greatly vary. And lastly, the cream should be churned when it is not above twenty-four hours old.

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THE TUPPER GRATE BAR—A CORRECTION.—The grate bar favorably noticed on page 265, current volume, was exhibited at the Fair of the American Institute, not by *Wm. W. Tupper*, as therein stated, but by *L. B. Tupper*, of 120 West street, New York. This bar has been used at the Cincinnati Industrial Exposition, which before its introduction could not get steam to properly drive the machinery on exhibition, but afterwards had more than was required. The exhibitor was, in virtue of this successful trial, awarded a silver medal.

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Pictures for the Drawing Room.—Prang's "Lake George," "West Point," "Joy of Autumn," "Prairie Flowers." Just issued. Sold in all Art Stores. "Three Tom Boys." "Bethoven," large and small.

Building Felt (no tar) for inside & out. C.J. Fay, Camden, N. J.

Blind Stile Mortising and Boring Machine, for Car or House Blinds, fixed or rolling slats. Martin Buck, Agent, Lebanon, N. H.

Best Boiler-tube cleaner—A. H. & M. Morse, Franklin, Mass.

"Your $50 Foot Lathes are worth $75." Good news for all. At your door. Catalogues Free. N. H. Baldwin, Laconia, N. H.

The Best Hand Shears and Punches for metal work, as well as the latest improved lathes, and other machinists tools, from entirely new patterns, are manufactured by L. W. Pond, Worcester, Mass. Office 98 Liberty st., New York.

One 60 Horse Locomotive Boiler, used 5 mos., $1,200. Machinery from two 500-tun propellers, and two Martin boilers very low. Wm. D. Andrews & Bro., 414 Water st., New York.

For solid wrought-iron beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Keuffel & Esser, 116 Fulton st., N.Y., the best place to get 1st-class Drawing Materials, Swiss Instruments, and Rubber Triangles and Curves.

Glynn's Anti-Incrustator for Steam Boiler—The only reliable preventive. No foaming, and does not attack metals of boiler. Liberal terms to Agents. C. D. Fredricks, 587 Broadway, New York.

Cold Rolled—Shafting, piston rods, pump rods, Collins pat. double compression couplings, manufactured by Jones & Laughlins, Pittsburgh, Pa.

For mining, wrecking, pumping, drainage, and irrigating machinery, see advertisement of Andrews' Patents in another column.

Incrustations prevented by Winans' Boiler Powder (11 Wall st. New York,) 15 years in use. Beware of frauds.

To ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's manufacturing news of the United States Terms $4·00 a year.

Facts for the Ladies.

After using my Wheeler & Wilson Sewing Machine for ten years, I feel that I cannot say enough in its praise. I have found it everything you represented it to be. I have never spent one cent for repairs, and now recommend it cheerfully as the best machine patented. S. A. SMITH.
Brooklyn, N. Y.

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Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal.

All reference to back numbers should be by volume and page.

J. S. K., of Ala.—The horse power of boilers, all other things being properly proportioned, depends upon the area of fire surface. The horse power of engines is determined by multiplying the mean effective pressure, per square inch, in the cylinder in pounds, by the area of the piston in square inches, multiplying the product by the speed of the piston per minute in feet, and dividing the last product by 33,000. You will now see that your question in its present form cannot be answered.

W. H. B., of Mass.—Everything else being equal, the power of a screw driver will not be increased by making the bit forked, and separating the two prongs to as wide a distance as the heads of the screws to be inserted will permit. No advantage of any kind will be gained by such a construction, while the positive disadvantages of lessened strength of bit, and smaller bearing on the head of the screws, will be sustained.

F. M. W., of Ala.—We have discussed the subject of kerosene lamp explosions over and over in these columus, and no regular reader of this journal for the last two years need have any justification for ignorance on this subject. We have also given time and time again tests for adulterated and dangerous oils, and do not think it necessary to repeat what we have said at present.

A. M. T., of Mass.—Your reasoning is correct, the pressure of the atmosphere upon the surface of the earth is not equal to its entire weight, but is equal to the weight of a column of air, having one square inch of base, and extending to the outside limit of the atmosphere, multiplied into the entire area of the earth's surface in square inches.

B. K., of Pa.—The fly-wheel gives no increase of mechanical power to any machine, on the contrary it subtracts power by the friction of its bearings. It is simply a reservoir storing up power where there is a surplus over that needed to perform the useful work, and imparting the power again when needed, thus giving adaptibility but not mechanical power to machines.

J. B., Jr., of Ohio.—Carrier pigeons are not trained to carry messages. Their instinct guides them unerringly to the place where they were reared. They are taken from their wonted abodes to the places from which they are desired to carry messages, and the message being tied to their bodies in such a way as not to obstruct their flight they are released. As soon as released they rise high in the air, fly around in a circle, and at last strike off in the direction of their former homes which they generally reach.

F. S. H., of Mass.—You can make cloth waterproof by varnishing it with linseed oil, or coating with solution of rubber in naphtha. You can keep steel and iron from rusting on exposure to salt air, by coating them with mercurial ointment.

N. P. A., of N. Y.—We do not think your invention would prove valuable. Sulphurous acid is used for many other bleaching operations besides bleaching woolens, and is of special value in bleaching straw goods.

F. T., of La.—You will find the information you seek in regard to screw-cutting lathe gear, in "Campin's Practical Treatise on Mechanical Engineering," published by Henry Carey Baird, 406 Walnut Street, Philadelphia, Pa., 1870.

J. G. T., of Texas, has a shot gun which scatters too much, for which he seeks a remedy. He also wants to know whether large shot scatter more than fine, and what is the most approved length for a shot gun.

J. E. D., of N. Y.—We think the improvement in stove-pipes, suggested by you, would be useful and patentable. It would be well, however, to test it by practical experiment before expending much money upon it.

F. S. P., of Ga.—"Bourne's Catechism of the Steam Engine," published by D. Appleton & Co., of New York, is a good work for a beginner.

J. H. M., of N. Y., wishes counsel from practical forgers, which will enable him to temper articles of thin sheet steel without their warping.

W. A. M., of Pa., wishes to know how eyelets, etc., for shoes, are colored black, in large quantity, and cheaply.

APPLICATIONS FOR THE EXTENSION OF PATENTS.

SEWING MACHINE.—William R. Landfear, Hartford, Conn., has petitioned for the extension of the above patent. Day of hearing Dec. 7, 1870.

ARRANGEMENT OF RAILROAD PLATFORM SCALES.—Samuel G. Lewis, Philadelphia, Pa., executor of Lea Pusey, deceased, has petitioned for an extension of the above patent. Day of hearing Dec. 7, 1870.

CULTIVATOR TEETH.—James P. Cramer, Schuylerville, has applied for an extension of the above patent. Day of hearing Dec. 21, 1870.

MILKING SHIELDS.—Orwell H. Needham, New York city, has petitioned for an extension of the above patent. Day of hearing Dec. 21, 1870.

OPERATING SLIDE VALVES OF STEAM ENGINES.—Robert H. Fletcher, Brooklyn, N. Y., has petitioned for the extension of the above patent. Day of hearing Dec. 21, 1870.

CRIBS FOR HORSES.—Henry Eddy, North Bridgewater, Mass., has petitioned for an extension of the above patent. Day of hearing Dec. 21, 1870.

MODE OF LATHING AND PLASTERING.—John G. Vaughan, Middleborough, Mass., has applied for an extension of the above patent. Day of hearng Dec. 28, 1870.

MACHINE FOR PARING AND SLICING APPLES.—D. H. Whittemore, Worcester, Mass., has petitioned for an extension of the above patent. Day of hearing Dec. 28, 1870.

SEWING MACHINES.—Albert F. Johnson, Parkville, N. Y., has applied for an extension of the above patent. Day of hearing Dec. 28, 1870.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

Corn Plow.—John A. Walter and Eli Bushman, White House, Pa.—The object of this invention is to improve the construction of corn plows so that they can the more conveniently be adjusted for the different operations required of them. To this end the shovel standards are provided with a joint which makes the lower end of the same to be turned back out of the way when it is desirable to use only one or two shovels.

Faucet.—Abel Putnam, Jr., Saratoga Springs, N. Y.—This invention relates to that class of faucets used in connection with vessels containing beer, soda water, and other liquids, and compressed air, carbonic acid gas, or other expansive gas, and it particularly relates to the class of such faucets in which a plug containing a passage for the fluid, a valve to close it, and an air vent, is inserted into the barrel or vessel, and is operated in connection with a detachable spigot. The invention consists in the means for readily effecting a communication between the air vent of the plug and that of the spigot when the latter is in use, and the combination therewith of the spring valve and other parts of the plug.

Smoke Stack.—Eugene Fontaine, Fort Wayne, Ind.—This invention consists in securing a cylinder with or without an outside flange to the pipe within the head of the stack, and arranging it in combination with an inverted flanged cone, in such a manner that the sparks from the fire-box are carried up through the said cylinder by the steam from the exhaust pipes of the engine and striking the cone are thrown down the outside of the cylinder upon the converging bottom of the head of the smoke stack so as to come beneath an opening between the cylinder and the inside pipe, where it is again carried up through the cylinder until it strikes the cone, and is thrown down in the same manner, this operation being repeated until the sparks are extinguished by the steam, and beaten to dust, after which the portion not consumed is finally ejected through the bonnet.

Shelving for Stores.—Richard Murdoch, Baltimore, Md.—This invention has for its object to enable salesmen to lay hold of the goods placed in the higher shelves of stores out of easy reach, without climbing to the same, in order that the surfaces of the walls may be utilized for shelving clear to the ceilings.

Carriage-Top Fixtures.—Nathan B. Richardson, Somerville, N. J.—This invention has for its object to improve the construction of carriage tops so as to make them more convenient in use and manufacture, and at the same time, more durable and less liable to injure the cover at the top.

Wagon Brakes.—Daniel J. Rundell, South Westerlo, N. Y.—This invention has for its object to furnish an improved brake, which shall be simple in construction and effective in operation, being so constructed as to apply the brake shoes to both the front and rear sides of the wheels at the same time and by the same operation.

Land Marker.—Arthur C. Smith, Joyner's Depot, N. C.—This invention has for its object to furnish an improved marker for attachment to plows to mark the land for the next row so that the rows may be at an equal distance apart throughout their whole length.

Self-acting Signaling Apparatus.—John Garner Johnson, Coombe Fields, England.—This invention relates to improvements in signaling apparatus for railways, tramways, etc., and consists in improved self-acting apparatus, wherein the signal is thrown up to indicate the passage of a train by a weight let fall by the action of the wheels of the train on a lever and tripping catch when passing the signal, and the said signal is re set by a clock mechanism.

Bridle Bit.—F. B. Kalkbrenner, Clinton, Mo.—This invention relates to improvements in bridle bits, and consists in making the part which goes through the mouth in two parts, and joining each part with a pair of lines or check pieces, to one of which it is connected at each end, the said pieces of lines being jointed together, and one pair for the check rein being so arranged that when the said check reins are pulled the devided bit will be separated in such a way as to force the animal's mouth open and prevent him from seizing the bit between the teeth.

Gates.—William C. Hooker, Abington, Ill.—This invention relates to improvements in gate-operating devices such as are intended for opening and closing the gates without dismounting from the horse or carriage, and is similar in some respects to the gate operating apparatus patented, June 2, 1868, No 78,452.

Water Meter.—G. B. Massey, New York city.—The object of this invention is to provide efficient means for measuring water so that the quantity discharged from a service or other pipe may be accurately ascertained and registered, and it consists in operating in a cylindrical chamber, by the pressure of the water, a radial arm or wing, and in opening and closing induction and discharge valve ports, by means of a falling weight, which is raised by the arm or wing, and also in the mode of actuating the register.

Gloves.—Wm. S. Tooker, Kingsboro', N. Y.—This invention relates to improvements in gloves, and it consists in making the back part for the hand, and wrist and arm of a gauntlet, in one piece of peculiar form, the front of the arm piece, part of the wrist, and the back of the thumb in another piece, and in the manner of combining them with the palm piece for the hand, and the piece for the inner side of the thumb.

Gloves.—Wm. S. Tooker, Kingsboro' N. Y.—This invention relates to improvements in the manufacture of gloves, such as are made of buckskins, or similar skins, or partly of the same and cloth, and it consists in the form and manner of combining the several parts for economizing the material and labor, and producing neatly fitting gloves.

Combined Collar and Cuff Box.—Jacob C. Bauer, New York city.—This invention has for its object to furnish an improved paper box, designed more especially for containing paper collars and cuffs, but equally applicable for containing collars and cuffs made of other materials, and which shall be so constructed as to contain the collars and cuffs in such a way that they may be conveniently removed when required for use.

Hot-Air Furnace.—William James and William James, Jr., Montreal, Canada.—This invention has for its object to improve the construction of hot-air furnaces, so as to obtain a greater amount of heat from the same amount of fuel than is possible with furnaces constructed in the ordinary manner.

Printers' Chase.—Thomas A. Clements, Little Rock, Ark.—This invention has for its object to so improve printers' chases that the same can be fully adjusted to the types, with the use of the regular square metal furniture, without the use of beveled furniture, quoins, shooting-sticks, or mallets, thereby saving time and labor.

Vise.—R. S. Hildreth, South Adams, Mass.—The object of this invention is to produce a powerful vise of simple construction, which can be used for securely holding articles of suitable shape in any desired position.

Loom.—Joseph F. Randall, Warren, Ohio.—This invention relates to a new and useful improvement in looms for weaving textile fabrics, but more especially designed for looms used in weaving bagging for baling cotton, and for similar purposes, and it consists in a cylinder for increasing the tension of the thread, as the latter is drawn into the loom, and for affording a continuous motion to the loom, in the process of weaving.

Carriage Wheel.—Thomas M. Jones and Charles W. Fillmore, Chicago, Ill.—This invention relates to a new and useful improvement in wheels for carriages and wagons, and all wheeled vehicles, whereby the wheels are made stronger and more durable than wheels of ordinary construction.

Bleaching Tobacco.—Hugh Mearns, South Fork, Ky.—This invention relates to a new and improved process for the treatment of tobacco, for bleaching it, and consists in, first, sprinkling the tobacco until moist; second, hanging it up in a tight room, and, third, subjecting it immediately while damp to the action of sulphurous acid gas generated in any approved way and admitted to the said room.

Oil Cake Envelopes or Hairs.—Cyrus Eskrett and Henry Searle, Kingston-upon-Hull, England.—The inventors construct the envelopes or hairs by fitting together strips or pieces of wood so as to form a corrugated plate or board of a form similar to the face of the hair now in general use for seed crushing and oil-cake making purposes. Each corrugation should be made out of a separate piece of wood placed transversely, and as many such pieces should be put together as may be required to make up the proper length for the size of cake required to be produced by the use of the hairs.

Printer's Chase.—T. A. Clements, Little Rock, Ark.—This invention consists in constructing the chases in sections, which are connected to each other by means of right and left screws, so that by turning said screws the size of the chases can be adjusted at will.

Leather Scouring Machine.—H. C. Havemeyer and D. P. Burdon, New York city.—This invention relates to a new manner of arranging a self-adjusting bed or table under the rotary scouring cylinder of a leather-dressing apparatus, and to a novel method of securing the scouring stones and brushes in alternate rows to the said cylinder.

Bark Mill.—Charles Korn, Wurtsboro, N. Y.—This invention relates to certain additions to the ordinary bark mills now in use, whereby the grinding of the bark to the requisite degree of fineness is facilitated.

Water Wheel.—W. V. Martin, Waverly, Ohio.—This invention relates to improvements in water wheels, and consists in an improved arrangement, with the buckets, of the wheel and the bottom of the scroll case, of a vertical ringer band and a horizontal flange for maintaining a tight joint and the case, and confining the water upon the buckets.

Apparatus for Drying and Pressing Lard Scraps.—A. K. Howe, New York city.—This invention relates to a new machine for treating the scraps of lard, with a view of extracting from the same all the oily or fatty substances which they may yet contain.

Hoe Scraper.—R. R. Spedden and H. T. Spedden, Astoria, Oregon.—This invention relates to a new and useful improvement in a scraper for hoes and other such implements or tools, whereby the blades of such implements (more especially the hoe) may be kept clean and in proper condition for use.

Sewing Machine Table.—E. L. Morgan, Riversville, West Va.—This invention has for its object to provide an attachment to sewing machine tables whereby the same may be properly steadied on uneven floors to prevent the rattle of machinery, the consequent inconvenience of operation, and wearing loose of parts.

Leather Scouring Machine.—H. C. Havemeyer and D. C. Burdon, New York city.—This invention relates to a new machine for dressing and scouring leather, and consists in the employment of a hinged scouring bed held by means of uprights against the rotating scouring tool, which is hung in a fixed frame.

Fire-arms.—Peter Schuler, Morris, Ind.—This invention relates to certain new improvements in breech-loading fire-arms and cartridge shells, and has for its object to simplify the construction of the breech-ends of barrels, and economize cartridge shells.

Umbrella.—Hugh Keenan, Worcester, Mass.—This invention has for its object to provide a drop-catch on umbrellas, so that the same, when wet, may be taken into church, theater, hall, or parlor, without danger of wetting the floors or carpets.

Machine for Grinding Saw Blades.—Charles J. Gardner, Philadelphia, Pa.—This invention relates to a new machine for grinding the blades of hand or circular saws, of all kinds and sizes, and for grinding the handsaws thin on the back to give them the requisite degree of elasticity.

Type Setting and Distributing Machine.—Wm. T. Morgans, Youngsville, N.Y.—The object of this invention is to construct a machine by means of which types or dies for printing can be set up in rows in the requisite succession, by means of pivoted keys, and on which provision is made for instantly and simultaneously redistributing all the characters to their proper places.

New Mode of Shipping and Unshipping Screw Ppopellers.—Geo. Leach, Leeds, England.—The object of this invention is to facilitate the shipping and unshipping of the auxiliary screw propellers used with sailing ships for the purpose of assisting them in calms, and on other accasions when their sailing gear is either useless or insufficient.

Gate.—John S. Covell, Salt River, Mich.—This invention has for its object to furnish an improved gate, which shall be so constructed that it may be conveniently raised without unlatching it, to allow it to swing over snow or other obstructions, or to allow small stock to pass beneath it, while preventing the passage of larger animals.

Sewing-machine Attachment.—W. A. Rayer and W. S. Lincoln, Boston Mass.—This invention has for its object to provide a machine on which goods can be sewed together in a continuous operation, as required in cotton mills, hosiery, and bag manufactories, printing mills, etc. The invention consists chiefly in providing a circular or annular, and, therefore endless rotating guide for and support of the fabric to be sewed. The pieces can be placed against each other on the said endless guide, without interrupting the sewing.

Compound for Treating Wool.—H. H. Capamagian, Pittsburgh, Pa.—The object of this invention is to provide a simple, cheap, and efficient substitute for the oil now used for preparing wool for picking, carding, spinning, and the other operations to which it is subjected in working into cloth, the oil being objectionable, on account of the difficulty of expelling it from the yarn previous to coloring, or, in case the color is applied to the wool previous to carding and spinning, the liability of removing or damaging the color in expelling the oil.

Reclining Chair.—Emil Bartels, New York city.—This invention relates to improvements in reclining chairs, and consists in a combination with the back, which is hinged to the back part of the seat, and strong posts rising from the front of the seat, of extension arms, pivoted to the posts and the back, and made in two parts, one of which is a notched bar, sliding in and out of the other part, which is provided with a spring catch to engage the notched bar and hold it in the required position, and, in combination with the above, springs are employed to raise the back or throw it forward.

Store Shelving.—Robert Pool, New Providence, Tenn.—This invention relates to improvements in shelving for stores, and the like, and consists in an arrangement of the same above the drawers and counters commonly employed at the lower part, so that the upper part of the shelves, above the counter may fold down against the lower part thereof, and be locked or otherwise fastened, to inclose the goods completely, those in the upper part being prevented from falling out by wire cloth, buttoned or otherwise fastened in front, or straps of any kind may be used, and the back part of the shelves being cased up.

Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

PROVISIONAL PROTECTION FOR SIX MONTHS.

2,491.—Electro-plating the Interior of Lead and other Metal Pipes.—H E. Towle, New York city. September 15, 1870.

2,521.—Vapor or Gas Burners.—J. C. Love, Philadelphia, Pa. Sept. 19, 1870.

2,533.—Machinery for Skiving and Cutting Leather.—C. Brown and W. Childs, Montreal, Canada. September 21, 1870.

2,535.—Machine for Heeling Boots and Shoes.—H. H. Bigelow, Worcer, Mass. September 21, 1870.

2,537.—Rolling Mills.—D. I. Jones, Newburg, Ohio. September 21, 1870.

2,557.—Steam Boiler and other Furnaces and Stoves.—J. T. Rich, Philadelphia, Pa. September 23, 1870.

2,571.—Water Gages for Steam Boilers.—L. L. Lee, Milwaukee, Wis. September 26, 1870.

2,590.—Refining Crude Cast Iron for Foundery and other Purposes.—James Henderson, New York city. September 29, 1870.

2,602.—Signals and Signaling.—James Gordon, San Francisco, Cal. September 30, 1870.

2,633.—Combined Lifting and Force Pumps.—I. H. Guston, Middletown, Ind. October 4, 1870.

Official List of Patents.

Issued by the United States Patent Office.

FOR THE WEEK ENDING Nov. 1, 1870.

Reported Officially for the Scientific American.

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108,749.—Friction Pulley.—Edwin F. Allen (assignor to himself, Charles Campbell, and Elmer A. Beaman), Providence, R. I.

108,750.—Reclining Chair.—Emil Bartels, New York city.

108,751.—Combined Hydrant and Fire Plug.—Frederick Bauschtliker, Washington, D. C., assignor to himself and F. Gentner, Philadelphia, Pa.

108,752.—Curtain Fixture.—Richard Beal, Commerce, Mich.

108,753.—Cheese Press.—G. B. Boomer, T. G. Morse, and Rufus E. Boschert, Phœnix, N. Y.

108,754.—Hot Air Furnace.—Royal F. Brown, Chicago, Ill.

108,755.—Muff, Collar, and Cuff Box.—John C. Budd, New York city.

108,756.—Compound for Treating Wool.—Hagop H. Capamagian, Pittsburgh, Pa.

108,757.—Water Wheel.—Joel T. Case, New Hartford, Conn.

108,758.—Thread-winding Machine.—Dwight M. Church, Holyoke, Mass.

108,759.—Printers' Chase.—T. A. Clements, Little Rock, Arkansas.

108,760.—Printers' Chase.—T. A. Clements, Little Rock, Arkansas.

108,761.—Curtain Fixture.—Wm. C. Clover (assignor to Henry E. Clover), Brooklyn, N. Y.

108,762.—Tinsmiths' Furnace.—Michael Conner, Plymouth, Mich.

108,763.—Sliding Door.—L. A. Cook, Concord, Mich.

108,764.—Gate.—John S. Covell, Salt River, Mich.

108,765.—Soap Dish and Brush Rack.—Archibald Crawford, Albany, N. Y.

108,766.—Line and Wire Tightener.—Theophilus Crosby, Manchester, Iowa.

108,767.—Lock for Sliding Door.—John Davidson, Albany, N.Y.

108,768.—Broiler.—Alexander Dick, Buffalo, N. Y.

108,769.—Machine for Breaking Stone.—Andrew Dietz, New York city.

108,770.—Lock.—C. D. Dickerman, Boston, Mass. Antedated Oct. 28, 1870.

108,771.—Plow Jointer.—Daniel Dillenback, Galesburg, Mich.

108,772.—Baling Press.—George Duncan, San Francisco, Cal., assignor to himself and William Blackmore.

108,773.—Fermenting Alcoholic Liquors from Grain. Joshua Ellingwood, Owensborough, Ky.

108,774.—Oil-Cake Envelope.—Cyrus Eskrett and Henry Searle, Hull, England.

108,775.—Machine for Grinding Saw Blades.—Charles J. Gardner, Philadelphia, Pa.

108,776.—Clothes-line Hook.—James Garvey and Matthew H. Kimball, San Francisco, Cal.

108,777.—Spring Seat for Railway Cars.—T. J. Gifford Salem, Mass.

108,778.—Sash Fastener.—William Gorman, New Britain, Conn., assignor to Russell and Erwin Manufacturing Co.

108,779.—Machine for Molding Earthenware.—Thomas G. Green, Church Gresley Pottery, England.

108,780.—Milk Wagon.—Benjamin B. Gudge, Chicago, Ill.

108,781.—Tesselated Floor.—Lavinas B. Hamilton, Boston, Mass.

108,782.—Leather-scouring Machine.—H. C. Havemeyer and D. P. Burdon, New York city.

108,783.—Leather-scouring Machine.—H. C. Havemeyer and D. P. Burdon, New York city.

108,784.—Vise.—R. S. Hildreth, South Adams, Mass.

108,785.—Printing Press.—R. M. Hoe and S. D. Tucker, New York city.

108,786.—Gate.—W. C. Hooker, Abington, Ill.

108,787.—Ruffler for Sewing Machine.—C. W. Howard, Philadelphia, Pa.

108,788.—Apparatus for Drying and Pressing Lard Scraps.—A. K. Howe (assignor to himself, H. E. Donor, and E. Purdy) New York city.

108,789.—Railway Car Axle Lubricator.—Charles Hyatt (assignor for two thirds of his right to J. N. Milehan and E. Schlenker), Buffalo, N. Y.

108,790.—Hot Air Furnace.—William James and William James, Jr., Montreal, Canada.

108,791.—Street and Station Indicator.—Geo. A. Jenks and John J. Fawcett (assignors to themselves and Joseph Hampson) Chicago, Ill.

108,792.—Time Signaling Apparatus for Railroad.—J. G. Johnson, Coombe Fields, England.

108,793.—Apparatus for Evaporating and Concentrating Bark Extracts, etc.—T. W. Johnson, Jr., and A. W. Goodell New York city.

108,794.—Carriage Wheel.—T. M. Jones and C. W. Fillmore, Chicago, Ill.

108,795.—Bridle Bit.—Frederick B. Kalkbrenner, Clinton, Mo.

108,796.—Grate Bar and Bearer.—William Kearney, Belleville, assignor to himself and A. D. Graham, Newark, N. Y.

108,797.—Sawing Machine.—George W. Kearns, Lilleyville, Pa.

108,798.—Drip Catch for Umbrella.—Hugh Keenan, Worcester, Mass.

108,799.—Divider and Calipers.—G. W. Lane (assignor to E. R. Newell), Plantsville, Conn.

108,800.—Shipping and Unshipping Screw Propeller.—George Leach, Leeds, England.

108,801.—Planing Machine.—Thomas Llewellyn, London, England.

108,802.—Fix for Puddling Furnace.—Charles S. Lynch, Boston, Mass.

108,803.—Machine for Jointing Stair Rails.—John B. Margeson, Lynn, Mass. Antedated Oct. 29, 1870.

108,804.—Liquid Meter.—Gideon B. Massey, New York city.

108,805.—Apparatus for Giving Form to Wood.—G. R. Mather, Wellingborough, England.

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108,950.—Earth Commode.—Enos Woodruff, Elizabeth, N. J.

REISSUES.

4,170.—Hasp for Trunk Lock.—Samuel Croft and John C. Schuellermann, Philadelphia, Pa., executors of Conrad Liebrich, deceased.—Patent No. 10,862, dated May 2, 1854; extended seven years.

4,171.—Machine for Rolling Cornices.—Asa Johnson, Cairo, N. Y., for himself and W. H. Johnson, assignee of Asa Johnson.—Patent No. 18,906, dated December 22, 1857.

4,172.—Corrugated Iron Bridge.—Richard Montgomery, New York city.—Patent No. 25,210, dated Aug. 23, 1859.

4,173.—Fabric for the Manufacture of Shoes, etc.—E. Waite, Franklin, Mass., assignor of one half-interest to S. M. Weld.—Patent No. 107,642, dated Sept. 20, 1870.

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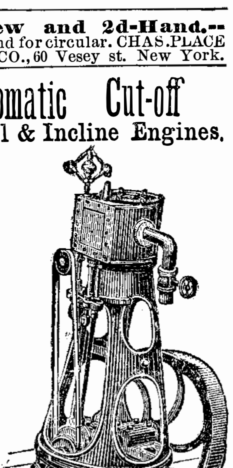

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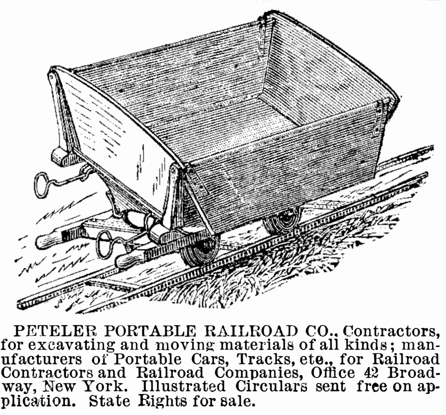

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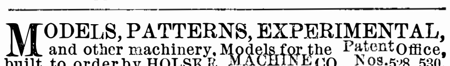

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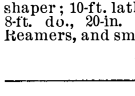

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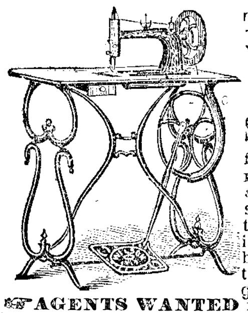

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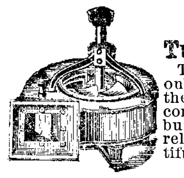

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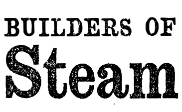

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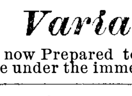

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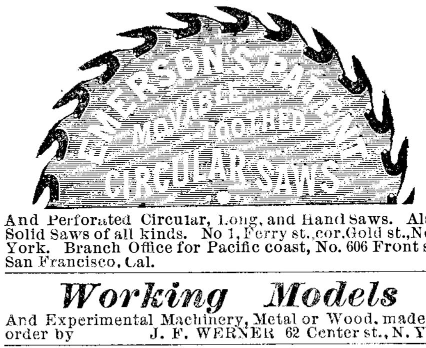

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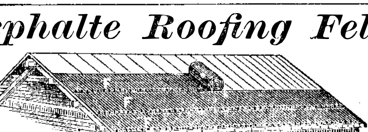

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