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Improvement in Road Steamers.

This remarkable traction engine has, during the past two years, attracted more notice among scientific men than any of the numerous road locomotives which have ever preceded it. The use of steam on common roads has long excited the great interest of all engineers as well as of those who would benefit by its practical introduction. Without discussing the special reasons of the failure of the Boydell system, with its cumbrous self-carrying tramway, or the Bray engine with its projecting and receding claws operating through the periphery of its driving wheels, it may be briefly stated that no road engine has ever satisfied the demand for driving heavy trains of wagons on common roads, until the advent of Mr. Thomson's ingenious invention, which is illustrated on this page.

Adhesion, without too great weight; traction, without destroying the roads; gearing, which would not break when jolting over rough pavements, and steerage which would enable the engine to be easily turned, were some of the absolute requirements of a practical road locomotive. The enormous weight of the traction engines, with rigid tires, now used in connection with steam plowing in England, proves its necessity for the purpose of gaining sufficient adhesion. Their provision for inserting teeth in the face of the wheels tells the story of their destruction of roads when drawing heavy loads. Their inability to use springs causes a wear and tear of gearing and working parts, which any mechanic will understand, and the time consumed in turning corners quite unfits them for high speed.

Many ingenious traction engines have been made in this country, but as they were not constructed for drawing heavy loads, there was no occasion for them to surmount the difficulties stated above.

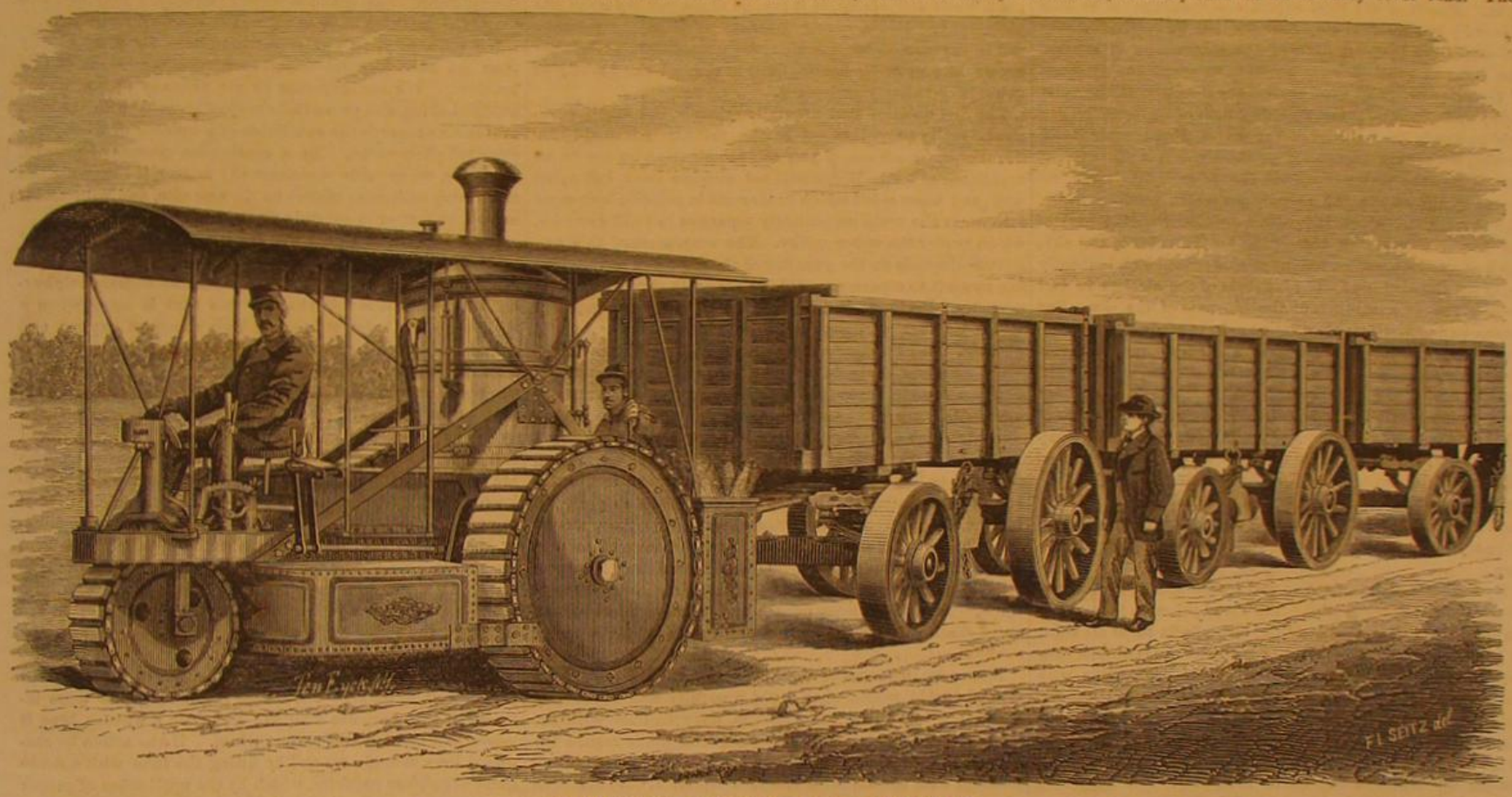
In the elastic tire invented by R. W. Thomson, C. E., of Edinburgh, all these fatal objections have been overcome and new powers developed. The idea of using vulcanized rubber for gaining adhesion, traction, and simplicity of gearing, was as novel as valuable. Even this useful and important discovery might have never been given to the world had not Mr. Thomson been a gentleman of large means as well as a thoroughly educated engineer. He was thus enabled to continue his experiments and perfect his invention before it was brought before the public, and it is probably for this reason that it at once attracted the notice of the most eminent engineers of the Old and the New World.

A brief description of the "Road Steamer" is all that is necessary in connection with the accompanying engraving. The driving wheels are about five feet in diameter with a broad iron tire having narrow flanges, upon which is placed a ring of soft vulcanized rubber twelve inches in width and five inches in thickness, which surrounds the iron tire, and is kept in place by the flanges. Over the rubber there is placed an endless chain of steel plates, three and a half inches wide, which series of plates is the portion of the wheel which comes in contact with the rough road. This reticulated chain is connected by what might be properly styled steel vertebræ, at each side of the wheel. The rubber tire and this ring of steel plates, have no rigid connection, but are at perfect liberty to move round independently of each other, or even without the concurrence of the inner ring of the wheel which they both inclose. This is a remarkable combination and contributes to the great success of the wheel as a whole. Holes are made in the inner iron rim of the wheel to admit air under the rubber tire. This enables the rubber to slowly creep round the wheel, so that in going a mile with a heavy load in tow, the rubber tire will be found to have crept once around the iron tire. To this ingenious device is due the indestructible nature of the tire. An enormously sudden and heavy strain upon the soft tire might tear it, but the slight slip saves it. Nearly the whole weight of the engine is upon the drivers, the third wheel in front being only for steering. The steering apparatus is therefore exceedingly simple, and the rapidity and ease with which it guides the steamer must be seen to be properly realized. It will instantly spin around with its inner driving wheel, describing a circle of less than six feet in diameter. The weight upon the rubber tires causes them to collapse and conform to all the irregularities of the road for a space of twenty inches each, and thus is insured adhesion and traction, which cannot be obtained in the slight line of contact with smooth rigid tires. To this fact is due the ability of the road steamer to draw enormous loads and to ascend steep hills.

Perhaps one of its most important features, as concerns its use in this country, is its ability to run over soft ground or muddy roads. The rigid-tired traction engines in England are able to slowly grind over their hard and magnificently macadamized roads, but upon our common dirt roads they would be utterly useless. In this respect the road steamer has been not inaptly compared to the elephant and camel, whose elastic cushioned feet enable them to cross the soft yielding sands of the desert. It is this same elastic cushion which prevents injury to the roads, and which, acting as springs or buffers between the rough road and the gearing saves the machinery from damage. The work done by the wheel in depressing the rubber in front, is again performed by the rubber at the rear in urging the wheel forward, so that the one exactly balances the other, hence there is no loss.

The boiler used is of the vertical tubular type made entirely of steel and constructed with special regard to simplicity and great strength. All the gearing and working parts are either of steel or malleable iron, and are entirely hidden from sight. An ingenious device in connection with the exhaust steam almost completely suppresses the noise caused by its escape. The coal bunkers hold a day's supply, and the water tanks hold a third of a day's supply. There is a single gear for quick speed, and a double gear for heavy loads. The engines are double cylinders with a reversing gear. Either of the driving wheels can be thrown in or out of gear, so that in turning sharp corners the inner wheel is out of gear, slipping freely while the outer wheel drives the machine around.

When attached to a loaded train of four wagons by a simple triangle coupling the whole can be turned in any road of ordinary width, each wagon following in the exact wake of the steamer. The loads drawn by the two sizes now made are from twelve to twenty tuns, up inclines of one in twelve, and twenty to thirty tuns on an ordinary level road. The speed varies from two and a half to six miles per hour for freight steamers, and ten miles per hour if constructed specially for passenger service. The consumption of coal averages about half a tun per day. About three times as much wood by weight is required to furnish the same steam power.



THOMSON'S PATENT ROAD STEAMER.

All the road steamers can be fitted with a fly wheel and governor, so as to run as stationary engines for driving any description of machinery.

The British Government appointed a commission of military men to examine these road steamers with the view of adopting them in the War Department. The examination was most severe and the report so favorable that a number have been ordered; among others one to carry stores up the Rock of Gibraltar, the inclines being one in six. Various other European governments have, after careful examination, ordered them for drawing heavy artillery and for other purposes. Over seventy road steamers are now in order at the works in Great Britain for India, Australia, and other countries.

With our vast country so much of which must be for many years without railroads they will be of great use for mines, transportation companies, feeders to railroads, for general carrying purposes, and for towing on canals. One steamer can draw six boats at double the speed of horses. And lastly, in plowing the grain fields of the Great West, as also the sugar and cotton plantations of the South, they will find a wide field of usefulness, and prove of great value. Harnessed to one of Williamson's gang plows they turn seven furrows of eight inches depth and twelve inches width with perfect ease, as we can testify, having personally witnessed the performance of one of them, not long since, in plowing obstinate soil.

Mr. D. D. Williamson, of 32 Broadway, New York, is the exclusive manufacturer under Mr. Thomson's American patents. No better assurance can be given that the American engines will be fully equal if not superior to the British, than the fact that the Grant Locomotive Works, of Paterson, whose locomotive at the great Paris Exhibition took the prize over all others, have contracted to build them for Mr. Williamson, and are now constructing a number for the American market.

SCIENTIFIC USE OF THE IMAGINATION.

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

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Not only are the waves of ether reflected by clouds, by solids, and by liquids, but when they pass from light air to dense, or from dense air to light, a portion of the wave-motion is always reflected. Now our atmosphere changes continually in density from top to bottom. It will help our conceptions if we regard it as made up of a series of thin concentric layers or shells of air, each shell being of the same density throughout, and a small and sudden change of density occurring in passing from shell to shell. Light would be reflected at the limiting surfaces of all these shells, and their action would be practically the same as that of the real atmosphere.

And now I would ask your imagination to picture this act of reflection. What must become of the reflected light? The atmospheric layers turn their convex surfaces towards the sun; they are so many convex mirrors of feeble power, and you will immediately perceive that the light regularly reflected from these surfaces cannot reach the earth at all, but is dispersed in space.

But though the sun's light is not reflected in this fashion from the aerial layers to the earth, there is indubitable evidence to show that the light of our firmament is reflected light. Proofs of the most cogent description could be here adduced; but we need only consider that we receive light at the same time from all parts of the hemisphere of heaven. The light of the firmament comes to us across the direction of the solar rays, and even against the direction of the solar rays; and this lateral and opposing rush of wave-motion can only be due to the rebound of the waves from the air itself, or from something suspended in the air. It is also evident that, unlike the action of clouds, the solar light is not reflected by the sky in the proportions which produce white. The sky is blue, which indicates a deficiency on the part of the larger waves. In accounting for the color of the sky, the first question suggested by analogy would undoubtedly be, is not the air blue? The blueness of the air has in fact been given as a solution of the blueness of the sky. But reason basing itself on observation asks in reply, How, if the air be blue, can the light of sunrise and sunset, which travels through vast distances of air, be yellow, orange, or even red? The passage of the white solar light through a blue medium could by no possibility redden the light. The hypothesis of a blue air is therefore untenable. In fact, the agent, whatever it is, which sends us the light of the sky, exercises in so doing a dichroitic action. The light reflected is blue, the light transmitted is orange or red. A marked distinction is thus exhibited between the matter of the sky and that of an ordinary cloud, which latter exercises no such dichroitic action.

By the force of imagination and reason combined we may penetrate this mystery also. The cloud takes no note of size on the part of the waves of ether, but reflects them all alike. It exercises no selective action. Now the cause of this may be that the cloud particles are so large in comparison with the size of the waves of ether as to reflect them all indifferently. A broad cliff reflects an Atlantic roller as easily as a ripple produced by a sea bird's wing; and in the presence of large reflecting surfaces the existing differences of magnitude among the waves of ether may disappear. But supposing the reflecting particles, instead of being very large, to be very small, in comparison with the size of the waves. In this case, instead of the whole wave being fronted and in great part thrown back, a small portion only is shivered off. The great mass of the wave passes over such a particle without reflection. Scatter then a handful of such minute foreign particles in our atmosphere, and set imagination to watch their action upon the solar waves. Waves of all sizes impinge upon the particles, and you see at every collision a portion of the impinging wave struck off by reflection. All the waves of the spectrum, from the extreme red to the extreme violet, are thus acted upon. But in what proportions will the waves be scattered? A clear picture will enable us to anticipate the experimental answer. Remembering that the red waves are to the blue much in the relation of billows to ripples, let us consider whether those extremely sma' particles are competent to scatter all the waves in the same proportion. If they be not—and a little reflection will make it clear to you that they are not—the production of color must be an incident of the scattering. Largeness is a thing of relation; and the smaller the wave the greater is the relative size of any particle on which the wave impinges, and the greater also the ratio of the reflected portion to the total wave.

A pebble placed in the way of the ring-ripples produced by our heavy rain-drops on a tranquil pond will throw back a large fraction of the ripple incident upon it, while the fractional part of a larger wave thrown back by the same pebble might be infinitesimal. Now we have already made it clear to our minds that to preserve the solar light white its constituent proportions must not be altered; but in the act of division performed by these very small particles we see that the proportions *are* altered; an undue fraction of the smaller waves is scattered by the particles, and, as a consequence, in the scattered light blue will be the predominant color. The other colors of the spectrum must, to some extent, be associated with the blue. They are not absent but deficient. We ought, in fact, to have them all, but in diminishing proportions, from the violet to the red.

We have here presented a case to the imagination, and, assuming the undulatory theory to be a reality, we have, I think, fairly reasoned our way to the conclusion that, were particles, small in comparison to the size of the ether waves, sown in our atmosphere, the light scattered by those particles would be exactly such as we observe in our azure skies. When this light is analyzed all the colors of the spectrum are found; but they are found in the proportions indicated by our conclusion.

Let us now turn our attention to the light which passes unscattered among the particles. How must it be finally affected? By its successive collisions with the particles the white light is more and more robbed of its shorter waves; it therefore loses more and more of its due proportion of blue. The result may be anticipated. The transmitted light, where short distances are involved, will appear yellowish. But as the sun sinks towards the horizon the atmospheric distances increase, and consequently the number of the scattering particles. They abstract in succession the violet, the indigo, the blue, and even disturb the proportions of green. The transmitted light under such circumstances must pass from yellow through orange to red. This also is exactly what we find in nature. Thus, while the reflected light gives us at noon the deep azure of the Alpine skies, the transmitted light gives us at sunset the warm crimson of the Alpine snows. The phenomena certainly occur *as if* our atmosphere were a medium rendered slightly turbid by the mechanical suspension of exceedingly small foreign particles.

Here, as before, we encounter our sceptical "as if." It is one of the parasites of science, ever at hand, and ready to plant itself and sprout, if it can, on the weak points of our philosophy. But a strong constitution defies the parasite, and in our case, as we question the phenomena, probability grows like growing health, until in the end the malady of doubt is completely extirpated.

The first question that naturally arises is, Can small particles be really proved to act in the manner indicated? No doubt of it. Each one of you can submit the question to an experimental test. Water will not dissolve resin, but spirit will, and when spirit which holds resin in solution is dropped into water the resin immediately separates in solid particles, which render the water milky. The coarseness of this precipitate depends on the quantity of the dissolved resin. You can cause it to separate in thick clots or in exceedingly fine particles. Professor Brücke has given us the proportions which produce particles particularly suited to our present purpose. One gramme of clean mastic is dissolved in eighty-seven grammes of absolute alcohol, and the transparent solution is allowed to drop into a beaker containing clear water kept briskly stirred. An exceedingly fine precipitate is thus formed, which declares its presence by its action upon light. Placing a dark surface behind the beaker, and permitting the light to fall into it from the top or front, the medium is seen to be distinctly blue. It is not perhaps so perfect a blue as I have seen on exceptional days, this year, among the Alps, but it is a very fair sky blue. A trace of soap in water gives a tint of blue. London, and I fear Liverpool milk, makes an approximation to the same color through

the operation of the same cause; and Helmholtz has irreverently disclosed the fact that a blue eye is simply a turbid medium.

Numerous instances of the kind might be cited. The action of turbid media upon light was fully and beautifully illustrated by Goethe, who, though unacquainted with the undulatory theory, was led by his experiments to regard the blue of the firmament as caused by an illuminated turbid medium with the darkness of space behind it. He describes glasses showing a bright yellow by transmitted, and a beautiful blue by reflected light. Professor Stokes, who was probably the first to discern the real nature of the action of small particles on the waves of ether, describes a glass of a similar kind. What artists call "chill" is no doubt an effect of this description. Through the action of minute particles, the browns of a picture often present the appearance of the bloom of a plum. By rubbing the varnish with a silk handkerchief optical continuity is established and the chill disappears.

Some years ago I witnessed Mr. Hirst experimenting at Zermatt on the turbid water of the Visp, which was charged with the finely divided matter ground down by the glaciers. When kept still for a day or so the grosser matter sank, but the finer matter remained suspended, and gave a distinctly blue tinge to the water. No doubt the blueness of certain Alpine lakes is in part due to this cause. Professor Roscoe has noticed several striking cases of a similar kind. In a very remarkable paper the late Principal Forbes showed that steam issuing from the safety valve of a locomotive, when favorably observed, exhibits at a certain stage of its condensation the colors of the sky. It is blue by reflected light, and orange or red by transmitted light. The effect, as pointed out by Goethe, is to some extent exhibited by peat smoke.

More than ten years ago I amused myself at Killarney by observing on a calm day the straight smoke columns rising from the chimneys of the cabins. It was easy to project the lower portion of a column against a dark pine, and its upper portion against a bright cloud. The smoke in the former case was blue, being seen mainly by reflected light; in the latter case it was reddish, being seen mainly by transmitted light. Such smoke was not in exactly the condition to give us the glow of the Alps, but it was a step in this direction. Brücke's fine precipitate above referred to looks yellowish by transmitted light, but by duly strengthening the precipitate you may render the white light of noon as ruby colored as the sun when seen through Liverpool smoke or upon Alpine horizons.

I do not, however, point to the gross smoke arising from coal as an illustration of the action of small particles, because such smoke soon absorbs and destroys the waves of blue instead of sending them to the eyes of the observer.

These multifarious facts, and numberless others which cannot now be referred to, are explained by reference to the single principle that where the scattering particles are small in comparison to the size of the waves we have in the reflected light a greater proportion of the smaller waves, and in the transmitted light a greater proportion of the larger waves, than existed in the original white light. The physiological consequence is that in the one light blue is predominant, and in the other light orange or red. And now let us push our inquiries forward. Our best microscopes can readily reveal objects not more than $\frac{1}{100000}$ of an inch in diameter. This is less than the length of a wave of red light. Indeed a first-rate microscope would enable us to discern objects not exceeding in diameter the length of the smallest waves of the visible spectrum. By the microscope, therefore, we can submit our particles to an experimental test. If they are as large as the light-waves they will infallibly be seen; and if they are not seen it is because they are smaller.

I placed in the hands of our president a bottle containing Brücke's particles in greater number and coarseness than those examined by Brücke himself. The liquid was a milky blue, and Mr. Huxley applied to it his highest microscopic power. He satisfied me at the time that had particles of even $\frac{1}{100000}$ of an inch in diameter existed in the liquid they could not have escaped detection. But no particles were seen. Under the microscope the turbid liquid was not to be distinguished from distilled water. Brücke, I may say, also found the particles to be of ultra microscopic magnitude.

But we have it in our power to imitate far more closely than we have hitherto done the natural conditions of this problem. We can generate in air, as many of you know, artificial skies, and prove their perfect identity with the natural one as regards the exhibition of a number of wholly unexpected phenomena. By a continuous process of growth, moreover, we are able to connect sky matter, if I may use the term, with molecular matter on the one side, and with molar matter, or matter in sensible masses, on the other.

In illustration of this, I will take an experiment described by M. Morren, of Marseilles, at the last meeting of the British Association. Sulphur and oxygen combine to form sulphurous acid gas. It is this choking gas that is smelt when a sulphur match is burnt in air. Two atoms of oxygen and one of sulphur constitute the molecule of sulphurous acid. Now it has been recently shown in a great number of instances that waves of ether issuing from a strong source, such as the sun or the electric light, are competent to shake asunder the atoms of gaseous molecules. A chemist would call this "decomposition" by light; but it behooves us, who are examining the power and function of the imagination, to keep constantly before us the physical images which we hold to underlie our terms. Therefore I say, sharply and definitely, that the components of the molecules of sulphurous acid are shaken asunder by the ether waves. Inclosing the substance in a suitable vessel, placing it in a dark room, and sending through it a powerful beam of light, we at first see nothing; the vessel containing the gas is as empty as a vacuum. Soon, however, along the track of the beam a beautiful sky-blue color is observed, which is due to the liberated particles of sulphur. For a time the blue grows more intense; it then becomes whitish; and from a whitish blue it passes to a more or less perfect white. If the action be continued long enough, we end by filling the tube with a dense cloud of sulphur particles, which by the application of proper means may be rendered visible.

Here, then, our ether waves untie the bond of chemical affinity, and liberate a body—sulphur—which at ordinary temperatures is a solid, and which therefore soon becomes an object of the senses. We have first of all the free atoms of sulphur, which are both invisible and incompetent to stir the retina sensibly with scattered light. But these atoms gradually coalesce and form particles, which grow larger by continual accretion until after a minute or two they appear as sky matter. In this condition they are invisible themselves, but competent to send an amount of wave motion to the retina sufficient to produce the firmamental blue. The particles continue, or may be caused to continue, in this condition for a considerable time, during which no microscope can cope with them. But they continually grow larger, and pass by insensible gradations into the state of *cloud*, when they can no longer elude the armed eye. Thus without solution of continuity we start with matter in the molecule, and end with matter in the mass, sky matter being the middle term of the series of transformations.

Instead of sulphurous acid we might choose from a dozen other substances, and produce the same effect with any of them. In the case of some—probably in the case of all—it is possible to preserve matter in the skyey condition for fifteen or twenty minutes under the continual operation of the light. During these fifteen or twenty minutes the particles are constantly growing larger, without ever exceeding the size requisite to the production of the celestial blue. Now when two vessels are placed before you, each containing sky matter, it is possible to state with great distinctness which vessel contains the largest particles.

The eye is very sensitive to differences of light, when, as here, the eye is in comparative darkness, and when the quantities of wave motion thrown against the retina are small. The larger particles declare themselves by the greater whiteness of their scattered light. Call now to mind the observation, or effort at observation, made by our president when he failed to distinguish the particles of resin in Brücke's medium, and when you have done so follow me. I permitted a beam of light to act upon a certain vapor. In two minutes the azure appeared, but at the end of fifteen minutes it had not ceased to be azure. After fifteen minutes, for example, its color and some other phenomena pronounced it to be a

blue of distinctly smaller particles than those sought for in vain by Mr. Huxley. These particles, as already stated, must have been less than $\frac{1}{100000}$ of an inch in diameter.

And now I want you to submit to your imagination the following question: Here are particles which have been growing continually for fifteen minutes, and at the end of that time are demonstrably smaller than those which defied the microscope of Mr. Huxley. What must have been the size of these particles at the beginning of their growth? What notion can you form of the magnitude of such particles? As the distances of stellar space give us simply a bewildering sense of vastness without leaving any distinct impression on the mind, so the magnitudes with which we have here to do impress us with a bewildering sense of smallness. We are dealing with infinitesimals compared with which the test objects of the microscope are literally immense.

From their perviousness to stellar light, and other considerations, Sir John Herschel drew some startling conclusions regarding the density and weight of comets. You know that these extraordinary and mysterious bodies sometimes throw out tails 100,000,000 of miles in length, and 50,000 miles in diameter. The diameter of our earth is 8,000 miles. Both it and the sky, and a good portion of space beyond the sky, would certainly be included in a sphere 10,000 miles across. Let us fill this sphere with cometary matter, and make it our unit of measure. An easy calculation informs us that to produce a comet's tail of the size just mentioned about 300,000 such measures would have to be emptied into space. Now suppose the whole of this stuff to be swept together, and suitably compressed, what do you suppose its volume would be? Sir John Herschel would probably tell you that the whole mass might be carted away at a single effort by one of your dray-horses. In fact, I do not know that he would require more than a small fraction of a horse-power to remove the cometary dust. After this you will hardly regard as monstrous a notion I have sometimes entertained concerning the quantity of matter in our sky. Suppose a shell, then, to surround the earth at a hight above the surface which would place it beyond the grosser matter that hangs in the lower regions of the air—say at the hight of the Matterhorn or Mont Blanc. Outside this shell we have the deep blue firmament. Let the atmospheric space beyond the shell be swept clean, and let the sky matter be properly gathered up. What is its probable amount? I have sometimes thought that a lady's portmanteau would contain it all. I have thought that even a gentleman's portmanteau—possibly his snuff-box—might take it in. And whether the actual sky be capable of this amount of condensation or not, I entertain no doubt that a sky quite as vast as ours, and as good in appearance, could be formed from a quantity of matter which might be held in the hollow of the hand.

Small in mass, the vastness in point of number of the particles of our sky may be inferred from the continuity of its light. It is not in broken patches nor at scattered points that the heavenly azure is revealed. To the observer on the summit of Mont Blanc the blue is as uniform and coherent as if it formed the surface of the most close-grained solid. A marble dome would not exhibit a stricter continuity. And Mr. Glaisher will inform you that if our hypothetical shell were lifted to twice the hight of Mont Blanc above the earth's surface, we should still have the azure overhead. Everywhere through the atmosphere those sky particles are strewn. They fill the Alpine valleys, spreading like a delicate gauze in front of the slopes of pine. They sometimes so swathe the peaks with light as to abolish their definition. This year I have seen the Weisshorn thus dissolved in opalescent air.

By proper instruments the glare thrown from the sky particles against the retina may be quenched, and then the mountain which it obliterated starts into sudden definition. Its extinction in front of a dark mountain resembles exactly the withdrawal of a veil. It is the light then taking possession of the eye, and not the particles acting as opaque bodies, that interfere with the definition.

By day this light quenches the stars; even by moonlight it is able to exclude from vision all stars between the fifth and the eleventh magnitude. It may be likened to a noise, and the stellar radiance to a whisper drowned by the noise. What is the nature of the particles which shed this light? On points of controversy I will not here enter, but I may say that De la Rive ascribes the haze of the Alps in fine weather to floating organic germs. Now the possible existence of germs in such profusion has been held up as an absurdity. It has been affirmed that they would darken the air, and on the assumed impossibility of their existence in the requisite numbers, without invasion of the solar light, a powerful argument has been based by believers in spontaneous generation.

Similar arguments have been used by the opponents of the germ theory of epidemic disease, and both parties have triumphantly challenged an appeal to the microscope and the chemist's balance to decide the question. Without committing myself in the least to De la Rive's notion, without offering any objection here to the doctrine of spontaneous generation, without expressing any adherence to the germ theory of disease, I would simply draw attention to the fact that in the atmosphere we have particles which defy both the microscope and the balance, which do not darken the air, and which exist, nevertheless, in multitudes sufficient to reduce to insignificance the Israelitish hyperbole regarding the sands upon the seashore.

The varying judgments of men on these and other questions may perhaps be, to some extent, accounted for by that doctrine of relativity which plays so important a part in philosophy. This doctrine affirms that the impressions made upon us by any circumstance, or combination of circumstances, depends upon our previous state. Two travelers upon the same peak, the one having ascended to it from the plain, the other having descended to it from a higher elevation, will be differently affected by the scene around them. To the one nature is expanding, to the other it is contracting, and feelings are sure to differ which have two such different antecedent states.

In our scientific judgments the law of relativity may also play an important part. To two men, one educated in the school of the senses, who has mainly occupied himself with observation, and the other educated in the school of imagination as well, and exercised in the conception of atoms and molecules to which we have so frequently referred, a bit of matter, say $\frac{1}{50000}$ of an inch in diameter, will present itself differently. The one descends to it from his molar hights, the other climbs to it from his molecular lowlands. To the one it appears small, to the other large. So also as regards the appreciation of the most minute forms of life revealed by the microscope. To one of these men they naturally appear conterminous with the ultimate particles of matter, and he readily figures the molecules from which they directly spring; with him there is but a step from the atom to the organism. The other discerns numberless organic gradations between both. Compared with his atoms, the smallest vibrios and bacteria of the microscopic field are as behemoth and leviathan.

The law of relativity may to some extent explain the different attitudes of these two men with regard to the question of spontaneous generation. An amount of evidence which satisfies the one entirely fails to satisfy the other; and while to the one the last bold defense and startling expansion of the doctrine will appear perfectly conclusive, to the other it will present itself as imposing a profitless labor of demolition on subsequent investigators. The proper and possible attitude of these two men is that each of them should work as if it were his aim and object to establish the view entertained by the other.

(To be continued.)

PROFESSOR TYNDALL'S LECTURE ON ELECTRICAL PHENOMENA.

MAGNETO-ELECTRIC MACHINES.—SAXTON'S MACHINE.—SIEMENS' ARMATURE.

Faraday's discovery of magneto-electricity was announced in 1831. In 1833 a machine was constructed by Saxton for the more copious development of magneto-electric currents.

In it copper-wire coils, within which were placed cores of iron, were caused to rotate before the poles of a powerful magnet.

On the approach of a coil to one of the poles of the magnet, a powerful current, whose direction depended on the nature of the pole, was induced in the coil. When the coil retreated from the magnetic pole, a current in the opposite direction was induced.

By means of an instrument called a *commutator*, which reversed one of the induced currents at the proper moment, the opposite currents were caused to flow in the same direction.

The cores of soft iron and their associated coils constitute what is called an *armature*. In Saxton's armature the coils were wound *transversely* to the iron cores.

But, by winding his coils *longitudinally*, or parallel to the axis of the core, and placing the armature so formed between the poles of a series of horse-shoe magnets, Siemens obtained magneto-electic currents much more powerful than those of Saxton.

WILDE'S MACHINE.

Things were in this state when, in 1866, Wilde made an important addition to our knowledge of magneto-electricity.

He conducted the current obtained by means of Siemens' armature round an electro-magnet, and found that the magnetism thus excited was far greater than that of the entire series of steel magnets employed to generate the magneto-electric current.

Thus, in one case, he found that, whereas the series of permanent magnets taken collectively was competent to support a weight of 40 pounds only, the electro-magnet which they excited sustained a weight of 1,088 pounds.

To produce this effect, however, it was necessary that the armature of the magneto-electric machine should rotate with great rapidity.

But Wilde went farther. Forming his electro-magnet from a large plate of iron, and placing between its long poles a correspondingly long armature, similar in shape and construction to that of the magneto-electric machine, he obtained from this second armature currents of enormously greater power than those obtainable from the first.

These currents could in their turn, be sent round a second electro-magnet, formed from a larger plate of iron. Furnished with a rotating armature, this second electro-magnet produced effects previously unknown. Rods of iron a quarter of an inch in thickness were fused by the currents, and they were also found competent, when discharged between carbon terminals, to produce a light of intolerable brilliancy.

SIEMENS' AND WHEATSTONE'S MACHINE.

The next great step in magneto-electricity was made simultaneously by Dr. Werner Siemens and Sir Charles Wheatstone.

Expressed generally, this discovery consists in exalting, by means of its own action, to a high pitch of intensity an infinitesimal amount of magnetism.

Conceive an electro-magnetic core with a very small amount of residual magnetism, which is never wholly absent when iron has been once magnetized. Let a secondary coil, with cores of soft iron, rotate before the poles of such a magnet. Exceedingly feeble induced currents will circulate in the secondary coil. Let these induced currents, instead of being carried away, be sent round the electro-magnet which produced them; its magnetism will be thereby exalted. It is then in a condition to produce still stronger currents. These also being sent round the magnet, raise its magnetism still higher, a more copious production of induced currents being the consequence. Thus, by a series of interactions between the electro-magnet and the secondary helix, each in turn exalting the other, the electro-magnet is raised from a state of almost perfect neutrality to one of intense magnetization.

When the magnet has been raised to this condition, other coils than those employed to magnetize it may be caused to rotate before, or between, its poles; the currents from these coils may be carried away and made use of for magnetization, for chemical decomposition, or for the electric light.

The first magneto-electric machine used to produce a light sufficiently intense for lighthouses was constructed by Mr. Holmes. In it permanent steel magnets and rotating helices were employed. Mr. Holmes has lately constructed a very powerful machine on the principle of Siemens and Wheatstone.

INDUCED CURRENTS OF THE LEYDEN BATTERY.

If a Leyden jar, or battery, be discharged through a primary spiral, it evokes a current in a secondary spiral. With a strong charge this secondary current may be caused to deflagrate a foot of thin platinum wire.

If the current from the secondary spiral be led round a third spiral which faces a fourth, on discharging the battery through the primary spiral, the secondary in the third spiral acts the part of a primary, and evokes in the fourth spiral a *tertiary current*.

With another pair of spirals this tertiary current can be made to generate a current of the *fourth order*; this, again, with another pair of spirals, a current of the *fifth order*. All these currents can impart shocks, ignite gunpowder, or deflagrate wires.

For the investigation of the induced currents of the Leyden battery we are indebted to Professor Joseph Henry, Director of the Smithsonian Institution, and to Professor Riess, of Berlin.—*Chemical News.*

To Telegraph Learners.

A great many persons are now learning to telegraph. There will be many more in the years yet to come. A large number of men and women, in addition to the fifty per annum who die, will be ever leaving the business; the former, to engage in new pursuits; the latter, to marriage and the care of households; thus leaving spaces to be filled by fresh recruits. It is interesting, therefore, to many, to know how to learn easiest and most rapidly. Many excellent plans have been proposed, among which we recall those of Prof. Smith and Mr. Pope, and Mr. Little. We propose to add our own, or rather, to state how we acquired the language. It may help some one to know how that was done.

We were first ordered to telegraph service Sept. 14, 1845 We had, at that time, never seen a telegraph register, or key. But we had given to us a copy of Vail's pamphlet, in which was the Morse alphabet. That alphabet, we at once decided, had to be learned thoroughly. Immediately, therefore, we commenced, what to us was very solemn and mysterious work, thumping out the dots and dashes on the table, with every finger of the five hugging its neighbor, and using this quintuple digit as an electric hammer. And we got on nicely. At night, we kept up the practice on the bed post, until the stars began to fade. On the cars, we drummed it out on the window pane, or on the back of the seat before us, to the wonderment of those who sat thereon. But none of these plans fixed the characters so thoroughly in mind as a practice we adopted, of writing letters to friends in the telegraphic idiom. In a very short time, by this telegraphic correspondence, we got such hold of the language that the letters soon came instinctively to us, as they must always come before any one can ever do telegraphic service worth the name. It is an easy and pleasant way to learn; an hour in the evening may thus be spent as a pastime—passing notes to companions at the table, and receiving replies. The memory will speedily become so charged with every letter that, when the fingers come to touch the key its chief difficulty will be gone, and the learner will carry to the key the same exactitude which was found necessary to execute intelligibly the letters on paper. So true was this in our own case, that, on reaching Washington, and being placed at an instrument for the first time, we at once wrote out these very euphonious lines without hesitation:

"Butcher's meat has riz,
People say it will be rizzer,
But 'tis as 'tiz,
And it can't be no 'tizzer."

And we did it about as well as ever we have done it since. We had the reputation also, for some years, of writing symmetrically. We were indebted for that to this mode of learning. Now, we have not patented the process, and all may try it who please. We think it will greatly facilitate learning at the key. When once the alphabet is thus thoroughly impressed on the memory, so that the mind has nothing to do but attend to the mechanical movement, the process of learning at the instrument is simple and readily acquired. Experience will do the rest.

Learning by sound may be acquired, after such a beginning, by as simple a method. Thus, the letter E is a single sharp click, which can be made by striking the table or plate with the edge of a cent. Two clicks make I, three make S, and so on. Now, families may learn these around the tea-table, and it may be that, in some day not far distant, the fair president of a dinner table may communicate orders to the kitchen by the Morse alphabet, or scold the juniors by a similar vernacular.—*Journal of the Telegraph.*

Improvement in Hulls of Vessels.

Our engravings illustrate a recently patented mode of constructing the hulls of vessels, which is such a radical change of form, that practical experiments with full-sized models can only prove its real value.

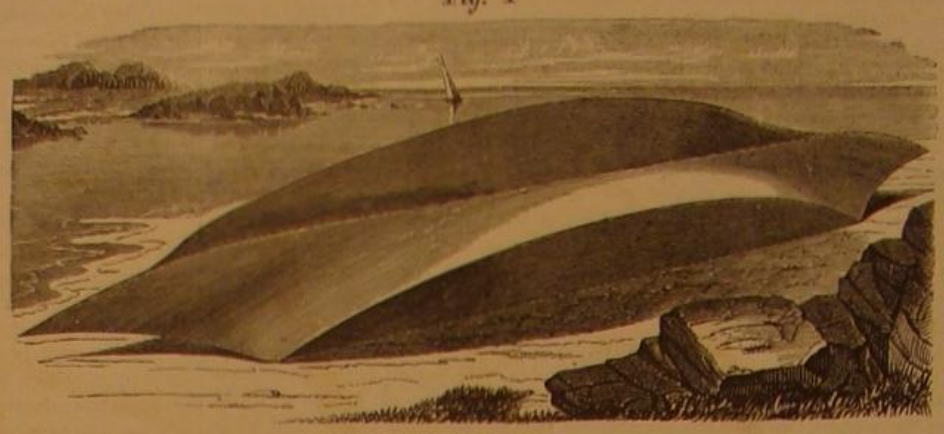
The great desideratum claimed, and which the patentee states he has demonstrated, is that the vessel is lifted above the static water line in proportion to speed attained heretofore.

Fig. 1 is a perspective view of the bottom of a vessel constructed in this manner. Fig. 2 is a plan of the same. Fig. 3 is a side plan view, and Fig. 4 is an end plan view.

The object sought to be attained is to cause the water displaced by the cut-water to be gathered together convergingly under the center of the boat,and to be thence divergingly passed over at the stern in order to retain the vessel in a horizontal position, and thereby facilitate its motion through the water.

A is the center or keel line. B is the diagonal or grade line which runs from the cut-water to any given hight, and to the center of the boat or the line, D. The line, C, is produced by passing a straight edge over the lines, A and B, at a right angle with the line, A, as shown in Fig. 4. That is, if straight lines be drawn at right angles from the line, A, and also passing through the straight line, B, they will, when produced, also pass through and form points in the curved line, C.

Fig. 1



RIDER'S IMPROVED BOAT HULL.

The positions of the lines, A and B, therefore, determine all the other lines of the hull, and the modeling becomes a matter of absolute measurement, leaving nothing for the eye or judgment to do except to secure accuracy in performing the work, as indicated.

E is a central chamber commencing where the cut-water ends, where it ceases to displace the water. This chamber terminates where the counterpart of the cut-water begins to separate the volume of water from the central chamber. The opposite sides of the chamber, E, incline gradually, attaining their maximum at the center where their depth is also greatest.

The water, when the boat is in motion, is displaced by the inclined sides of the cut-water, and is converged by the reversely inclined sides of the chamber, E, until it reaches the center. The further progress of the boat brings the reversed cut-water over the united mass of fluid, which is then laterally divided, at first by a very obtuse angle or the arc of a very large circle, which gradually becomes more and more acute.

Fig. 2

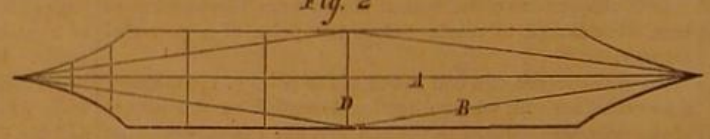


Fig. 3

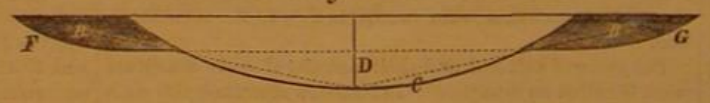
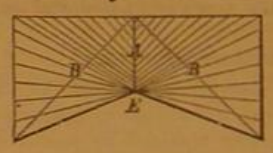


Fig. 4



It is claimed that the converging of the volume of water displaced by the cut-water, by the gradually converging sides of the chamber, E, so as to quickly fill up the trough made by the cut-water, furnishes a firm support to the hull in the line of its center of gravity rendering it steady.

It is also claimed that as an upward pressure is produced at the stern in passing over the volume of water from the chamber, E, equal to the upward pressure of the water upon the moving sides of the cut-water, there is no tendency of the boat to rise higher at the prow than at the stern, so that the boat may be urged to any practicable speed without losing its horizontal position, as is the case in boats constructed on other principles. This, it is claimed, admits of a more economical application of propelling power, as the power required to propel a boat which rises at the prow is partly expended in raising its weight up the incline thus formed.

It will be seen that in this method of construction the lines are placed geometrically so as to open and close the water with equal speed, and to maintain the horizontal position, both laterally and longitudinally.

It is claimed also that the water leaves the stern of the boat as compact as when the cut-water enters it, which gives the rudder a powerful hold at high speed.

Patented, through the Scientific American Patent Agency, October 4, 1870. Address, for further information, L. P. Rider & Co., Pittsburgh, Pa.

THE STEREOSCOPE.

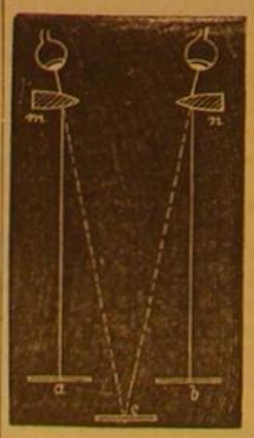
The stereoscope is comparatively a new invention, dating back only some twenty years. A form of the instrument in which mirrors were used to produce the effect was devised by Wheatstone, in 1838; but the stereoscope, as we are familiar with it, was invented by Sir David Brewster, in 1849. The former is known as the *reflecting* stereoscope, and the latter, in which lenses take the place of Wheatstone's mirrors, is called the *refracting* or *lenticular* stereoscope.

We have taken it for granted that the philosophy of the stereoscope was generally understood, but a little inquiry among our friends—including some of the better informed among them—has satisfied us that this is not the case. Even some of our leading teachers know nothing about it. A few months ago, at a little gathering of gentlemen interested in physical science, the fact that the pictures formed in the two eyes are different was referred to by one of the company, together with the related fact that the two pictures of the stereograph differ in the very same way, when, much to the surprise of most persons present, both facts were squarely denied by a gentleman who had for many years been at the head of one of our best high schools, and for the greater part of the time a teacher of mathematics and physics. It was only after a long and rather lively discussion that he became convinced of his error. He had never before understood either the stereoscope or the eye, so far as its action is like that of the stereoscope.

Why do we have two eyes, when we see but one image with them, and apparently one eye would serve to form that image? There may be other reasons for the arrangement, but the most obvious one is *that we may see objects solid*, or in relief, and not merely as pictures on a plane surface. It was not until Wheatstone made his experiments on binocular vision, in 1838, that this matter came to be thoroughly understood, even by scientific men. He showed that the pictures in the two eyes are not exactly alike, and that it is the blending of these two pictures which causes objects to appear solid.

A moment's reflection ought to satisfy the reader that the pictures in the two eyes cannot be exactly alike, since the eyes are not in precisely the same position with reference to the object. But if "he don't see it," a simple experiment will enable him to see it. Let him hold a book or any other solid object about a foot from the eyes, and look at it first with one eye and then with the other. He will find that with the right eye he sees a little more of the right side of the object, and with the left eye a little more of the left side. The same will be true, of course, whatever may be the distance of the object from the eye, though when the distance exceeds 250 or 300 feet the difference is too small to be appreciable, and objects beyond that distance are not really seen to be solid.

Now the stereoscope is simply a contrivance for blending two pictures which differ from each other as the images in the two eyes differ. When thus blended the pictures produce the same impression of solidity as the object itself does when viewed with both eyes. Hence the name of the instrument, which is from two Greek words, meaning *to see solid*.



How is this blending of the pictures effected? If we look at an object through the center of a convex lens, it will be seen exactly in front of the eye; if we move the lens a little to the left the object will appear to move to the right; if we move the lens to the right the object appears to move to the left. If now we cut the lens into two semicircular pieces, and place them side by side in a reversed position—that is, so that their thin or curved edges are adjacent, and their thick,or straight edges are turned outward and parallel—the right eye will then look through the left half of the lens, and the left eye through the right half. If two pictures, like those of a stereograph, be placed at a proper distance behind the lens as thus divided and arranged, they will be seen, not in their actual places, but in a position midway between the two. The figure illustrates this: *m* and *n* are the halves of the lens; and *a* and *b* are the two pictures, which appear as one at *c*.

How are the two pictures obtained? They are photographs of the object taken from slightly different points of view. Theoretically, they should be taken from points separated by a distance equal to that between the two eyes, or about two and a half inches; and for all objects within short distances this is just what is done. For objects farther off—as large buildings or landscapes of considerable extent—photographers usually take the pictures from points farther apart, the distance ranging from a few feet up to a quarter of a mile.

In this way, objects which are so distant that they are not really seen as solid with the unaided eye are brought out into clear relief by the stereoscope. Even the moon may be made to show her rotundity of figure by means of this instrument. Although she always turns the same side towards the earth she swings a little at times,so that we get a view of a little more of her eastern or western side; and by taking advantage of this swinging (or *libration*,as the astronomers call it),photographs can be taken corresponding to the images in the two eyes—or rather, as Sir John Herschel has remarked, "it is as though the moon were seen with the eyes of a giant, placed thousands of miles apart."

It has been suggested that similar photographs might be taken of the planet Saturn, with his system of rings. In this case an interval of two or three years would be allowed between the times of taking the pictures, in order that the position of the rings might change enough to answer the purpose.

A curious effect may be produced by tinting the pictures of a stereograph with different transparent colors. If, for example, one be colored blue and the other red, their blended image will appear purple; if blue and yellow be used, it will appear green, and so on. The colors are mixed *in the eye*, and the resultant color is precisely the same as if they had been mixed by a painter and applied to the picture outside the eye. We have seen French stereographs of statuary which illustrate this principle. One of the pictures is colored green and the other yellow, and the mixture of the two in the eye produces the exact tint of bronze.

Quite an amusing story is told of the first introduction of the stereoscope to the *savants* of France. The Abbé Moigno took the instrument to Arago, and tried to interest him in it; but Arago unluckily had a defect of vision which made him see double, so that on looking into the stereoscope he saw only a medley of four pictures. The Abbé then went to Savart, but he was quite as incapable of appreciating the thing, for he had but one eye. Becquerel was next visited, but he was nearly blind, and consequently cared little for the new optical toy. The Abbé, not discouraged, called next upon Pouillet, of the Conservatoire des Arts et Métiers. He was a good deal interested in the description of the apparatus, but unfortunately he squinted, and therefore could see nothing in it but a blurred mixture of images. Lastly Biot was tried, but Biot was an earnest advocate of the corpuscular theory of light, and until he could be assured that the new contrivance did not contradict that theory, he *would* not see anything in it. Under the circumstances, the wonder is that the stereoscope ever got fairly into France; but if you have any doubts on that point, a short walk under the arcades of the Rue de Rivoli, in Paris, will soon settle them. We question whether you will see anywhere else on earth more stereoscopes or stereographs than are displayed in the windows of the picture-shops of that noted thoroughfare.—*Journal of Chemistry.*

Patents.

Every really valuable invention is the result of long previous training, expensive experiment, and hard earnest thought. Such being the case, it becomes a matter of prime importance to the inventor that that which has cost so much in the past should be well secured for the future so as to insure to the owner an adequate return for his outlay, his anxiety, and his toil. If experience is worth anything in such matters (and in what department is it not of value?) no better aid can be found than in the office of Messrs. Munn & Co., of this city, the well-known publishers of the *Scientific American*. It is probable that they have taken out more patents than all the other patent agencies in the United States put together. The consequence is that their office is so extensive that, for the several departments, they can afford to give constant employment to specialists, men who have made a particular study of some one or two things. Hence, in their office an improvement in potato-diggers need not necessarily be confided to a man who has applied himself all his life to steam engines, nor an improvement in woolen carding to one who, though great, is great in fire-arms. A word to the wise is sufficient.—*Technologist.*

MINK FURS.—In all parts of Canada where a mink track is to be seen in the soft mud along the banks of streams or lakes dead-fall can be found also. Trappers calculate that there is not a mink in the country for which a trap is not set. The animal being voracious is easily caught, and will soon become exterminated if not better protected. The fur is of very little use before the 1st of November, and yet minks are caught by hundreds during the month of October.

The Solar Engine.

Captain John Ericsson, of this city, has addressed a communication to *Engineering* in reference to his solar engine, in which he remarks that it is not intended as a competitor with the steam engine, where coal can be obtained; nor is it proposed, in the first instance, to erect this motor where there is not continuous sunshine.

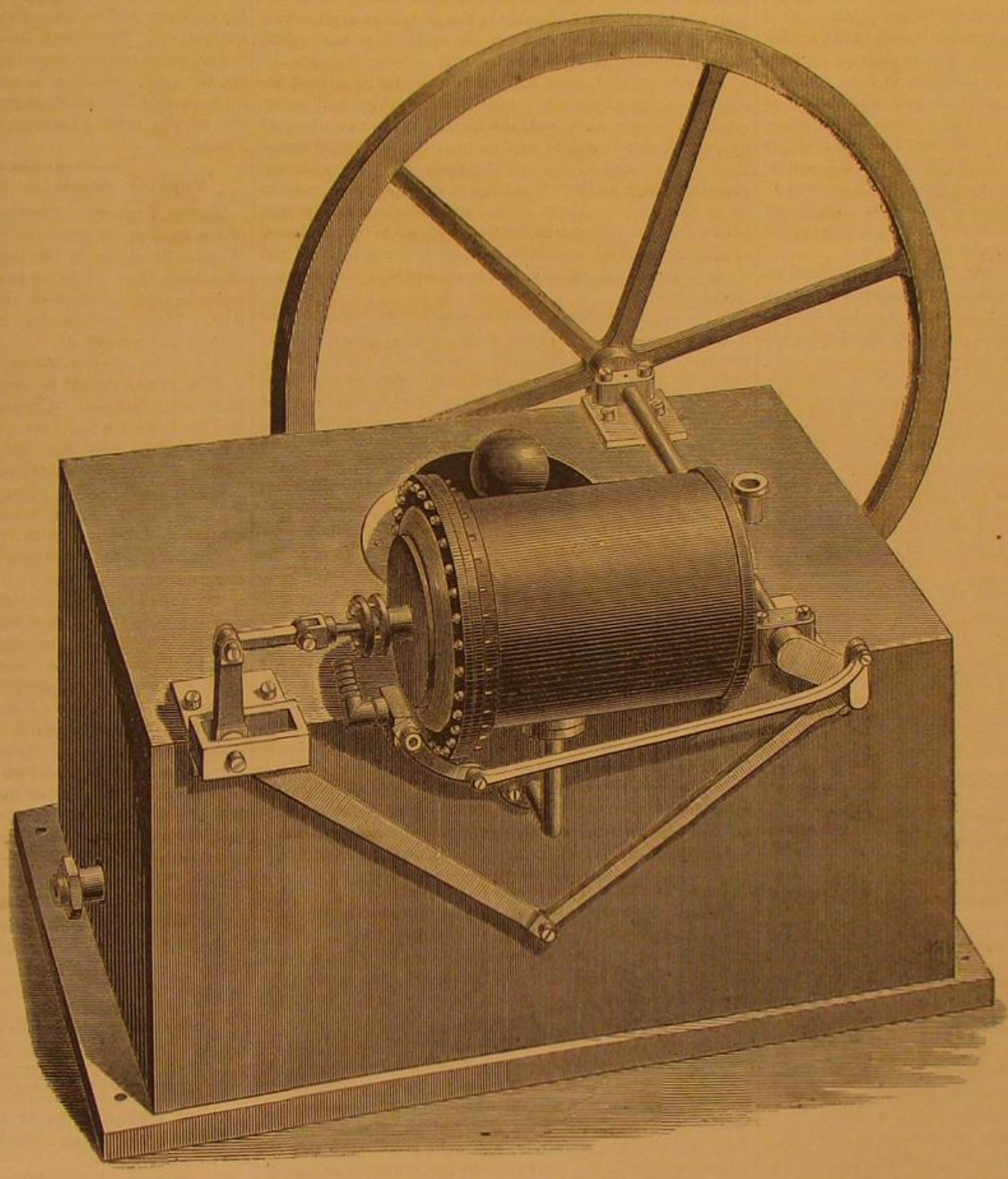
The accompanying illustration, which derives its chief interest from the fact that it represents a piece of mechanism actuated by the direct agency of solar heat, is copied from a photograph of a small solar engine just completed, intended as a present to the French Academy of Sciences. Apart from being a motor, this engine has been designed to operate as a *meter* for registering the volume of steam generated by the concentrated heat of a sunbeam of a given section. Regarded as a steam meter, it is important, as it verifies the results of previous experiments and previous calculations, based on the number of units of heat developed in evaporating a certain weight of water in a given time. Engineers will not fail to notice the unusual proportions of the working parts, nor will they fail to appreciate the object in view, that of reducing the friction to a minimum—an indispensable condition in a meter. The entire mechanism being shown with perfect distinctness, it is only necessary to explain that the square pedestal which supports the steam cylinder (4½ inches in diameter), the beam center, and the crank shaft, conceals a surface condenser.

Under a clear sun, the engine which our illustration represents, runs with perfect uniformity, at a fixed rate of 240 revolutions per minute, consuming at this rate only part of the steam furnished by the solar steam generator, now temporarily employed, belonging to an engine of greater dimensions constructed some time ago. With reference to ascertaining the amount of mechanical power developed by the solar engines, engineers need scarcely be reminded that, by dispensing with a vacuum, the atmospheric resistance and back pressure exerted against the pistons furnish accurate means for measuring the dynamic force transmitted by sunbeams of definite sections.

Plans and descriptions of the mechanism by which the sun's radiant heat is concentrated, and of the steam generator which receives the concentrated heat, I shall be compelled for some time to withhold from publication. Experienced professional men will appreciate the motive—that of preventing enterprising persons from procuring patents for *modifications*. In connection with the course thus deemed necessary, it will be proper to mention that I have in several instances—notably in the case of the screw propeller and the caloric engine—been prevented from perfecting my invention in consequence of conflicting privileges having in the meantime been granted to others.

Regarding the solar engine, I avail myself of this opportunity to say that I shall not apply for any patent rights, and that it is my intention to devote the balance of my professional life almost exclusively to its completion. Hence my anxiety to guard against legal obstructions being interposed before perfection of detail shall have been measurably attained. Within a few years the entire engineering community of both hemispheres will be invited to take the matter in hand. In the meantime, let us hope that no exclusive privileges may be granted tending to throw obstacles in the way of an unrestricted manufacture and introduction of the new motor wherever it may be applicable.

The foregoing having introduced the subject, let us now enter upon a cursory examination of the merits of the solar engine. The several experiments that have been made show that the mechanism adopted for concentrating the sun's radiant heat abstracts, on an average, during nine hours a day, for all latitudes between the equator and 45°, fully 3·5 units of heat per minute for each square foot of area presented perpendicularly to the sun's rays. A unit of heat being equivalent to 772 foot-pounds, it will be perceived that, theoretically, a dynamic energy of 2,702 foot-pounds is transmitted by the radiant heat, per minute, for each square foot; hence, 270,200 foot-pounds for an area of 10 feet square. If we divide this sum by the adopted standard of 33,000, we ascertain that 100 square feet of surface exposed to the solar rays develop continuously 8·2 horse power during nine hours a day, within the limits of latitude before mentioned. But engineers are well aware that the whole dynamic energy of heat cannot be utilized in practice by any engine or mechanical combination whatever, nor at all approached; hence I have assumed, in order not to overrate the capability of the new system, that a solar engine of one-horse power demands the concentration of solar heat from an area of 10 feet square. On this basis I will now proceed to show that those regions of the earth which suffer from an excess of solar heat will ultimately derive benefits resulting from an unlimited command of motive power which will, to a great extent, compensate for evils hitherto supposed not to be counterbalanced by any good. Before entering on this task of estimating the results of utilizing sun-power, it will be well to scrutinize, as closely as we can, the mechanical devices by means of which we propose to avail ourselves of the fuel contained in that great store-house, from whence it may be obtained free of cost and transportation. The solar engine, we have seen, is composed of three distinct parts: The engine, the steam generator, and the mechanism by means of which the feeble intensity of the sun's rays is augmented to such a degree that the resulting temperature will exceed that of the lowest pressure of steam admissible in an efficient engine.



ERICSSON'S SOLAR ENGINE.

As to the motor itself, it suffices to say that it is essentially a modern steam engine utilizing, to the fullest extent, the mechanical energy of the steam generated by the concentrated solar rays. Regarding the steam generator, it will only be necessary to state that it is not exposed to the action of fire, clinkers, or soot, and therefore can only suffer from the slow action of ordinary oxidation. We have, lastly, to consider the efficiency of the mechanism by means of which the solar heat is concentrated and the temperature raised above that of the water in the steam generator. Regarding this mechanism—concentration apparatus, it may appropriately be termed—it will be asked: Is it costly? Is it heavy and bulky, so as to render transportation difficult? And, finally, the question will be put, Is it liable to derangement and expensive to keep in order? I will answer these questions in the same order in which they have been presented. The cost is moderate. The weight is small—indeed, lightness is the most notable peculiarity of the concentration apparatus. As to bulk, this apparatus is composed of small parts readily put together. Regarding durability, the fact need only be pointed out that certain metals, however thin, if kept dry, may be exposed to the sun's rays during an indefinite length of time, without appreciable deterioration; hence, unlike the furnaces of steam boilers, which soon become unserviceable, structures protected, as the concentration apparatus is, by thin metallic plates, cannot be rendered unserviceable from the mere action of the sun's rays. Another question will be asked, whether the solar engine will answer as well on a large as it does on a small scale? The following reply will effectually dispose of this pregnant query. It is not necessary, nor intended, to enlarge in future the size of the apparatus by means of which the solar intensity has been successfully concentrated and the temperature sufficiently elevated to generate steam for the engines which have been built. The maximum size adopted has been adequate to utilize the radiant heat of a sunbeam of thirty-five square feet section. The employment of an increased number of such structures will therefore be resorted to when greater power is wanted, as we increase the number of hands when we desire to perform an additional amount of work. The motor itself, the steam cylinder and other parts, will obviously be proportioned as at present with reference to the pressure of steam employed and the work to be done.

Agreeable to our introductory remarks, it is not proposed, in the first instance, to apply solar engines in places where there is not steady sunshine. The isolated districts of the earth's surface suffering from an excess of solar heat being very numerous, our space only admits of a glance at the sunburnt continents. An examination of the extent of these will show that the field for the solar engine, even with the proposed restriction, is not very contracted. There is a rainless region extending from the northwest coast of Africa to Mongolia, 9,000 miles in length, and nearly 1,000 miles wide. Besides the north African deserts, this region includes the southern coast of the Mediterranean east of the Gulf of Cabes, Upper Egypt, the eastern and part of the western coast of the Red Sea, part of Syria, the eastern part of the countries watered by the Euphrates and Tigris, Eastern Arabia, the greater part of Persia, the extreme western part of China, Thibet, and, lastly, Mongolia. In the western hemisphere, Lower California, the tableland of Mexico and Guatemala, and the west coast of South America, for a distance of more than 2,000 miles, suffer from continuous, intense, radiant heat.

Computations of the solar energy wasted on the vast areas thus specified would present an amount of dynamic force almost beyond conception. Let us, therefore, merely estimate the mechanical force that would result from utilizing the solar heat on a strip of land, a single mile in width, along the rainless western coast of America; the southern coast of the Mediterranean, before referred to; both sides of the alluvial plain of the Nile in Upper Egypt; both sides of the Euphrates and Tigris for a distance of 400 miles above the Persian Gulf; and, finally, a strip one mile wide along the rainless portions of the shores of the Red Sea, before pointed out. The aggregate length of these strips of land, selected on account of being accessible by water communication, far exceeds 8,000 miles. Adopting this length and a width of one mile as a basis for computation, it will be seen that the assumed narrow belt of the sunburnt continents covers 223,000,000,000 of square feet. Dividing this by the area necessary to produce one-horse power, we learn that 22,300,000 solar engines, each of 100-horse power, could be kept in constant operation, during nine hours a day, by utilizing only that heat which is now wasted on a very small fraction of the land extending along some of the water-fronts of the sunburnt regions of the earth.

It will be said that these extravagant figures are devoid of practical significance. Due consideration, however, cannot fail to convince us that the gradual exhaustion of the coal fields will inevitably cause great changes in regard to international relations, in favor of those countries which are in possession of continuous sun-power. Upper Egypt, for instance, will, in the course of time, derive signal advantage, and attain a high political position, on account of her perpetual sunshine and the consequent command of unlimited motive force. The time will come when Europe must stop her

mills for want of coal. Upper Egypt, then, with her never-ceasing sun-power, will invite the European manufacturer to remove his machinery and erect his mills on the firm ground along the sides of the alluvial plain of the Nile, where sufficient power can be obtained to enable him to run more spindles than a hundred Manchesters.

Correspondence.

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

Constructing and Balancing Cylinders.

Messrs. Editors:—Having noticed your answer to correspondents on page 106, August 13, upon the subject of balancing cylinders and pulleys, I prepared a short article for your paper, but unavoidable delays occurred in sending it forward at the time. Next I noticed the communication of Mr. Jacobi, on page 148, September 3, which seemed so clear an explanation that I laid aside what I had intended to send you, and prepared a short reply to your editorial note which followed said article. This was also delayed by absence in attending the late State fairs and trials at Utica until another article from Mr. Jacobi appeared on page 232, October 8th, accompanied with illustrations and explanations which seemed to hit the nail on the head and to drive it home. His theory and practice cannot be misunderstood and with short cylinders must insure uniformly favorable results.

The practice of your Schenectady, N. Y., correspondent, referred to by your editorial notes on same page, although rude, "and upon the cut and try plan" are none the less sure to produce the same ultimate results as far as short cylinders without intermediate heads are concerned.

Your Timberville, Va., correspondent's mode of constructing cylinders, as described in the editorial on same page, by which each end and intermediate head or pulley is balanced separately as they are successively fixed upon the shaft in position, is the only proper mode to be practiced so far as it applies to the end heads or intermediates; but as to balancing the staves or lags for covering, each one separately, it seems to be a useless process—labor lost, and wholly impracticable in the construction of conical cylinders of any length, long or short.

It is only by a velocity test that any cylinder, when completed, can be properly balanced, by the application of weight at the ends or along the cylinder where it is really required, and the greater the length of the cylinder the more important becomes this velocity test and balancing, notwithstanding the statement to the contrary, in your Virginia correspondent's article on page 243, October 15, in which he states "that a long cylinder cannot be perfectly balanced after once constructed."

In regard to balancing millstones alluded to in same article, I will not now reply, but may at a future time.

The communication on page 261, October 22, by your Morrison, Ill., correspondent, is so wide of mechanical, practical, or scientific merits, as not to require any comments, except to characterize it as simply absurd, and carries its own worthlessness with it.

As I have devoted more than thirty years to practical and professional mechanics, and had much experience, and always with successful results with what I have undertaken, I assume that the mode adopted by me in the construction of cylinders of all kinds, large or small, heavy or light, long or short, cylindrical or conical, and for high or low speed, may be of sufficient interest to be inserted in your columns and meet with favor among your correspondents and readers, I therefore send to you for publication this communication.

My chief business has been for many years in constructing thrashing machines for grain and rice, clover seed, and cider mill graters, cotton gins, and condensers, horse-powers, etc. Many of these require cylinders of various kinds as to size and speed, etc.

In constructing a cylinder, I affix each end head, and intermediates (if any), in position upon the shaft, and balance each one separately and successively as they are put on by means of the steel bars and spirit level, by resting the journals themselves upon the bars (but never upon centers, as in a lathe), and am careful to avoid all air currents upon the cylinder during the process.

When ready for the covering, the staves and lags are strongly fixed to the heads and the cylinder completed, and spikes inserted in a manner to withstand fully twice or thrice the speed required in practical operation; the whole cylinder is again placed upon the balancing bars, and allowed to settle itself with its heaviest side down; then by turning the extreme upper portion of the cylinder down to a line horizontal with the axis of the shaft a lump of putty is pressed upon this point and on a level with the shaft, and more or less putty applied until a perfect balance is obtained, so the cylinder will stand in any position at rest.

The putty is then removed and placed in a balance, and two slugs of iron of equal size are selected and placed in the opposite balance, which shall just equal the weight of the putty, or by using a flat piece of thin steel plate, with its edge or corner tacked on to the cylinder at the periphery and at the end on a horizontal line with the shaft; and instead of using putty, slugs of iron in pairs are selected and laid upon the plate until the exact weight to balance is obtained, when they are inserted, one at each end, and upon the light side of the cylinder as near the periphery as practicable. This process may require to be repeated once or twice, but is usually accomplished at the first trial.

If the cylinder or pulley to be balanced is iron, then the slugs must be drilled and bolted or made fast in some safe manner.

This accomplished, the cylinder is removed to a heavy substantial frame, and placed in fixed and strong bearings, and belt motion applied to it by an accelerating clutch coupling to the line shaft or counter shaft of the manufactory. The bearings are so made as to allow of nearly one eighth of an inch play to the journals or may be made to fit closely at pleasure of the operator, and both are required with some cylinders, especially with all long ones.

The object of the strong, heavy frame is to cause the cylinder itself to vibrate in all its unbalanced lines instead of the bearings on which it is mounted.

As the motion is applied to the cylinder gradually, and the speedometer indicates its velocity, the centrifugal force of the unbalanced portions will soon cause the journals to "fly" in the bearings. The band is then shipped off and a piece of chalk is applied at each end of the shaft closely up to the journals, so as to mark the side of the journal or shaft, which mark indicates the heavy side of the cylinder at that point, and by knowing at what velocity this "flying" occurs the operator is enabled, after a few trials, to judge almost accurately the first time the weight of slugs which will be required to balance each end, and he will select two of equal size, whose united weight will be required, and insert one of them at each end of the cylinder upon the side exactly opposite the chalk marks. The band is again applied, and the speed increased probably from three hundred revolutions, with a thrasher cylinder at the first trial, up to one thousand or more revolutions when the journals will again "fly," and the belt is slipped off and chalk applied, and speed ascertained as before.

If the speed of three hundred would "fly" the journal it would probably require two slugs of one pound each at first trial, while at one thousand revolutions, a quarter of an ounce for each slug would be sufficient. This process is repeated until two or three thousand revolutions are attained and the slugs required become so small that one third or less of a twopenny nail is driven in and broken off.

In balancing large cylinders, and especially light ones, the chalk indications are taken at the ends as before described with large bearings, after which the bearings are made tight to prevent any flying at the journals, and motion being applied gradually as before, until the middle portion of the cylinder is observed to describe a larger circle than is due to its true diameter. This is also indicated with chalk by slipping off the band as before.

A careful and observing workman, with a little practice, finds no more difficulty in balancing a long cylinder than a short one, although it may require a few more trials in proportion to its length than a short one. It is this balancing of long cylinders on a heavy substantial frame and fixed bearings which cannot be accomplished with the device of Mr. Jacobi, described on page 232, October 8.

To the perfect "velocity balancing" of our machines are greatly due their success, durability, and efficiency as well as their light consumption of power used in driving them.

Albany, N. Y. Horace L. Emery.

The Familistery of Guise.

Messrs. Editors:—One of the most interesting things I saw in Europe was the Familistery of Guise, France. It is a self-supporting school or home of a peculiarly practical and modern type, and although it is the effect of the genius and perseverance of one man, yet it deserves imitation by co-operative societies.

This enterprising genius is M. Godin, a machinist by trade, who followed his profession fifteen years. Being poor, he was only able to develop his plan by degrees, and the left wing of the palace was not entirely completed when the war broke out. His plan is based upon four principles—agriculture, manufacture, education, and enjoyment. For this he selected a curve in the river Oise, on the northern suburb of the city of Guise, in the Department of the Aisne, but owing to difficulty in obtaining land, the agricultural part of M. Godin's ideal is far behind his hopes. The institution is chiefly maintained by its manufactory. This is an industry in stoves and other heating apparatus, and employs ordinarily 1,000 men. A large number of these workmen live in the palace near by, where their families and even they themselves have the free benefit of the educational system. The schools, eating-houses, and theater occupy the building directly in front of the palace, on the opposite side of the street.

The success of the plan of instruction has excited a good deal of notice of late years. There are about 300 children living in the palace who receive their education there, and recently this number has been augmented by children coming from the city. So great has been the prejudice against this institution by the outside world that it not only was discountenanced by Napoleon, but several strong efforts have been made to break it up by bankrupting its founder. But it has triumphed over all calumnies, and no other cause attributable to this triumph can be greater than that of the schools.

The main feature of this institution is the palace, which is situated in the center of the garden, and consists of three edifices, each in form of a parallelogram, with a central court covered with glass—a main structure and two wings. These are four stories high, and are divided into 324 residences, each large enough to accommodate a family, and including from two to four rooms and an anteroom. The main structure has a front of 200 feet, with a depth of 130 feet. Its inner court is 150 by 65 feet. The wings are 160 by 140 feet, with magnificent inner courts, all furnished with cement floors, and covered with glass which admits light but no rain.

The corridors, galleries, and stair-cases are artistically constructed, and form at every floor of the palace a fine promenade. Such is the economy of the structure that a single gaslight sufficiently illuminates each court, casting distinct rays upon every door of the residences. These residences are so entirely separated one from another that they resemble houses in cities, and it often happens that near neighbors are unacquainted with each other. To give an idea of the cheapness of these rooms, let me say that the cost per month of one kitchen 10 by 13 feet, a parlor 13 by 14 feet, a cabinet 4½ by 6, lighted, and the vestibule, is two and one half dollars.

The workingman is fortunate who lives in this palace. It is not only an honor to live there, since it is far more commodious and *à la mode* than other houses, but he enjoys gratis a multitude of other favors peculiar to it. A co-operative store which sells at cost is in the basement. A society of mutual aid pays his physician's bills, and he and his children receive instruction. Music and merriment echo everywhere. Feast days come, and are celebrated with intellectual concurrencies, illuminations, and garlands; and above all, the noble principles of conscientious liberty are in every sense carried into practice, making the Familistery of Guise one of the most progressive workingmen's institutions in France. C. Osborne Ward.

Popular Errors in Regard to the Watch.

Messrs. Editors:—I notice in the Scientific American, of the 22d inst., an article on "Popular Errors Regarding the Watch—Breaking of Mainsprings," by Mr. R. Cowles, of Cleveland, Ohio. I do agree with Mr. Cowles in his remarks, when he says the cause of breakage is an unexplained mystery. There are, however, many causes which can be explained and remedied.

One of the greatest and most frequent errors—one that no good workman should be guilty of—seems to prevail among most watch-makers. It is made by putting the mainspring into the barrrel when taken down to be cleaned, or in replacing it by a new one. The mainspring winder generally used cannot be used in all cases, and is not satisfactory when it can be used; besides in putting in the spring it will mar the flange of the barrel which serves to hold the cap on. The consequence is that the winder is scarcely ever used, except on very stiff springs, and they are put in with the fingers, forcing the spring out of shape, and leaving on the spring the perspiration and dirt of the hands, which causes destruction to the spring sooner or later.

I have adopted a mainspring winder of my own invention, that I have used for two years without a single breakage. With this winder the spring need not be touched with the fingers after it is ready for the barrel; besides, any kind or size of springs can be put in quicker and with the greatest ease and regularity.

I procured letters patent for this tool through your agency, as well as for several other useful tools of my invention. You will please accept my thanks for the prompt and satisfactory manner in which you have conducted the business I have intrusted to your care. M. D. Kelly.

Cadiz, Ky.

Remarkable Production of Bessemer Steel.

Messrs. Editors:—The following was the product of the two five-tun Bessemer converters at the works of Messrs. John A. Griswold & Co., Troy, for the month of October:

No. of whole working days in the pay-roll month	27½
" " days in which steel was made	26½
" of days stopped for repairs	1
Total tuns of steel ingots made	1,686½
" No. of charges made	349
Average tuns of ingots made per charge	4·83
" No. of charges made per day	13·18
" tuns of ingots made per day	63·64

One of the best works in England, advertises that it can make, with the six-tun converters, 150 tuns per week, or say 650 tuns per month.

The highest product, it is believed, of a pair of five-tun converters in Europe is 750 tuns per month. The remarkable product of the Troy Works—1,686 tuns—is due to improvements developed there, and coming into use in the other works in this country. Steel.

Troy, N. Y.

Effect of Artillery Discharges on Weather.

Messrs. Editors:—I send you the following table showing the effect of artillery discharges on weather, a subject which I see by a recent editorial in your paper is exciting much attention at present in Europe. The table is prepared from notes of observation made on weather in the vicinity of the scenes of great battles fought during our own recent war, and made immediately subsequent to these battles, and shows the time, after the battles, which elapsed before rain fell:

Resaca—One day after.
Kenesaw—Three days after.
Jonesboro'—Five days after.
Altoona—All night and next day.
Nashville—All night and next day.
Franklin—Two days after.
Fort Anderson—Five days after.
Kingston—Five days after.

In all these battles from 40,000 to 100,000 men were engaged. E. W. Brown.

Cambridge, Ill.

The Darling Self-Supplying Pen-Holder.—Mr. B. L. Goulding, of 108 Fulton street, New York, recently left on our table one of the above fountain pens. It contains enough ink to write several pages of manuscript without refilling. They fill by simply placing the point of the pen in the ink, and exerting a slight pressure with the thumb on the side of the holder. It is one of the best fountain pens we have seen.

PROGRESS OF INVENTION ABROAD.

In a paper read before the British Association for the Advancement of Science, Mr. J. W. Cooper, who has given much attention to the

WATERING OF STREETS BY CHEMICALS,

states that three streets in the city of Liverpool were watered with salts during the month of July, 1869, with very favorable results, so much so, that the experiments were continued this year. It was difficult to prove the economy resulting from the use of chloride over a limited area; and the Westminster Board of Works, after observing the effect produced at Whitehall and Knightsbridge, resolved to extend the experiment throughout their entire district, comprising an area of 250,000 square yards. As soon as the area was extended, the economy in labor and water was at once made evident. By using one tun and a half of chlorides per day, costing £3 15s., the labor of ten cart horses and men, costing £4 10s. (at 9s. per horse, cart, and man), can be dispensed with, and, consequently, the quantity of water they would spread is saved also, viz., 350 loads of 250 gallons each, which, at 10d. per 1,000 gallons (a fair average price for water in London) would amount to £3 12s. 11d. in addition to the 15s. per day saved in labor; thus showing a clear gain of £4 7s. 11d., after paying for the salts. An effective method of remedying the evils arising from organic matter deposited on public thoroughfares is becoming daily a serious matter for consideration with sanitary authorities,as much sickness is believed to arise from the malaria emanating from this source. The disgusting odor and dangerous nature of some of the deodorizing agents used were strong evidence that they would not be used at all if the necessity for some determined action to prevent the spread of contagion and disease was not fully recognised. The deliquescent chloride of aluminum, recently introduced to public notice by Professor Gamgee, seemed to meet all the requirements needed in the antiseptic of the future. It was non-poisonous and free from any odor; it prevented decomposition, and arrested it when commenced. It absorbed noxious gases resulting from putrefaction,and destroyed parasites and germs. It was also not to be surpassed as a precipitant and deodorizer of sewage, and was only one-third the cost of carbolic acid. Mr. Cooper proposed to add a sufficient percentage of this chloride to the salts for street watering, and thereby afford a means of thoroughly and effectually purifying public thoroughfares without additional cost to the ratepayers, the value of the water and labor saved being more than sufficient to pay for the use of the chlorides.

A very ingenious automatic device for

FLUSHING SEWERS

has been produced by a London inventor. In this device, the flood-gate is hinged, opening upward and outward upon the release of a hook bolt by the buoyant power of a large copper float. Many lives have been lost through the action of poisonous gases,in flushing sewers,which flushing this simple device does whenever it is required. The rush of accumulated water swings the gate outward, and, also, carries off accumulations of sewage. As soon as the flood current subsides, the gate swings back to its original position, and is automatically locked.

A machine for

HACKLING LONG VEGETABLE FIBERS,

such as aloe, manilla, hemp,etc., consists of a drum, revolving on a horizontal axis, and armed with teeth or spikes pointed at the end, and having sharp, annular edges in front, or at the front and back. This drum is of such a size that the fiber upon the machine shall not be able to lap more than about half way round it. This is an English invention.

A French invention, in the same line as the above, is a machine for

COMBING FLAX.

Two endless chains, consisting of flat links, are caused to travel together over flat-sided pulleys,and disposed, one above the other; the two adjoining or opposing surfaces of the two chains being held in contact with each other by passing between guides. These surfaces form nippers for holding the tufts of fibers while being combed or straightened, and serve to carry them along, at the same time, to a receiving trough, wherein each tuft is deposited in succession, the one overlapping slightly the other. The bottom of the receiving trough consists of an endless traveling band, which continuously conveys away the combed tufts in the form of a ribbon or sliver. A vibrating arm, worked by a crank and provided with a crosshead or rake, serves to take each tuft as it is released from the nippers, and draw it into the receiving trough.

A Swedish inventor has patented a process for making

ARTIFICIAL LEATHER.

He takes leather wastes, leather cuttings, leather shavings, or other small bits of leather,either new or old,and reduces them to a kind of fibrous pulp, by hand labor, or by a machine or mill (either by grinding, pounding, cutting, rasping, carding, or grating); if old waste is used it should first be cleaned thoroughly. This matter or pulp is then kneaded with india-rubber, which is rendered fluid, or dissolved in oils or spirits, and treated with ammonia. He prefers to dissolve the india-rubber in oil of turpentine. To effect this, the inventor cuts the india-rubber into pieces and mixes it with the oil, after which he lets it remain quiet in a closed vessel until it is dissolved. When the india-rubber is dissolved, he adds ammonia, of a strength of 30 per cent, in the proportion of about equal parts by weight, of ammonia to the india-rubber contained in the solution; when the mass has become of a grayish white color it is ready to be mixed with the pulp.

A Liverpool inventor has patented a taper or

FRICTION LIGHT,

which is made after the following formula: He takes one ounce saltpeter, one half ounce powdered orris root, one eighth-ounce of minium, and one ounce of phosphorus, or any other convenient friction match composition. To these ingredients, the phosphorus being dissolved, he adds one to two ounces of oil, preferably castor oil, varying the quantity according to the nature of the oil and the resultant tenacity or flexibility required. After all the ingredients are well incorporated, the inventor adds thereto chloride of sulphur, in the proportion of from ten to fifteen parts of liquid chloride of sulphur to every hundred parts of oil, agitates quickly, and shapes into the form required, either by molding, cutting, pressing, or drawing.

A new method of

PAVING STREETS,

—French—consists, first, in the employment of wood disintegrated into fragments, of as great a length as possible, in the construction of rides and bridle paths, carriage drives, riding schools, and training grounds, streets and roads of all kinds. Second, in the employment of disintegrated wood of shorter length than the preceding, in the construction of foot paths of all kinds for promenades and gardens. Third, in the employment of disintegrated wood mixed or not with pitch or with antiseptic material, or both, as a cushion for supporting the sleepers of railways. Fourth, in the employment of this disintegrated wood mixed with pitch obtained from gas tar or otherwise, or with natural asphalte or bitumen in the construction of roads, footways of streets, public drives, and any description of works in which asphalte is ordinarily employed.

Sir William Fairbairn, of Manchester, England, has invented an improvement in

STEAM BOILERS,

in which he combines together three cylindrical shells of boiler plate. He arranges them parallel, the one to the other, and horizontally, or nearly so. Two of the cylinders, which are set side by side, are each traversed from end to end by an internal tube in which are the furnaces, and these cylinders each communicate with the third cylinder, which is placed over and between them by three or other number of pipes or passages, of sufficient size to allow the steam generated in the lower cylinders to escape freely into the upper, and to allow the water freely to circulate.

SCIENTIFIC INTELLIGENCE.

THE REDUCING PROPERTIES OF METALLIC ALUMINUM.

In reference to the action of aluminous upon metallic solutions there exists a diversity of information in our books, and to settle the point an Italian chemist, Professor Cossa, has instituted a number of experiments, an account of which we find in the journal *Nuovo Cimento*.

SALTS OF SILVER.—The metal is thrown down in dendritic form from weakly acid and neutral solutions of nitrate of silver. The precipitation of the silver begins in the concentrated as well as in the dilute solution of the nitrate six hours after the immersion of the aluminum. Silver is immediately precipitated from an ammoniacal solution of the chloride of silver in granular form, and also from ammonia—chromate of silver.

COPPER SALTS.—At first aluminum has no action upon solutions of sulphate or nitrate of copper, but after the lapse of two days small crystals collect on the sheet, and gradually increase in size, partly dendritic, but chiefly octahedra. Copper is at once thrown down from a solution of the chloride and also from the acetate, and if to the sulphate or nitrate a little chloride of potassium be added, the precipitation of the copper is greatly accelerated.

SALTS OF MERCURY.—Aluminum at first throws down metallic mercury from solutions of the chloride, cyanide, and nitrate, but this soon forms an amalgam with a second portion of the aluminum and produces a compound that decomposes water rapidly and also oxidizes quickly in the air. If an amalgan of aluminum and mercury be produced by heating the two metals in an atmosphere of carbonic acid, it exhibits similar properties to those mentioned above. Professor Wurtz, of New York, was the first to call attention to the remarkable properties of the amalgam of aluminum and mercury at a meeting of the Lyceum of Natural History more than a year ago. He prepared it by rubbing aluminum foil and mercury together.

SALTS OF LEAD.—Aluminum separates lead in crystals slowly from solutions of the nitrate and acetate and rapidly from the chloride. Also an alkaline solution of chromate of lead is decomposed by aluminum into metallic lead and oxide of chromium.

SALTS OF THILLIUM.—Regular octehedra crystals of thallium alum formed upon the aluminum foil from a solution of the sulphate after the lapse of ten days. Metallic thallium was immediately thrown down from a hot solution of the chloride.

SALTS OF ZINC.—Aluminum immediately precipitates metallic zinc from alkaline solutions.

The aluminum employed in the above experiments was free from every trace of sodium, and applied in the form of thin sheets after having been cleaned in nitric acid.

ACTION OF ELECTRICITY UPON AIR AND OXYGEN IN THE FORMATION OF OZONE.

A. Houzeau, after a series of 400 ozone determinations of the action of electricity on air and oxygen, comes to the following conclusions:

1. The production of ozone is greater in renewed than in confined air.

2. It is greater at the negative than at the positive pole.

3. It increases only up to certain limits with the duration of the electric action,

4. The intensity of the electricity adds to the amount.

5. It diminishes when the distance of the electrodes is increased.

6. It varies with the length or surface of the electrodes.

7. Under otherwise analogous circumstances more ozone is produced when the effect of both electrodes are employed.

8. The formation of ozone takes place when the air is not in direct contact with the electrodes, as when the points are isolated in a thin glass tube, but the effect is greater when the air is in contact with the poles of the battery, and it varies in proportion to the length and superficial area of the metallic electrodes.

9. The production of ozone increases as the temperature of the air diminishes.

10. Under like circumstances a given volume of oxygen yields far more (8 to 10 times) ozone than the same quantity of air.

11. Besides ozone there is always some nitrous oxide produced in the air, whereas in pure oxygen there is none.

After the author had ascertained these results, he was able to invent an apparatus by aid of which he could at any time prepare ozone in any quantity from the air or oxygen. Unfortunately the description of the apparatus is wanting, but the experiments made by Houzeau, and the results at which he has arrived, will be of value to future experimenters. We need a cheap and practical invention for producing ozone at pleasure, as its powerful chemical properties render it of great value in the arts.

ICE PAPER.

Paper may be made to resemble the figures produced by the flakes of snow or the freezing of water on a window pane by allowing a salt to crystallize upon its surface. During the Paris Exposition card paper thus prepared from sugar of lead was very popular, but it was discovered that the lead salt turned black, and its poisonous character soon brought it into disrepute. A new mixture without lead has been suggested by Puscher—it is prepared as follows: Dissolve 6 ounces sulphate of magnesia in 6 ounces of water and add 6 ounces dextrine mucilage paste. The solution is boiled, a little glycerin dropped in, and the whole allowed to cool. The paper, after having been previously glazed with a coating of glue and gelatin must be uniformly covered with the solution and left to dry in a warm place. After 10 or 15 minutes the surface of the paper will be covered with a uniform cluster of crystals, the size and number of which will be dependent upon the concentration and temperature of the bath and also of the heat at which it is dried. If the paper be glazed with a solution of egg albumen instead of glue and gelatin, it can be beautifully dyed with aniline colors previous to immersion in the solution of sulphate of magnesia. This kind of ice paper does not undergo any change in sulphureted hydrogen gas, and is not poisonous.

ACTION OF HEAT UPON COAL.

If powdered coal, after having been dried until its weight remained constant, be heated in a drying oven from 356° to 360° F., it has been found by Dr. Richter that there is a constant increase of weight up to a certain point, after which it begins to diminish. After twelve hours heating the increase amounts to several per cent of the original coal—after twenty hours it reaches its maximum and further heating causes it to lose weight. Coal which has thus been heated has simply its external appearance in common with the original sample. It has a higher specific gravity, in one instance going up from 1·275 to 1·453, and its chemical constitution is different. If we compare the composition of dry coal with the heated, the latter shows much less carbon and hydrogen, and a considerable increase of oxygen and nitrogen. An accurate analysis demonstrated the loss of hydrogen to be 0·74 per cent, and of carbon 1·17 per cent, while the increase of oxygen and nitrogen occasioned by the next was 6·07 per cent. If the heated coal be made red hot, it no longer yields coke, and does not materially change in appearance. If it be heated rapidly, an exceeding great swelling up takes place, and the escaping gases which carry off the carbon in powder, burn with a non-illuminating and not smoking flame. Finally the heated coal absorbs water from the air more rapidly than the dry coal.

Bessemer on Steam Artillery.

Mr. H. Bessemer has lately aired his ignorance of military and steam engineering in a proposition to use steam as a projectile agent in artillery. His plan, which he attempts to support by a string of absurdities, is briefly as follows: He proposes to apply the principle of the steam fire engine to the projection of bullets. He calculates that, with a pressure of 150 pounds of steam, one ounce and two ounce bullets might be projected with an initial velocity of 1,600 feet or 1,800 feet per second, at the rate of 2,000 per minute of the smaller and 1,000 per minute of the larger missiles. Mr. Bessemer proposes to submit details to the War Office; but he seems confident of the practicability of combining the bullet projector with the traction engine, and of so producing a warlike machine of most formidable and deadly character.

AN ICE LENS.—It is interesting to observe that radiant heat from the sun may be collected into a focus by means of an ice lens, and yet produce all the effects of an ordinary burning-glass. Such a lens, for experiment, may easily be made by placing a flat cake of ice upon a warm concave surface of metal or porcelain dish, such as an evaporating dish used by chemists; as soon as one side has assumed the proper form, the ice must be turned to make both sides alike. Any sunny, crisp, frosty morning will be suitable for this experiment; from which we learn that in Northern regions it would be quite possible to raise a fire without matches —a fact not altogether unworthy of being known.

DEVICE FOR SPREADING CIRCULAR SAW TEETH.

We illustrate in connection with the present article a device for spreading the teeth of circular saws to give the proper clearance, and improve the cutting edges.

Fig. 1 is a perspective view of the principal part of the device, shown attached to the saw; and Fig. 2 is a view of a punch used in connection with the plate, B, in Fig. 1, for spreading the teeth.

A, in Fig. 1, is a plate made of cast or wrought metal, with ears attached to its sides between which the teeth of the saw are placed during the operation of spreading. B is a steel plate firmly attached to the plate, A, by screws, or in any other suitable manner, and which serves as an anvil in in spreading the teeth.

The plate is applied as shown in Fig. 1. The ears, C, serving to hold the plate in position on the saw. The distance to which the ears lap on to the teeth of the saw is governed by the gage screw, D. The outer ends of the ears, E, are connected by a pin, F. The tooth to be operated upon is passed through the space between this pin and the steel plate, B, as shown, the position of the point of the tooth being governed by the gage screw, D.

The space between the ears, C, is designed to be just wide enough to admit the saw at or near the base of the tooth, and the space between the front ear, E, admits the point of the tooth.

When the point of the tooth is placed on the steel anvil,

Fig. 1

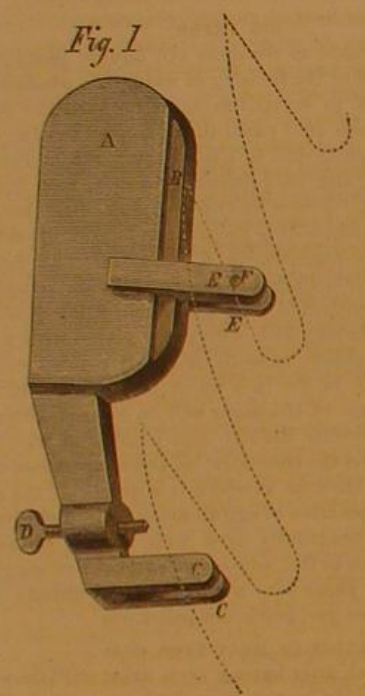


Fig. 2

B, the punch shown in Fig. 2 is applied to it, and a blow of a hammer thereon spreads the tooth laterally in each direction, forming small lips on each side of the point, which are claimed to serve in place of the ordinary "set" to give the proper clearance. The punch is made in the form shown, so that it may be set squarely on the tooth.

It is claimed that the cutting point of the tooth is thus made thin and sharp, and that its edge may be kept longer under wear than by ordinary filing. Also that the lips formed on the tooth make the cut much smoother than when saws set and filed in the old style are used.

Patented, through the Scientific American Patent Agency, October 14, 1870, by W. H. Rudolph, Clarksville, Tenn., whom address for further information.

Honors to the Inventor of Telegraphy.

Prof. S. F. B. Morse, the inventor of telegraphy, presided at the late annual meeting of the Western Union Telegraph Company, at the close of which Mr. William Orton, President of the company, made the following very "personal" remarks:

"I cannot but regard it as a circumstance of peculiar interest connected with this day's proceedings, that at the head of this table, and presiding over this body sits our venerable friend, Professor Morse, the father of all the telegraphs. In the same presence sit to-day, participating in the annual services of the largest telegraphic organization of the world, the man who made its existence possible, and the men who made it. It seems a deeply interesting fact that from the brain of a single man who yet mingles with us thus so unassumingly, and who, though crowned with the honored hoar of nigh eighty years, is yet clear of eye and firm of foot, there sprang a design which has given a language, and a literature, and a means of instant audience with the world. It is significant, also, of that design that is so simple as to be elementary, and so complete as to have challenged, unimproved, the acceptance of the world. I therefore, for myself, and I think for you, also, gentlemen, desire to offer to our illustrious Chairman the warmest congratulations on the auspicious development of the art to which he gave birth, and to desire for him all that may render his ripened years as happy as they are honored."

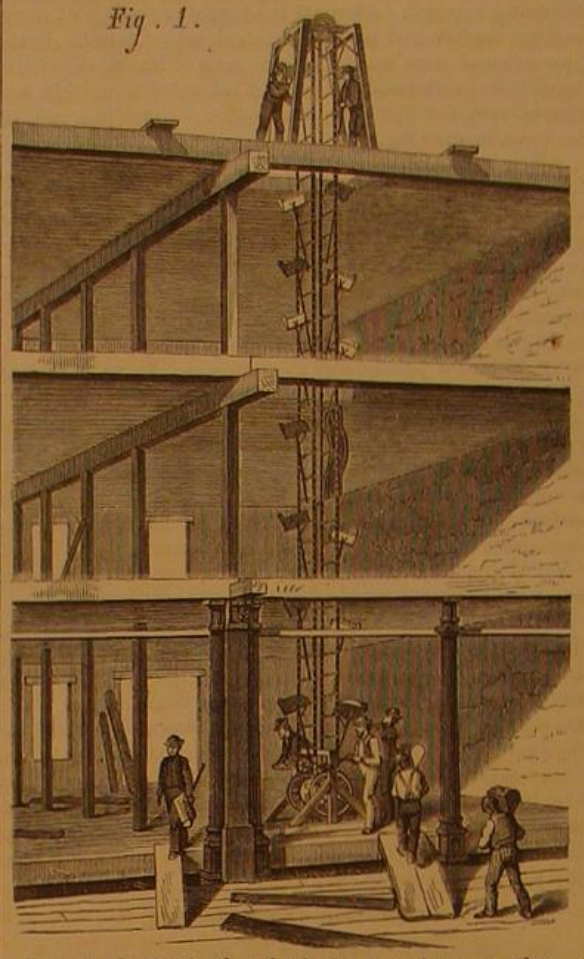
The telegraph operators and others in various parts of the country have contributed the money for the erection of a splendid monument of Morse, which is soon to be placed in Central Park.

HORRORS OF WAR.—It will bring home to our readers the murderous extent and horrors of the war when it is announced that the Prussian Government has ordered the supply of two hundred thousand wooden legs.

POWER'S ENDLESS LADDER HOD ELEVATOR.

The folly of carrying bricks and mortar up long ladders by the climbing action of human arms and legs, has been often deprecated in this journal as a disgrace to modern engineering. Nor have our views upon this subject been unseconded. Prominent architectural and engineering periodicals, both in this country and Europe, have joined in our cry of "down with the hod."

Fig. 1.



It seems, however, that the hod counts for more than we and our cotemporaries have reckoned. In conversations with practical builders we have been told that no other instrument has yet been devised rivaling in convenience the hod for carrying on scaffolds, over joists, and narrow plank ways, and on this account devices heretofore invented to elevate building materials, have failed to secure popular favor.

We illustrate, however, this week, a device which retains all the convenience of the hod as a distributer with ample elevating facility, and which is both simple and ingenious.

It consists of an endless chain ladder, A, Fig. 2, with iron rungs, upon which the hods with their contents are suspended by flat hooks, as shown at B. The endless chains run over flanged pulleys, C, placed on a suitable frame at the top, and the lower ones being impelled either by hand or other power. Hand power is, on all accounts, preferable, perhaps, for this purpose, and it also avoids the jar occasioned by steam or horse power.

Fig. 2

The hods are placed upon or taken off the rungs without stopping the motion of the endless ladder, and as the weight of the hods on one side is balanced by that of those on the other side; no power is expended except that required to overcome the friction of the machine, and to raise the materials.

We are told that seven hods of bricks and mortar can be raised per minute by the labor of two men at the cranks, and to any hight usual in building; an immense increase of useful work, over what the same men could perform in climbing a ladder with hods upon their shoulders, carrying their own weight with that of the hod and contents.

The space necessary for passing the hods up is only twenty inches by six feet. The apparatus being vertical requires less space than the ordinary ladder. The hods being detachable from the chain, the materials do not need to be handled to put them in hods or buckets for distribution after their elevation, as is the case with bucket elevators and other mechanical devices, and the breakage caused by this handling is saved.

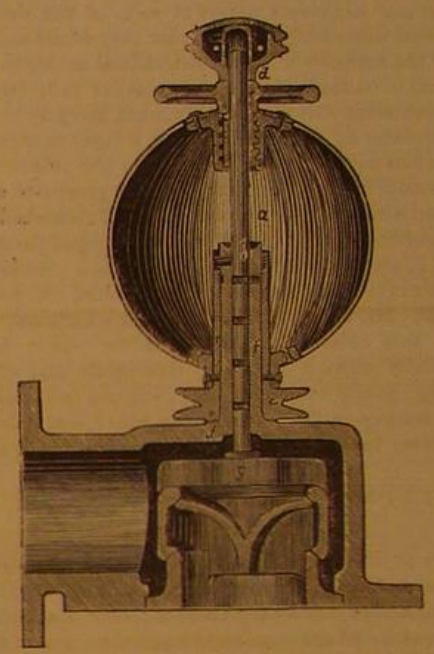
The apparatus is now in use by some of the most extensive builders in New York and Chicago, and we are informed that two manufactories in Chicago are now employed in their construction. Portions of the right will be sold.

Patented, through the Scientific American Patent Agency, July 14, 1870, by Jesse Powers. Address for further information J. Powers, Broadway, corner 49th street, New York or 106 Monroe street, Chicago, Ill.

BOURNE'S SPHERICAL STEAM ENGINE GOVERNOR.

Mr. John Bourne, who has an enviable reputation as a constructor of, and writer upon, the steam engine, has recently invented the novel form of governor which forms the subject of the accompanying engraving, copied from the *Mechanics' Magazine*.

In the engraving, *a* represents a hollow sphere, which is made of thin brass, rendered elastic by hammering and divided into segments. On one end of the central spindle, *b*, is



a brass nut, *c*, which is prolonged outwards and terminates with a small hand wheel. By means of this wheel and nut the valve is opened or shut, and by it also the point of cut-off is regulated. The spindle, *b*, is screwed into the valve, and both are prevented from revolving by a flat rib, which is cast on the under side of the valve cover, a similar rib being formed on the valve, and with which the rib on the cover engages. On the extreme end of the spindle is a nut, *d*, which keeps the hand wheel and nut in the position in which it is set. This nut also serves a second purpose, that of a lubricator, being fitted as an oil cup. The brass, *e*, is turned with grooves and forms a thrust bearing for the upper part of the sphere in a manner similar to that adopted for screw propeller shafts. The ribs of this brass work in corresponding grooves in the metal cap, which encircles them, and to which the upper portion of the brass sphere is attached. The base of the elastic sphere is attached to a sleeve, *e*, which is made in one with the pulley, over which a gut band from the crank shaft of the engine passes, and which gives rotation to the ball. The sleeve *e*, revolves freely upon the fixed portion, *f*, of the valve casing, and is prevented from rising upon it by a collar, which is fixed by a side screw to the end of *f*.

The arrangement illustrated is one in which the central spindle is connected direct to an ordinary double beat or equilibrium valve, *g*. The governor, however, may be made to operate on any other kind of throttle valve, and can be fitted to existing engines It will be seen that when the ball is put into revolution, the centrifugal force causes the poles to approach each other. As, however, the lower pole is confined to the same horizontal plane, the whole vertical motion occurs at the upper pole, and depresses the spindle and closes the throttle valve to a corresponding extent.

As a marine governor this apparatus seems especially suitable, being unaffected by the rolling or pitching of the vessel. Mr. Bourne has succeeded in producing an efficient, compact, and elegant apparatus, which will doubtless come into extensive use. It adds one more testimony to his ingenuity and mechanical ability, and like the rest of his inventions is based upon correct and sound principles.

The rolling mills at San Francisco, which have been in operation two and a half years, use 400 tuns of iron monthly, turning out 230 tuns of finished iron, of which ninety tuns consist of rails. Besides railroad iron they have been turning out car axles, spikes, shoe shapes, and general railroad work

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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.

HOW LONG SHALL NITRO-GLYCERIN CONTINUE ITS WORK OF DESTRUCTION?—THE FAIRPORT EXPLOSION.

We have been taught from early infancy that human life is of all earthly things most sacred and valuable. The Scriptures tell us the greatest evidence of love a man can manifest is to give his life for that of his friend. Yet in these latter days we seem to have adopted a new gospel, by which the pecuniary interests of corporations and unscrupulous and avaricious men, are set higher in the scale of value than the lives of innocent, industrious people, and the happiness of families.

Since the first introduction as an explosive agent of that most terrible compound, nitro-glycerin, its history has been one of disaster and destruction. The calamities, of which it has been the cause, are too horrible to dwell upon, even in the recollection. It is our painful duty to now record still another, and we copy the following brief account of it from the Painesville (Ohio) *Telegraph*. The explosion took place at Fairport, Ohio, on Tuesday the 1st inst.

"At about 5 o'clock the people of Painesville were startled by a sudden concussion of the doors and windows, and jarring of buildings, as though some heavy body had been hurled against them, with a force almost sufficient to crush them in. This was followed by a dull heavy reverberation, similar, yet still unlike, the firing of heavy guns at a distance. Buildings were jarred, and trembled as though shaken by an earthquake. The reverberation and rolling sound as of distant thunder were perceptible at least from three to five minues after the first concussion was felt. An immense cloud of blood-red smoke was seen to arise in the direction of Fairport, and then to change its color to a lighter hue, and spread itself out in the heavens. This terrible phenomenon at once seemed to explain the cause of the great commotion. All at once understood that it was either the explosion of the nitro-glycerin manufactory or their magazines. Teams were immediately brought into requisition, and a number of our citizens started for the scene. It would be impossible to describe the scene which the town presented. The whole place seemed at first a complete mass of ruins. The buildings were shattered, the doors blown off their hinges, the windows all smashed in, plastering off, crockery, lamps, and looking-glasses demolished, chimneys torn down, stoves overturned, and everything in the houses in utter chaos. But if the scene was terrible within, it was still more so without. The whole population nearly were in the street, wild and crazed. The crash had come so suddenly, and the concussion had been so great, that many of them for the time were perfectly insane. Some of the men were for a few moments attacking each other, and women were insanely struggling, while all were loudly weeping and wailing. Children were running wildly about, screaming in terror, as if seeking protection, while others were struggling and screaming in the arms of their mothers, who were rushing hither and thither, not knowing what to do or where to go.

"Both the magazines of the Glycerin Company, situated on the west side of the river, had exploded, and four men who were at work in or near them were blown to atoms. The immediate cause of the explosion is not and never will be known. It is supposed that Mr. Malone, one of the four men, was digging a pit for a new magazine, and that one of the men was engaged in putting glycerin into cans from the jars in the magazine ready for shipping, while the other two were in some way assisting, by carrying glycerin backward and forward between the magazines and the manufactory. The explosion of the two magazines, which were near each other, was simultaneous, so far as the people in the vicinity could judge, they hearing but a single report. The men were blown to atoms. So far as we have heard only one piece of flesh has been found, not larger than a man's hand, and a bone, apparently part of a rib.

"The effect upon the magazines was wonderful. Of the frame structures only a handful of splinters was anywhere to be seen. It seems as if the wood must have been consumed, or the pieces blown so far that no one has yet found them. The force of the explosion penetrated deep into the earth, heaving out immense quantities of sand, and below this huge masses of blue clay. The holes, which must have been blown out to the depth of fifty or sixty feet, soon filled with water up to the level of the lake. They are forty or fifty feet in diameter at the top, and seem like the craters of extinct volcanoes. Two or three sycamore trees, which stood near the magazines, were scathed and rent, limbs were wrenched off, and all covered with sand and blackened, as if swept by a fiery tornado.

"The explosion was felt even in Buffalo, a distance of 160 miles. Soon after it occurred, a dispatch was sent over the wires from that city to Cleveland, and other points on the lake shore, asking if they had been again visited by an earthquake.

In Painsville, the shock was very severe, especially in the south part of the town, where the clay or hard pan comes very near the surface. In one small house we have heard of, things were thrown from the shelves, and a bedstead moved near two feet. It is supposed that the explosion must have reached the clay or hard pan, some thirty feet below the magazine, with such force, that houses built on that strata, though some miles distant, were more affected than those on the sand much nearer."

In addition to the above particulars, we have received, through private sources, others, some of which show in a most startling manner the appalling force of nitro-glycerin.

We are told that a physician riding at a distance of not less than twelve miles from the scene of the disaster was stunned by the shock, and his horse brought to a stand-still. Upon looking at his watch he found that the concussion had stopped it.

Another man sick with typhoid fever, lying two miles from the magazine, was instantly killed by the shock.

There is something intensely awful in the contemplation of a force like this, which, held by a slender and feeble thread, will, when let loose, rend the air like an earthquake and scatter destruction for miles around.

Since the introduction of nitro-glycerin to this country we have more than once raised our voice in denunciation of it as a far too dangerous substance to be allowed to exist in larger quantities than a chemical professor would venture to exhibit to his class. Experience has shown that it may, and will explode under the most ordinary circumstances which attend its storage and transport, and that it cannot with safety be intrusted to the handling of such men as must use it, if used at all, for purposes of ordinary blasting. The damage done by it has far exceeded any good derived from its use, and it is time, and more than time, that its record of death should be terminated by stringent laws prohibiting its general use.

ROADS AND ROAD-MAKING.

Of primary importance to the civil as well as military power of any country are good public thoroughfares. Rapidity and cheapness in transportation are vital necessities to commercial prosperity, and in time of war the safety of a nation may depend upon the state of her roads. These facts have long been recognized, and hence the perfection of roads has been a problem to which engineers have in all ages assiduously applied themselves. The importance of even a slight advance in improvement has kept alive interest in this department of engineering, and century after century has elapsed without the perfect ideal being considered as yet reached.

That this is true is proved by a very brief review of the Patent Office records, in which patents for various compositions for road surfaces, and for methods of road-building, constitute every year a notable number of the patents applied for and issued.

Probably the most remarkable success ever yet achieved by any one system was that which attended and still attends the macadam road. Notwithstanding its expensive character, it to-day covers more surface in Europe than any other. In America, except in the vicinity of large towns, this road is not much employed, the comparative sparseness of the population and the small amount of travel in rural districts not warranting the cost of its construction and maintenance.

There are few circumstances under which this road is not admirably adapted to town and country thoroughfares. It has a smooth surface, after it has been a little used, and affords an admirable foothold for horses. It is expeditiously laid, and perhaps demands as little expense for care and maintenance as any other capable of equal endurance and service.

It is now fifty years or thereabouts since Macadam introduced this celebrated system, and it is quite doubtful whether the next fifty years will give the world anything better for all purposes. But, as we have already said, this system is not at the present, nor is it probable that it soon will be, available for the greater part of American thoroughfares.

Roads in this country must, from the nature of the case, be constructed of such materials as are available immediately along their lines, and must necessarily be more or less imperfect.

In this as in other countries the great enemy of roads is frost, and the only way to even partially prevent its ravages is to construct roads high enough to allow thorough drainage. The flat surfaces permitted on most roads in this country is their most radical defect. The result is rivers of mud in spring and autumn, and frozen ruts of indescribable ugliness and discomfort in winter until such time as the snow covers and fills them.

A few days' labor devoted to thorough ditching along the sides of roads and elevating the centers where they have settled below the proper grade would greatly mitigate the evils complained of. This is generally done, when done at all, by throwing back on the road the soil excavated from the ditches, a very erroneous method and almost a sheer waste of labor. Such soil is generally composed of comminuted and pulverized material washed off from the road, and will only temporarily pack. As soon as it becomes very dry in summer it grinds up into a dust heap, and is blown off by winds, and washed off again by rains.

All soil used to raise the level of roads should be new soil, not the washings of the roads, which latter should be carted away. Where roads are much traveled these washings are a valuable manure, and it would pay well to cart them into the lands lying along such roads, from which soil of inferior fertility might be taken to form the roadways.

Wherever practicable, a deep hard bed of stone or timber should be laid below the reach of frost, upon which the surface material should be distributed. Gravel stands unrivaled for road surfaces, but it is not available in many localities. Broken stone, however, is obtainable oftentimes where gravel cannot be got, and answers the purpose very well.

We have seen a road laid through a swamp made with a bed of rough logs, well sunk down, and covered with a mixture of blue clay and broken stone, which was excellent in all respects, having almost as good and permanent a surface as macadam.

It is usual to work country roads early in the summer, to repair the defects caused by spring upheavals. This done, they are generally left till the ensuing season, when the same operation is repeated. But a little labor late in the fall would pay well on most roads. This labor should be expended in securing proper drainage. All sluices should be opened if stopped, the roads raised where the summer wear and tear have depressed them, and their surfaces made smooth, so that the water may run off with the utmost facility Neglect in these particulars is always dearly paid for in the miring of teams and wagons, and in wear and tear of both animals and vehicles.

THE MOTIVE POWER OF EXPANDING GASES.

The power of expanding gases to perform work has only been successfully applied in the use of steam or water-gas, and atmospheric air. In the use of these gases they are allowed to escape after having expended a portion of their heat in the performance of work, and escaping to carry with them a portion of the heat imparted to them. In condensing steam engines, a portion of this heat is recovered and sent back to the boiler in the feed water, but a considerable loss is nevertheless experienced.

The general belief has been that fluids capable of being changed into gases by the action of heat, are more applicable to motive purposes than permanent gases. And we have yet to be convinced that this belief is not scientifically correct. It is true that the heat expended in converting water into steam at 212° is, and cannot be otherwise than lost in working steam under ordinary atmospheric pressure, in non-condensing engines; but this loss is so far compensated for by the conveniences attending its use, as contrasted with that of permanent gases, that it still maintains, and seems likely to maintain its supremacy.

Notwithstanding this, numerous attempts have been made and are still making by able engineers, to substitute permanent gases for steam in the working of engines. For the most part, air is the material employed, and it is with this material that the greatest success has been acheived. It has been used both separately and in combination with steam In the latter method, no very remarkable and permanent success has been reached, though some attempts in this direction have seemed to promise something.

With air used singly, there are now several engines, popularly known as "Caloric engines," which are efficient, safe, and economical within certain limits of power; but all attempts to develop great power with a single motor have failed up to the present time. With this brief review of the past and present history of invention in this field, we may proceed to notice an attempt recently made by Mr. A. W Bickerton, F. C. S. associate of the Royal School of Mines, who, in a paper presented to the British Association recently, gave an account of his invention.

Without admitting that the claims for economy made by him are probable or even possible, we think the statement made in his paper will interest our readers, and, therefore, will

close this article with an abstract from it, which gives the principal features of his invention.

Crude nitrogen gas is heated in a serpentine system of tubes until the pressure is double that of the air. It is then admitted into a cylinder in which it presses forward a piston, and is allowed to expand. Next it passes into an apparatus where it is cooled, and consequently diminished to half its bulk. The cooling is effected in a new arrangement, which is so constructed that the whole of the heat above that of the external air is transferred to an equivalent volume of air passing in an opposite direction. This heated air is then used as a blast for the fire, $\frac{1}{10}$ going to the hearth of the furnace through a tweer, and $\frac{4}{10}$ mixing with the products of combustion immediately above the fire, so as to complete any imperfect combustion, and also to modify the temperature of the whole mass, so that it may not be likely to injure the iron of the gas tubes, and the remaining $\frac{5}{10}$ being introduced into the system at a point further on. The construction of the system of tubes is such that, by the time the products of combustion reach the open air, they shall have parted with nearly all their heat, and transferred it to the nitrogen contained in the tubes, and hence a chimney draft cannot be used, and the blast has to be produced by a blowing engine. The nitrogen, after having been cooled to half the volume it occupied in the cylinder, is then compressed and forced into the system of tubes at the point furthest from the fire. If this forcing the gas back again into the system of heating tubes appears absurd, it must be remembered that the gas while leaving the heating tubes occupies twice the space it does when being forced back, hence it fills a cylinder of twice the area, and the force that may not be disposed of is equal to half the pressure exerted in the larger cylinder. But the other half of the power is not lost, it is simply conveyed back to the heating tube, and is used again. The losses that arise are those incidental to all engines, such as radiation, conduction, the enormous loss of heat that usually goes up the chimney, together with the still greater loss that is constantly being carried away by the condensed water is avoided—an amount in itself six times as great as that converted into work in the steam engine. The inventor expects his new heat engine to convert 60 per cent of the heat of combustion into work, a duty that is fully 500 per cent above that of well-constructed steam engines.

TIME AND DISTANCE.

At the very bottom of all exact science lies a just conception of time and distance. It may be said that no such thing as an exact science could possibly exist without the ability to accurately measure these relations. In the science of mechanics and its application to practical work, in the shop, and manufactory, they are both fundamental in importance. The terms, speed, velocity, rate, etc., all express the relations of time and distance, and the measure of power to perform work is a definite number of foot-pounds raised per minute.

The unit of work is one pound raised one foot without regard to the time employed in the elevation. The term work, then, does not include the idea of definite time, while the term power does.

This distinction is of primary importance to the correct conception of the laws of applied mechanics. Work is the overcoming of any resistance, whether the time occupied in its accomplishment be long or short. Mechanical power is that which can perform work or overcome resistance in definite time, whether the power be strength of men or horses, the fall of water, or the expansion of steam.

When we attempt, however, to conceive of time and distance we can set no limit to either; they expand to an illimitable extent. We are obliged to conceive of time only as the relation of the succession of events, and of distance as the relation of position. In the measurement of time, we adopt as the unit the interval between two events which succeed each other at uniform intervals. The oscillations of pendulums of uniform length, in the same position upon the surface of the earth are found by experiment, and may be mathematically demonstrated, to succeed each other with perfect uniformity of interval. The rotations of the earth upon its axis also practically succeed each other at uniform intervals. Thus we have both an artificial and a natural standard of time.

From natural standards of distance may be derived artificial ones, and standards of time—as the length of a pendulum oscillating seconds—may be made to correct standards of distance or length. From these two standards may be derived all other measures whatever they may be.

Few have anything like an appreciation of the vast importance of accurate measurement in the natural sciences. But such measurements are all based on time and distance. All weights are primarily derived from measurements of distance, and it follows that all estimation of magnitude, density, hardness, or any other physical property measured by pressure or weight may be referred back to measurement of distance.

It is therefore in and through the consideration of these relations that we gage all our sensations of external things. For size, intensity of color, and light, form, weight, and temperature, all are estimated, and conceived only through some application of these relations. Deprive the mind of any means whereby it may estimate or imagine the distance of a body from the eye, and it can form no conception of magnitude, and it is only by comparison of relative distances of parts from each other that it can conceive form. It is true that form also depends upon direction of outline, but direction is not apparent without extent or distance, and hence this consideration does not invalidate the foregoing proposition.

Even our knowledge—in so far as we have any—of the molecular constitution of masses is obtained in great part through the application of these relations. The definite weights in which chemical combination takes place is only an expression of definite bulks, or volumes, established by measure.

These relations are types of that in which all human knowledge consists. We perceive nothing and conceive nothing but relations, and the combination of relations of which the mind takes cognizance are to it the embodiment of all external things. The idea of relation, however, involves the existence of something to be related, and thus the idea of material existence is inferred; but as we cannot go beyond relations in mental operations, the existence of matter can never be made the subject of actual demonstration.

The existence of force is also inferred from change in the relation of distance, and is perhaps as just an inference as that of matter, though in our opinion not so essential to thought. Neither force nor matter can be estimated as entire entities, we can only conceive of them through relations of mass and movement, which are, as we have seen, only measured by the relations of time and distance.

In considering the ideas of matter and force we stand on the very border line which circumscribes thought, but even here, the moment we attempt to relinquish our ideas of time and distance we become lost in a maze from which we may return, but through which we find no pathway for the human intellect to transverse.

RESIGNATION OF COMMISSIONER FISHER.

The following letter will explain itself:

UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., Nov. 8, 1870.

SIR:—I ask permission to renew the tender of my resignation of the office of Commissioner of Patents, made October 24, and temporarily withdrawn at your suggestion. If there be no reason to the contrary I suggest that the resignation be accepted, to take effect at the close of Thursday, November 10th, inst. I have the honor to be, very respectfully, your obedient servant. SAMUEL S. FISHER.

To his Excellency, U. S. Grant, President United States.

Colonel Fisher has been an able, industrious, and conscientious public servant. The labors and reforms which he has introduced will be felt to advantage in the future administration of the Patent Office.

At the time of our going to press no appointment had been made to fill the vacancy. The names of Samuel A. Duncan, Assistant Commissioner of Patents, William Bakewell, patent lawyer, Pittsburgh, Judge Allison, Registrar of the Treasury, T. C. Theaker, Ex-Commissioner of Patents and patentee, Horace Greeley, President of the American Institute, Clinton Rosevelt, scientist and inventor of the panatechner, J. K. Fisher, steam carriages for common roads, Gideon Welles, Ex-Secretary of the Navy, Jonathan Dennis, Quaker and solicitor, E. P. Weston, the great pedestrian, and other well-known names have been mentioned; and that the interests of female inventors may not escape recognition we suggest the name of Elizabeth Cady Stanton.

ATTEMPT TO ABOLISH THE PATENT OFFICE.

A correspondent of the *Tribune* telegraphs from Washington that "a bill will be presented to and pressed on Congress for the abolition of the Patent Office Bureau. This office has, it is alleged, become too complicated to be beneficial and must either be abolished or have its jurisdiction materially changed."

A correspondent who has noticed this paragraph inquires "Whether if Congress should abolish the Patent Office it would cancel all unexpired patents."

We answer No. If the Patent Office should be abolished now or hereafter it could not affect patents issued before the act of abolishment went into effect. At present there is no likelihood that any such act can be got through.

A Successful Inventor.

Freeman Talbot, of Rockfield, Minn., writes: "I should have acknowledged the receipt of my patent before this were it not that I have been away from home for the last two weeks. During that time I have made more than three times what the patent cost me, and the future looks bright.

"I do not propose to take out more than forty patents more, and would here remind the eager aspirants for my patronage that the able, reliable, long-established, and world-renowned firm of Munn & Co., 37 Park Row, N. Y., are quite capable of doing all my business with the Patent Office to my entire satisfaction; and I am, from a sense of duty to my family and of gratitude to you, obliged to refuse the kind offers of those individuals and companies that have already offered their services."

A Veteran Inventor.

I. S. Clough, of this city, and who by the way is a true philosopher, writes to us as follows: "Promptness in business is one of the most prosperous traits for business men. I have to thank you again for your successful manner of application for a patent, you having taken out several for me since 1849—the last one on a complete ash-sifter, which I applied to you to procure for me on the 5th of October, and on the 13th I received official notice that the patent was allowed. This speaks well for the way the cases are managed at the Patent Office, where they always are much assisted if a finished model in all its parts, showing the benefit of the improvement, is sent with each application. This, with your manner of explaining the same, so truly written out and illustrated, makes all satisfactory and easily understood."

LETTERS FROM THE SOUTH.

COLUMBUS, Ga., Oct. 17, 1870.

Southwestern Georgia—Savannah—Atlantic and Gulf Railroad—Orange Fever—Macon—Columbus—Cotton Factories and Water Power—Railroads.

Southwestern Georgia, of which Columbus is the northern angle, is the great peculior cotton region of the State. The soil is mostly underlaid with rotten limestone. Just here commences the granite range. The land is fertile, but the people are poor, for they depend almost entirely on cotton as a crop, merely entertaining the foolish idea that corn will not grow on their lands. Albany is the center of this section and has its outlet through the Atlantic and Gulf Railroad to Savannah. This railroad traverses for the greater part of its length vast tracts of pine barrens, whence the markets of Savannah and the world are supplied with lumber. They claim to average about three million feet per month. It connects southward with Florida, whence, I am informed, quantities of canned pineapples are brought. It seems that this fruit is brought to Cedar Keys, there put up, and thence sent to Savannah by rail. In the hight of the season as much as two car loads a day are shipped. The saving of sugar by being enabled to use riper fruit is said to be very great. Another article of commerce sent over this road to Savannah and thence to Europe, is black (or sea island) cotton seed for oil making. Of this 500 tuns were sent in six months of 1870. This railroad also connects, via the Macon and Brunswick Railroad, with the to be great city of Brunswick. For fifteen or twenty years the fine harbor has remained almost unimproved except by occasional efforts to bring it into notice. Now it has passed into the hands of Northern capitalists, and if they do not make it in reality what it has been so long in name—a city—it will not be through lack of enterprise and good location. It is already rapidly improving. The M. and B. R.R. has just been finished, and another to Albany and Eufaula is building. The idea is thence to connect westward and make Brunswick the great cotton-shipping port.

The orange fever has raged for some years in Florida with great violence. When put on paper that a tree yields so many oranges, and that there are so many trees to an acre, and each orange worth so much, an immense profit is made out. It is also represented to be a very easy way of making a living. But it must be remembered that it takes years for an orange grove to grow and bear well, and good orange lands near transportation are already taken up, and sell very high, and when hauling comes in profit goes out. As Col. Haines, of the A. and G. R.R., says, "I want the line of my road, and Florida too, settled up by Northern people, but they must not expect to find any place here that they can live without work."

Savannah is a very active place, and has this year largely increased its cotton shipment. The town has a sandy soil and is almost a perfect level. It is supplied with water by pumping to the top of a reservoir tower, from which the water is distributed to the city. The pressure is not very great, but answers amply for the hight of the houses there. A great point of interest in the city is the Cemetery of Bonaventure. It is a rather private affair, but well worth a visit. The evergreen oaks hung with the somber gray moss have a melancholy look, almost an appropriate one. Savannah has no manufactures, if we except some steam and rice mills. Money is worth too much to trade in and to advance it on cotton for manufacturing.

Macon, the great interior cotton mart of the State, is similarly situated, though there was a small cotton factory run by steam, which I was informed had a rather sickly existence—more from bad management than any real permanent cause. This place is at present the great manufacturing town of Georgia, and is likely to be still greater. It is located on the Chattahooche river, which, three miles above, commences a series of falls that end near the middle of the town. From thence the river is navigable all the year to the Gulf. The hight of this fall is about 165 feet. On this line there are three factories and one large flour mill. The upper factory, called the Columbus Manufacturing Co., R. H. Chilton, President, owns land up and down the river for a mile, and has a fall of 42½ feet, with water and sites sufficient to run 600,000 spindles. The factory now contains only 4,000 spindles and 96 looms. The pickers and cards are English, the rest American machinery.

Next below and in the limits of the town is the Muscogee Factory, running 4,000 spindles and 60 looms. The building is not full. The looms and spindles are American, the cards English.

The other mill is the Eagle and Phœnix, and is the largest in the South, having lately been enlarged. As it has a wide-spread reputation not only for the character of its goods, and its good management, but also from its using in so great measure English machinery, I will notice it more fully. The power used is in each mill or building—two double Leffel turbines, 56 inches in diameter. Other wheels in each drive the pickers, and one stands ready to drive a fire pump. Another 40-inch wheel drives the workshop machinery. Hight of fall is 14 feet. The two mill houses are 220 × 57, and five stories high. The picker room is 80 × 40, and three stories high. The finishing room is 120 × 40 feet. The dye-house is 120 × 40; and the machine shop 54 × 50. The office and ware-room building is 124 × 40, and two stories high.

They run 18,000 cotton spindles and 2,000 woolen spindles, All the woolen and about two thirds the cotton spindles are American. Of the looms, 8 run on cotton blankets, and 60 on woolen goods; 186 are American, and 350 are English. Of the American looms they have nearly every make, and endeavor to use every new improvement that promises to be valuable. An experienced Glasgow dyer does their work in that line.

I asked as to the value of the English machinery compared

with the American. The general superintendent, Mr. Young, was decidedly in favor of the English. He thought the looms did far more work, could be run at higher speed, and the spindles would do just as much. He did not believe in the ring-traveler, but would stick to the old English throstle. I asked the foreman of the spinning rooms his opinion. He said the American ring-traveler would do nearly or quite one fifth more than the throstle, but for high numbers of yarns the throstle did best.

Mr. Young gave me a history of his experience in cotton manufacturing in Georgia. He said years ago while he was keeping a country store, a man came along with a wagon-load of spun yards and wanted to sell it to him. "Why, I told him, the country people wouldn't buy his factory-made thread—every woman in the country had a spinning wheel. He insisted on leaving it with me, and said if I did not sell it he would take it back. Three months after he came along, and I had not only sold all but needed more. That was about the first factory-spun yarn sold in Georgia." Previous to the war there were thirty-three cotton and woolen factories in the State; now there are twenty-five—some not rebuilt.

In the loom rooms, I was told, they could get 50 yards per day from the English loom, and about 40 from the American. The American spindle, running on ordinary yarns, made from 5 to 5½, the English 4 to 4¾ ounces of yarn per spindle per day.

This factory uses a little over 3,000 bales of cotton a year and nearly 200,000 pounds of wool. The wool is almost entirely drawn from So. W. Georgia. Their cotton blankets are a specialty and peculiar to them in this country; they get their idea from France. The factory was erected by Capt. U. J. McAllister, who has made many improvements in machinery, and, as he told me, always got them patented through the Scientific American Patent Agency.

These mills are an example of what the people of the South can do if they choose. They have a capital all paid in of $1,250,000, of which only $125,000 is from the North. Mill No. 1 paid a dividend of 18 per cent in 1868; in 1869, mill No. 2 was commenced, and has but lately been finished and filled with machinery. Two mills located here were burned during the war. The Company own other fine water powers, and with the same enterprise may treble their capacity.

Columbus is destined to be the great manufacturing place of the South. There is no such water power elsewhere, and nowhere else such ease of transportation. Then, too, it is in the midst of a fine cotton-growing region, and shipped last year over 75,000 bales of cotton. I asked the cost of manufacturing here compared with the North, but did not get a satisfactory answer. It was evident they did not desire to tell. Yet there is at least the difference in the price of cotton, and the difference of transportation and cheaper labor. In a pamphlet issued by General Chilton, he claims that it costs $22 more to manufacture 500 pounds of cotton in Massachusetts than at Columbus—all charges and freights included. Labor is abundant, there being hundreds of poor whites anxious to get such work. General Chilton told me he had to turn them off daily.

There are three more cotton factories in the adjoining county of Upson, running about 7,000 spindles in all. In Columbus there are two large founderies and machine shops, and one agricultural implement manufactory; also near by, is Ennis' Novelty Wood Works, for spokes, hubs, etc., and patent wheelbarrows.

A railroad in Alabama will soon connect the town with the Alabama coal fields, and another southwards to Bainbridge, will give rapid and better communication to Savannah *via.* A. & G. R. R.

Coal is now brought from Tennessee. The town is supplied with gas made from wood. It has no water works, but John E. Birkenbine, of Philadelphia, was there to examine localities, and report on the possibility of erecting suitable works. It is one of the needs of the place, especially as it will have a large manufacturing population, and should be well supplied with water. Good water can readily be had from the hill north of the town. H. E. C.

Nerve Telegraphs.

Within the flesh or muscular part of the body are two distinct sets of nerves, namely, the motor and the sensory nerves. By the sensory nerves the brain receives intelligence of all outward actions, and the mind becomes conscious of external things, such as light, scent, sound, taste, and touch, of pain or pleasure. The motor nerves, on the other hand, convey the intelligence or will of the mind from the brain to the outward world, by directing the muscular motion. If the brain desires the hand to strike the strings of a harp, it does so by the motor nerves; but the sound which is returned is conveyed to the brain by the sensory nerves. Intelligence from the brain to any part of the body, and conversely, is conveyed by the nerves at a velocity of 112 feet per second; that is, at a speed of one mile in 47 seconds. Quick as this may appear, the time between a wound given and the pain felt is appreciated. By what means the mind or will acts over the nerves we are unable to say. Persons who have what is figurately termed "an iron will" can endure pain with almost stoic indifference. Neither tears nor laughter seem to move them. Others there are who have so little command over their nerves that trivial things affect them greatly. To train the mind to exercise its will over the nervous system is highly beneficial.—*S. Piesse.*

Fire-Arms in Turkey.

The *Levant Herald* says the Porte has decided upon converting a large number of the Springfield and Enfield rifles into Remingtons, and several thousand breech-pieces on this latter system have been purchased in Vienna. As soon as the conversion has been effected the new arms will be served out to portions of various regiments with a view to test their practical value on a large scale. The military and naval preparations are being pushed on at Tophaneh, Zeitounbournou, and in the arsenal, in all three of which large numbers of hands are working extra time. In addition to the arms and munitions which are being rapidly manufactured in these establishments, a considerable contract for cannon on Krupp's system has been given to a house in Vienna, whence several batteries of mitrailleuses have also been ordered, in addition to those already purchased in Belgium and America.

RAZING BAND SAWS.

A correspondent of the *English Mechanic*, gives the following directions for brazing band saws: 1. Make a splice with a file on flat way of saw, the length of two teeth. 2. Get a

piece of flat iron, and bend it into the same shape as in the diagram, and with some small binding wire bind the saw perfectly straight and firm to the flat iron, so that the splice may come directly over the curve. 3. Wet the splice with clean water and rub on some powdered borax. 4. Make a stiff paste with spelter and borax mixed with water. Take a piece the size of a small nut and lay on top of splice. Put the splice between two pieces of charcoal and with a blow-pipe direct a steady flame from a gas jet on the paste.

TAX OF TRANSPORTATION.—The country that exports the commodity of smallest bulk, is almost wholly freed from the exhausting tax of transportation. At Havre—ships being little needed for the outward voyage, while ships abound—the outward freights must be always very low. France, in 1856, exported silks and cloths, clothing, paper, and articles of furniture, to the extent of $300,000,000; and yet the total weight was short of fifty thousand tuns—requiring for its transport but forty ships of moderate size, and the services of perhaps two thousand persons.—*Carey.*

TRADE-MARKS AND DESIGNS.—Some of our prominent manufacturers have just discovered the existence of the new law, which authorizes foreigners to patent their trade-marks and designs, and find that it will seriously cripple their right to continue the practice of copying designs of foreign carpets, delaines, and other stuff goods. We are assured that a powerful effort will be made at the next session of Congress to repeal this law; therefore it behooves those who wish to protect their designs to do so at once. If the law should be repealed it cannot affect existing design and trade-mark patents.

EXTENSIVE SALT DEPOSIT NEAR BERLIN.—The boring at Sperenberg, near the city of Berlin, about twenty-five miles to the south, had reached, on the first of June last, a depth of 3,090 feet, and for 2,810 feet is through a bed of rock salt. How much deeper the deposit is remains to be tested by further boring. The deposit appears to be quite as rich as the famous Stassfurt mines.

THE only shot tower in New England is, it is said, at Newport. This tower is 150 feet high. The lead is melted at the top of the tower and falls through sieves, cooling in drops of different sizes as it falls, which are caught by sieves of different sizes, and thus sorted for use.

THERE are now ten establishments in Missouri engaged in making pig iron, with a capacity of making 300 tuns of iron per day. Four of these establishments are situated in South St. Louis, three near the line of the South Pacific Railroad, and the remainder on the line of the Iron Mountain Railroad.

QUERIES.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers, and hope to be able to make this column of inquiries and answers a popular and useful feature of the paper.]

1.—IRON CASTINGS.—I have a difficulty to get my iron castings solid on the side which is uppermost in casting; would some brother molder give me a little advice as to the cause and remedy, and oblige?—A Young Molder.

2.—BLACK JAPAN.—Can you inform me how the pitch is prepared that is used in making black japan, and also how the japan is made, so that when put on a coach panel and varnished it does not turn green?—H. W. B.

3.—WATER COLORS.—Will some reader inform me how the liquid water colors in bottles are made; also how the moist water colors in pans are made?—W. C. C.

4.—POWER OF ENGINE.—Would any reader let me know, through the medium of your Journal, the pressure necessary to drive a fourteen horse-power high-pressure engine to work at its nominal power and how many revolutions per minute should it go?—J. B.

5.—LACKERS.—Will some obliging reader who is acquainted with lackering give me the recipes for making a good gold lacker, a good green lacker for bronzing, and a pale, colorless lacker?—Indicator.

6.—SILVERING CHEAP LOOKING LOOKING-GLASSES.—Can any of your readers tell me the way to silver cheap looking-glasses? also the materials required, and method of using? Having some pieces of glass that I want silvered for a particular purpose I should like to try and do it myself.—A. M.

7.—CHEMICAL AND BREWING.—The water I use for brewing contains a large quantity of iron. How can I get rid of this iron in the water? It prevents the beer getting bright. Would a filter of animal charcoal, vegetable charcoal, and gypsum do? I want some sort of filter which will ex act the iron without damaging the water in other respects.—Brewer.

8.—REMOVING PAINT AND TAR.—How can I remove oil paint and tar from oil-cloths, tarpaulins, and other fabrics, so as to obtain the body cloth intact? Can some kind reader oblige?—Old Tar.

9.—THE BIRD AND THE BAT.—Will any of your readers inform me of the mechanical principles involved in the flight of the bird and the bat, and also wherein the difference between the two modes consists, or refer me to any work in which I might find such information.—T. H.

10.—WHITE LIGHT.—I am greatly in need of an artificial white light, one by which I can distinguish shades of color; not required to be intense but regular, and moderate in cost first and second. Is there any plan of taking the yellow out of gas or any other artificial light? I have tried tinted glasses for correction, but they do not answer.—J. O. H.

11.—CONTRACTION AND EXPANSION OF METALS.—If iron be heated and plunged into cold water it becomes hard and contracts, but if copper be heated and plunged into cold water it becomes soft. How is this accounted for? It seems a contradiction of the general law, viz., that all bodies expand by heat and contract by cold.—A. C. S.

12.—SOLDERING BRASS TUBES.—Will some reader tell me how to join thin brass tubes without the application of heat?—W. H. D.

13.—DRY COLORS.—I should feel obliged if some of your subscribers will inform me how to make dry colors, such as greens and blues, etc., or name a work which will give the information; also the best work on varnish making.—H. J. D.

14.—A COTTON SPINNER'S DIFFICULTY.—Would any of your readers in the cotton district help a brother spinner out of a difficulty? I have to work a double beater scutcher, and the cotton will stick to the last beater blades, and when it gets on to one side takes all the draft from the other, and so causes one part to choke and make a bad lap. I know there are plenty of books giving instructions as to calculations, but every one who is in the trade knows that to be a very small part of cotton spinning.—Workman.

15.—DRY PLATE PROCESS.—Will some photographic reader furnish me with the formula and manipulation of one of the best dry plate processes for a novice in the art to commence with?—A Would-be Photographer.

16.—ENGINEERING ESTABLISHMENTS.—Will some subscriber please state what engineering works employ the largest number of hands, and state the number of hands employed by several of the largest works in the world?—Draftsman.

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.

W. R. J. answers the inquiry of I. D., in re ard to coloring butter, and preserving eggs. He recommends for coloring butter the juice of fresh carrots, or annotta, but gives no definite directions for the use of these materials. He says eggs may be kept by packing them in salt or bran point downward. He further says W. H. L. can get rid of red ants by sprinkling sugar on a coarse or very porous sponge. The ants will enter the cavities of the sponge to get the sugar, and being thus trapped they may be killed by immersing the sponge in hot water. The sponge may be used repeatedly in this way till the pests are removed The more sponges used the more rapid will the extermination proceed M. W., of Passaic, N. J., also recommends this plan.

Dr. T. A. H., of Ill., says red ants will not frequent a place where heavy coal oil has been smeared. A ring of this substance placed around a sugar barrel will, he says, protect the contents from the ants. Will he tell us whether the odor will not impregnate the sugar? He also recommends the method for keeping eggs given by W. K. J., of Illinois, but adds that it is important to keep them where the temperature does not rise above 50° nor fall lower than 32°.

R. L. C., of W. Va.—Birdlime may be made by boiling linseed oil over a slow fire till it is very thick and glutinous. Its adhesiveness may be proved by trial with the fingers. You will need to use much care not to burn it, and the vessel employed should not be more than one third full of oil. When sufficiently boiled pour it out into cold water. It is considered best to make it thicker than is actually necessary for use, and to bring it back to the proper consistency by mixing it with pine tar.

A. D. G., of Mass.—The theory in regard to the effect on health of the evaporation of water on heaters and stoves, is that the capacity of air to hold moisture is increased by heat, and that if not supplied in the manner alluded to it will seize moisture from the mucus membranes of the nose, throat, and lungs, irritating them, and rendering them unhealthy and susceptible to effect of atmospheric changes.

E. B., of Ill., says red ants may be exterminated by using a solution of one tablespoonful of tartar emetic in a pint of water. This placed where the ants can get it will, he says, prevent all further annoyance from them. Tartar emetic is, however, a deadly poison, and should, if used at all, be used with extreme caution.

G. R., of Mo.—The dark color of the steam escaping from the safety-valve of the boiler of which you speak, was probably due to the violent priming of the boiler. It is obviously impossible to give an intelligent opinion as to the primary cause of the explosion, without a personal inspection of the boiler, and full knowledge of the attendant circumstances.

E. G. P., of Mass., replies to R. L., of La., that he finds no better recipe for welding steel, than extensive careful practice. With that and a clean slow fire, and a liberal amount of borax, he finds no difficulty in welding steel to steel though it be hard and "rich in carbon."

W. H. A., of Tenn.—To join together pieces of tortoise shell, dress down the edges to a nice, true bevel, then lap them together and press them between hot iron plates. In practical working, tongs with long flat jaws are used for this purpose.

H. F., of Conn.—Rules for calculating diameters of speed pulleys are given in Fairbairn's "Mechanism and Machinery of Transmission," published by Henry Carey Baird, 406 Walnut Street, Philadelphia.

S. P., of N. Y.—After oil cloth has been well washed and is quite dry from water, it should be brushed over with beeswax, very slightly moistened with turpentine, then well polished with a polishing brush. Don't use soap and water—soap dissolves the oil.

J. A. C., of Md.—In our opinion borax and sal ammoniac constitute as good a flux in welding steel as any of the vended receipts.

J. H. E., of Iowa.—Our files contain all the information you seek on the subject of stained glass. We do not wish to repeat what we have said on this subject at present.

N. L., of N. Y.—No valuable information is conveyed in your article upon astronomy, therefore we cannot publish it.

W. M. W., of Ohio, wishes to know if cast iron can be hardened so as to retain its hardness after he ti

D. D. V., of Ill.—Copal varnish of the finest quality may be used on polished steel. It will not attack the metal.

W. E H., of Ct.—We have not published recently any article of the kind to which you refer

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For Fruit-Can Tools, Presses, Dies for all Metals, apply to Mays & Bliss, 118, 120, and 122 Plymouth st., Brooklyn, N. Y. Send for circular.

Practical Treatise on Soluble or Water Glass, just published. Price $3 20, mailed free, by L. & J. W. Feuchtwanger, Chemists and Drug Importers, 55 Cedar st., New York.

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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.

Recent American and Foreign Patents.

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

FLOATING VELOCIPEDE.—Wederkinch & Starkweather, Boston, Mass.—This invention relates to a new floating velocipede which can be conveniently operated and readily propelled, and consists in such a construction and combination of a frame, double floats, steering apparatus, and paddle wheel, that the rider straddles the paddle wheel in operating the crank axle of the same.

BRICK PRESS.—John R. Williams, Taunton, Mass.—This invention relates to a new machine for rapidly compressing brick after the same have been formed in another machine, and for thereby making them durable, hard and of equal size. The invention consists, chiefly, in the novel construction of press and carrier, both being arranged to operate automatically and with great rapidity, the carrier serving to feed the press, and also to remove the finished brick.

PISTON PACKING.—John Gates, Portland, Oregon.—The object of this invention is to provide an elastic and steam tight piston packing, which is composed of sectional rings, in such manner that the same may be spread apart by means of an inner spring.

HORSESHOE.—John S. Robertson, Wood End, Scotland.—The object of this invention is to provide an appliance by means of which horses may, in a few minutes, be fitted for encountering ice and snow, and by means of which the feet will be protected, and it consists in a metallic plate attached to the ordinary horseshoe.

LETTER AND PAPER FILE.—Frank W. Whitney, Brooklyn, N. Y.—This invention relates to a new and useful improvement in a file for preserving from damage, and in regular order, letters and other papers, including newspapers, pamphlets, periodicals, etc., and it consists in a succession of springs (more or less in number) attached to a backing of suitable material, and either combined with a book cover or not as may desired.

VENTILATOR.—William F. Ross, Davenport, Iowa.—This invention has for its object to furnish an improved means for ventilating rooms, cars, mines, and other inclosed spaces, with warm or cold fresh air, as may be required, free from dust and other impurities.

STRAW CUTTER.—E. A. Cralle, Jr., Brickland, Va.—This invention has for its object to furnish an improved straw cutter, simple in construction, strong, durable, and effective in operation, doing its work with great ease to the operator.

DITCHING AND GRADING MACHINE.—H. A. Winter, Windsor, Ill.—This invention has for its object to furnish an improved machine for opening ditches, and for grading roads and other places, which shall be simple in construction, inexpensive in manufacture, and effective in operation.

TOPS FOR GAS AND WATER STOP-COCK BOXES.—W. W. Pallis, St. Louis Mo.—This invention has for its object to improve the construction of the tops of gas and water-pipe boxes so as to make them more convenient in use, and which will prevent the possibility of the covers of said boxes being lost or carried off.

BENDING MACHINE.—Joshua Fipps, New Albany, Ind.—This invention relates to improvements in machines for bending wood bars, such as plow handles, and the like, and consists in a combination of a forming block and clamping bar, attached to a suitable frame, and a bending spring and holding apparatus.

SPRINGS.—A. W. McKown, Honesdale, Pa.—This invention relates to improvements in springs for wagons mainly, but applicable for other uses and it consists in a combination of cylindrical india-rubber springs, wood springs, and bars, calculated to form very efficient springs, which may be cheaply made.

LUNCH BOX.—James Elson, Northampton, Mass.—This invention relates to improvements in that class of lunch boxes which are made to resemble books, and it consists in inclosing an inner case of tin, like the said boxes as now made, in another box or case, made of paper, pasteboard, or other like substance of the same character as the covers of books, by which neater boxes are produced, more nearly resembling books, and better calculated to protect the contents from heat or cold, the said paper being non heat-conducting.

SETTING BOILERS.—Charles Neames, New Orleans, La.—This invention relates to improvements in setting cylindrical or flue boilers, and has for its object to provide for consuming the smoke and gases more effectually than is now done. It consists in an arrangement of a deep chamber behind the bridge wall at the rear of the fireplace, into which a supply of fresh air is conducted below the grate, and to which the gases are conducted by a downward sloping arch, surrounding the boiler, over the said chamber, so that the said gases are prevented from coming in contact with the boiler before being sufficiently heated, and are brought into the presence of a sufficient quantity of oxygen to make the most perfect combustion.

SULKY PLOW.—Milo A. Elliott, Stratford Hollow, N. H.—This invention has for its object to furnish an improved sulky plow, simple in construction, easily operated, and effective in operation, being so constructed that it may be readily adjusted to cut a deep, shallow, wide, or narrow furrow.

PLOW.—Andrew Day, Crystal Springs, Miss.—This invention has for its object to furnish an improved plow, simple in construction, and effective in operation, and which shall have an adjustable scraper connected with it.

ADJUSTABLE COAT PATTERN.—George P. Sweezy, Riverhead, N. Y.—This invention has for its object to furnish a coat pattern which may be placed upon and adjusted to the form of each customer, so that any size coat may be cut, and cut to fit perfectly, with scarcely the possibility of mistake.

BUTTER PRINTER.—W. C. Stern and James W. Robinson, London Grove, Pa.—This invention relates to a new and useful improvement in a machine for printing butter in the process of preparing it for market.

MILL GEARING.—Henry Shoemaker and John A. McClintock, Perry, Ill.—The object of this invention is to provide convenient and efficient means for starting and stopping the burr stones of flour mills, without stopping or retarding the propelling power, and it consists, first, in a mechanism for throwing the spindle pinion out of and into gear with the spur driving wheel, and fixing it in position; secondly, in the use of a coil spring in the pinion, by means of which the inertia of the burr is overcome, so that the gearing revolves smoothly and without jerk or concussion; and, thirdly in the mode of revolving the pinion without driving the burr or spindle.

SAFE LOCK.—Cryden F. Atwood, Hancock, Wis.—This invention has for its object to construct a safe lock, which will be absolutely safe against false keys, and which, in fact, cannot be opened by any key, being locked by clockwork that is concealed within the safe. No keyhole or knob will therefore enable burglars to apply their tools with a view of opening the lock. The invention consists chiefly in the application to the safe of a concealed clockwork, which serves to withdraw the bolt at any time to which it may have been set.

LINIMENT.—James C. Branch and Hugh P. Quinn, Washington, Ga.—This invention relates to a new and useful improvement in a liniment for curing rheumatism, neuralgia, and similar diseases.

COMPOSITION FOR LIQUID GLUE.—William Horwitz, New York city.—This invention relates to a new composition for a liquid adhesive material, which is not liable to ferment or congeal when prepared, and which will be insoluble in water after application.

OPERATING PLOWS.—James O. Potter, Rouseville, Pa.—The object of this invention is to provide means for operating plows with less manual labor than is now required, and for keeping the plow more steady and regular in its movements in the ground than by the ordinary mode.

HYDRAULIC APPARATUS.—Nicholas Nolan, New York city.—The object of this invention is to provide means for elevating without additional power, water, or other liquid, to a hight greater than that at which it has its original level.

ELECTRO-MAGNETIC LOCK.—Henry Arden, St. Louis, Mo.—This invention has for its object to so construct a lock for safes, vaults, etc., that the same may be operated entirely by means of electricity, so that no keyhole need be provided in the safe door, nor any register on the safe, whereby the bolt may be withdrawn. A safe provided with an operating lock of this invention was exhibited in the recent American Institute Fair.

ASH SIFTER.—W. S. Esty and I. S. Clough, New York city.—This invention consists of a simple and inexpressive device for separating the coal from ashes, and also flour, grains, and other materials, from impurities. The simplicity, cheapness, and efficiency of the machine recommend its extensive adoption. Mr. Clough is prepared to furnish the machine and dispose of rights at 62 Fulton St.

SPRING BED BOTTOM.—Thomas A. Carl, Nashville, Tenn.—This invention relates to a new bed bottom, which is supported by spring bars, made vertically adjustable along the inner faces of the side rails.

MEDIUM FOR TURNING MUSIC SHEETS.—Albert Kraft, Berlin, Prussia.—This invention relates to a new and useful improvement in a device for turning the sheets or leaves of music, when performing on a piano or other musical instrument, and it consists in so operating metallic fingers that the performer can, by simply pressing on a knob with the foot, cause the finger to turn the sheet or page of music to the end of the piece.

WATER WHEEL.—F. G. Coggin, Burlington, Vt.—This invention relates to a new chute mechanism for water wheels in which the chutes are made movable by being cast or secured to movable rings, and connected with gates that are pivoted to the stationary wheel case in such manner that by the movement of said movable rings the chutes and gates are adjusted simultaneously to more or less open the water veins, and consequently regulate the flow of water through the wheel.

DUMPING CARS AND CARTS.—S. D. King, Middletown, N. Y.—The object of this invention is to so construct a dumping car or cart that the tail board need not be taken off for every operation of dumping, but may be removed when required.

COMPOSITION FOR PENCILS.—William Geller, New York city.—This invention relates to a novel composition for pencils or marking instruments, and consists in the use of potato pulp for that purpose.

BOX OR BARREL SCRAPER.—F. B. Hill, East New York, N. Y.—This invention has for its object to furnish an improved tool for scraping the ends of barrels and the sides of boxes, to remove an old direction or mark, and prepare them to receive a new one.

MACHINE FOR AND PROCESS OF SCOURING THE EYES OF NEEDLES.—H. A. Nettleton and E. R. Lawton, West Cheshire, Conn.—This invention has for its object to facilitate the scouring or "threading" of the eyes of sewing machine and other sewing needles, and consists chiefly in the application of a movable scouring thread whereby the desired effect is rapidly produced.

PARLOR OR ROLLER SKATES.—T. F. Leak, Montgomery, Ala.—This invention has for its object to furnish an improved parlor or roller skate which shall be simple in construction and reliable in use, being so constructed that the wood of the skate may rock upon the roller frames to enable the said wood to accommodate itself to the necessary movements of the foot.

SAW MILL HEAD BLOCK.—B. F. Richardson and D. Richardson, Martinsburgh, Iowa.—This invention relates to a new and useful improvement in machinery for sawing lumber, having especial reference to the mode of handling and supporting the log, and it consists in a separate carriage or chair for each head block which may be moved either simultaneously or independently of the other, and in the mode of setting and dogging the log.

COMPOSITION FOR COATING BEARINGS, ETC.—P. J. Kelly, New York city.—This invention relates to a new compound for covering soft material, such as leather, paper, etc., to prepare the same as a bearing or step for shafting and axles of suitable kind. The compound is metallic, and serves to utilize fibrous substances for bearings, and to cause a reduction of friction, as the soft bearing will be more yielding than the hard metallic bearings heretofore in use.

SCROLL SAWING MACHINE.—A. M. Schilling, Chicago, Ill.—This invention has for its object to improve the construction of my improved scroll-sawing machine, patented March 30, 1869, and numbered 88,417, so as to make it more durable, more effective in operation, and more convenient in use.

THIMBLE SKEIN AND BOX FOR WHEELED VEHICLES.—Thomas Smart, Jr., Brockville, Canada.—This invention relates to a new self-lubricating axle-box or thimble skein for wheeled vehicles, and consists in such a construction of the skein and box that the lubricating material will by the box be distributed transversely and on the skein longitudinally, so as to be brought in contact with every portion of the surface to be lubricated.

COMBINED PIN-CUSHION ADVERTISER AND CALENDAR.—Marcus Ormsbee, Brooklyn, N. Y.—This invention consists in a pin-cushion advertiser or picture ca and calendar combined and arranged in a small, light, and compact disk-shaped article suitable for carrying in the pocket without inconvenience.

BEE HIVE.—J. A. Douglass, Altoona, Pa.—This invention relates to improvements in bee hives, and consists of two boxes and a slide arranged together in a peculiar way for transferring the bees from one to another.

IRON BLOCK LINING FOR FIRE POTS.—Edward A. Tuttle, Williamsburgh, N. Y.—This invention has for its object to furnish improved iron blocks for lining the fire pots of stoves, heaters, furnaces, etc.

WELL BORING APPARATUS.—Noah H. Lindley, Bridgeport, Conn.—This invention has for its object to furnish an improved apparatus for boring or digging wells, which shall be simple in construction, and effective in operation, cutting out and raising the dirt with dispatch, while, at the same time, leaving the inner surface of the bore or cut straight and smooth.

FENCE.—U. D. Mihills, Fond du Lac, Wis.—This invention has for its object to furnish an improved fence, simple and cheap in construction, strong and durable, and not liable to sag, or to be blown or pushed over.

DEEP-WELL PUMPS.—Martin Van Buren Rowley, Worcester, N. Y.—This invention has for its object to furnish an improved pump designed for use in deep wells and other situations where water is required to be raised to a greater hight than it can be by pumps constructed in the ordinary manner.

OYSTER DREDGE WINDER.—Charles T. Belbin, Baltimore, Md.—The object of this invention is to prevent the windlasses, used on board of vessels under way (for the purpose of hoisting oyster dredges), from being suddenly and violently reversed, to the great danger of the men and the machinery, in case of the dredge accidently catching upon a rock or other immovable obstacle. To this end, it consists in winding the dredge-rope or chain upon a spool upon the windlass, which is ordinarily prevented from turning on the shaft, when the latter is moving in the right direction, by means of a clutch, but is instantly released automatically from the clutch the moment the windlass turns backwards.

COTTON SCRAPER AND CHOPPER.—Nathan M. Hale, Cleborne, Texas.—This invention consists in the combination of a pair of plows, placed just far enough apart to run one at each side of a row of cotton plants and close to the same, for the purpose of laying them bare of dirt; with a hoe placed in rear of the said plows for chopping the row transversely into stands; and with a second pair of plows placed in rear of the hoe, and arranged so as to throw dirt towards the plants from each side in order to form a ridge, the said hoe being combined with a mechanism which operates it as the plow is drawn along.

HORSE POWERS.—Rufus W. Crouse, Westminster, Md.—This invention is an improvement on that for which letters patent, No. 95,440, dated October 5, 1869, were issued to Diffendal and Hughes. The invention consists in a tumbling shaft extending entirely across the space beneath the main driving pinion, and bearing a coupling box at both ends so that connection may be made at either extremity; and a bevel pinion placed on the tumbling-shaft in such connection with the main driving pinion, as to receive motion in the right direction when the horses are traveling with the sun

GANG PLOW.—William Mason, Independence, Oregon.—This invention relates to an improvement on the plow, for which letters patent of the United States were granted Wm. Mason, January 12, 1869, and is designed to simplify the construction of the same so as to reduce its weight and cost, and increase its efficiency.

PRESERVING WOOD.—F. Lear, St. Louis, Mo.—This invention consists in a simple, strong, portable, and convenient apparatus, adapted to permit the ready insertion and removal of the log or other piece of timber, whether straight or crooked. The construction is such as to insure the permeation by the preserving liquid of the sound as well as of the unsound or less dense portions of the timber, and that without employment of extra or additional devices.

DOOR BOLT AND HANDLE.—A. A. Stuart, Plainfield, Iowa.—This invention relates to a new mechanism for locking and unlocking doors, and consists chiefly in the use of a bow-shaped handle, which is provided with a sliding wedge, whereby the bolt can be opened.

DEVICE FOR UNLOADING WAGONS.—Isaac Williams, Westfield, Ind.—This invention relates to a new attachment to farmers' wagons, and has for its object to facilitate the unloading of the same, and to enable persons unloading to immediately make use of their scoops.

CHANNEL LAYING MACHINE.—Seth D. Tripp, Lynn, Mass.—This invention relates to improvements in machinery for the manufacture of boots and shoes, and consists in a combination with a last, or former, for holding the boot or shoe of rubbing or smoothing belts, rollers, or screws, arranged to so act upon the soles of the boots or shoes as to lay the ridge of leather raised in forming the channel in which the stitching or pegging for attaching the sole is done back into the channel and smoothing it down.

BED SPRINGS.—D'Alembert T. Gale, Fort Wayne, Ind.—This invention relates to an improved manner of connecting the top and bottom coils of coiled bed springs, and it consists in an arrangement of loops or eyes in one end coil and hooks in the other, and the hooking of the same together.

FASTENING FOR CLOTHES.—Frank M. La Bolteaux, College Hill, Ohio.—This invention relates to improvements in buttons or fastenings for clothes, and consists in a button of any form or size, having a small stem projecting from the center in which a slot is made on the outer end, and hook-shaped notches in the walls of the slats, which will admit of turning the said stem a quarter of a revolution, after passing into an eyelet having a cross-bar so arranged as to be received in the said slot, the said notches thus engaging the said bar and holding the button to prevent it being drawn out; the stem is passed through a small hole in the part of the cloth to which the button is to be attached, and screws into the button; the eyelet is placed in one part of the cloth to be buttoned, and the stem of the button is passed through the other into the eyelet.

Official List of Patents.

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108,951.—PAD AND TRUNK LOCK.—A. M. Adams, Washington, D. C.
108,952.—ELECTRO-MAGNETIC LOCK.—Henry Arden, St. Louis, Mo.
108,953.—FANNING MILL.—H. K. Averill, New Oregon, Iowa.
108,954.—PUMP.—W. C. Barker, Ypsilanti, Mich.
108,955.—GEARING FOR METAL PLANERS.—W. M. Barr, Williamsport, Pa. Antedated October 28, 1870.
108,956.—HEAD REST.—J. S. Bartlett, Warsaw, N. Y.
108,957.—COMPOUND FOR PIPES, TILES, SIDEWALKS, ETC.—W. A. Battersby, Williamsburgh, N. Y., assignor to himself, T. R. Crawford, Robert Brown, and John Anderson.
108,958.—SPARK-CATCHER AND CONSUMER.—Darwin Beach, Oshkosh, Wis.
108,959.—SUCKER-ROD COUPLING.—J. H. Beatty, Franklin, assignor to John Adams and T. W. Brigham, Venango county, Pa.
108,960.—BEE HIVE.—Joseph Behe, Carrollton, Pa.
108,961.—HAT AND COAT-RACK.—G. T. Benson, Jersey City, N. J.
108,962.—ORE WASHER.—Hezekiah Bradford, Reading, Pa. Antedated October 28, 1870.
108,963.—LINIMENT.—J. C. Branch and H. P. Quin, Washington, Ga.
108,964.—PERMUTATION LOCK.—F. H. Brown (assignor to himself and B. J. Wiley), Chicago, Ill. Antedated November 5, 1870.
108,965.—APPARATUS FOR COOLING THE VAPORS OF OXIDE OF ZINC.—J. E. Burrows, Newark, N. J.
108,966.—SPRING BED BOTTOM.—T. A. Carl, Nashville, Tenn.
108,967.—STEERING MECHANISM FOR VELOCIPEDE.—Andrew Christian, New York city.
108,968.—SASH HOLDER.—C. B. Clark, Buffalo, N. Y.
108,969.—CHURN.—Timothy Coffield and Benedic Egli, Natrona, Pa.
108,970.—WATER WHEEL.—F. G. Coggin, Burlington, Vt.
108,971.—GATE LATCH.—Calvin Cole, Ithaca, N. Y.
108,972.—SHADE FOR LAMP AND GAS BURNERS.—M. H. Collins, Chelsea, Mass.
108,973.—FOLDING CHAIR.—T. B. Comins, Jr., Lowell, Mass.
108,974.—STRAW CUTTER.—E. A. Cralle, Jr., Brickland, Va.
108,975.—PLOW.—R. S. Crockett, Rossville, S. C.
108,976.—PORTABLE ELEVATOR AND CONVEYOR.—H. C. Crosby, Chicago, Ill.
108,977.—DEVICE FOR KEYING PAVING BLOCKS.—P. D. Cummings, Portland, Me.
108,978.—STEAM RADIATOR.—L. S. Daniels, Foxborough, Mass.
108,979.—PLOW.—Andrew Day, Crystal Springs, Miss.
108,980.—TYPE-SETTING MACHINE.—Manoel de la Pena (assignor to J. G. O. Guimaraes), New York city.
108,981.—SAW MILL.—Moses Delude, Carrolton, Mich.
108,982.—VALVE GEAR FOR STEAM ENGINE.—W. B. Doddridge, Hebron, Ind.
108,983.—PRESERVING MEAT, FISH, OYSTERS, ETC.—J. E. Dotch, Washington, D. C. Antedated October 29, 1870.
108,984.—BEE HIVE.—J. A. Douglass, Altoona, Pa.
108,985.—INSOLE FOR MANUFACTURING SHOES.—C. S. Dunbrack, Swampscott, Mass. Antedated November 7, 1870.
108,986.—SCREW SPIKE FOR RAILROADS.—A. C. Dunn and I. L. Dunn, New York city. Antedated October 28, 1870.
108,987.—LOCK NUT.—Philip Dyer, Jr., Abram Parker, and W. B. Way, Pontiac, Mich.
108,988.—SEED PLANTER.—J. M. Elliott, Winnsborough, S. C.
108,989.—LUNCH BOX.—James Elson, Northampton, Mass.
108,990.—BLANK FOR SAW TEETH.—J. E. Emerson, Trenton N. J.
108,991.—ASH SIFTER.—W. S. Esty and I. S. Clough, Brooklyn, N. Y.
108,992.—WOOD-BENDING MACHINE.—Joshua Fipps, New Albany, Ind.
108,993.—CHILDREN'S CARRIAGE.—I. N. Forrester, Bridgeport, Conn.
108,994.—WINDOW SASH WEIGHT.—J. T. Foster, Jersey city, N. J., assignor to William Stanley, Englewood, N. J.
108,995.—HORSE COLLAR PAD.—John Fraser, Dowagiac, Mich.
108,996.—ATTACHMENT OF CULTIVATOR FRAMES TO WAGON AXLE-TREES.—David Fuller, Fullersburg, Ill.
108,997.—BEE HIVE.—G. G. Gabrion, Olive, Mich. Antedated October 28, 1870.
108,998.—BED SPRING.—D. T. Gale, Fort Wayne, Ind.
108,999.—PISTON PACKING.—John Gates, Portland, Oregon.
109,000.—COMPOSITION FOR PENCILS.—William Geller, New York city.
109,001.—LATERALLY SLIDING THROTTLE VALVE.—William Girss, Brooklyn, N. Y.
109,002.—ROOFING COMPOSITION.—J. P. Godfrey, Manchester, N. H.
109,003.—REED ORGAN.—H. N. Goodwin, Syracuse, N. Y.
109,004.—STEAM TRAP.—M. C. Gove, Lowell, Mass.
109,005.—LATH MACHINE.—J. T. Hall (assignor to himself and Isaac Pierce), Alma, Mich.
109,006.—PENDULUM CRUSHING MILL.—James Hart, Sweeden Center, N. Y.
109,007.—AWNING.—William Hildebrand, Fort Wayne, Ind.
109,008.—BOX SCRAPER.—F. B. Hill, East New York, N. Y.
109,009.—PREPARATION OF PEAT.—C. E. L. Holmes, New York city.
109,010.—LIQUID GLUE.—William Horwitz, New York city. Antedated October 24, 1870.
109,011.—ROCKER-CHAIR.—C. H. Hudson and Joel Bowker, New York city, assignors to C. H. Hudson.
109,012.—EXTENSION SCAFFOLD.—John Hughes, New Berne, N. C.
109,013.—GOVERNOR FOR STEAM ENGINE.—R. K. Huntoon Wakefield, assignor to J. A. Lynch, Boston, Mass.
109,014.—FIRE-CRACKER PISTOL OR HOLDER.—Robert Hutchison, Newark, N. J.
109,015.—MACHINE FOR EXTRACTING STUMPS.—J. A. Jenkins Clarksville, Mo.
109,016.—SPINNING WHEEL.—Thomas Johnson, Ruby Post Office, assignor to himself and George Adams, Watrousville, Mich.
109,017.—COAT AND HAT RACK.—James M. Keep, New York city.
109,018.—COMPOSITION FOR COATING BEARINGS.—P. J. Kelley, New York city.
109,019.—DIGGING MACHINE FOR AGRICULTURAL PURPOSES.—A. L. Kennedy, Philadelphia, Pa. Antedated October 22, 1870.
109,020.—DUMPING-CAR.—S. D. King, Middletown, N. Y., assignor to himself and J. M. Welch, Bradford, Pa.
109,021.—FLUX FOR WORKING METALS AND MINERALS.—Solomon W. Kirk (assignor to himself and Henry Thomas), Philadelphia, Pa.
109,022.—FIREPLACE STOVE.—Philip Klotz, Baltimore, Md.
109,023.—MEDIUM FOR TURNING MUSIC SHEETS.—Albert Kraft, Berlin, Prussia, assignor to F. G. Utassy & Co., New York city.
109,024.—BUTTON-FASTENER.—F. M. La Bolteaux, College Hill, Ohio.
109,025.—REMOVING DIES MADE FROM ANILINE, ETC., FROM PORTIONS OF FABRICS.—Jean Lambert, Jr. (assignor to Gustave Bourgade), New York city.
109,026.—PARLOR SKATE.—Tilman F. Leak, Montgomery, Ala.
109,027.—COLORING AND PRESERVING WOOD.—Frederick Lear, St. Louis, Mo.
109,028.—WELL-BORING APPARATUS.—N. H. Lindley, Bridgeport, Conn.
109,029.—DOUBLE AND SINGLE-TREE ATTACHMENT FOR STREET CAR.—J. F. Lowe, Louisville, Ky.
109,030.—WASHING AND TRANSPORTING SAND.—David D. Mallory, Mystic Bridge, Conn.
109,031.—DEVICE FOR FASTENING DESKS, SEATS, ETC., TO FLOORS.—John D. McAuliff, St. Louis, Mo. Antedated October 28, 1870.
109,032.—HORSE HAY FORK.—W. W. McFaddin, Ennisville, Pa.
109,033.—SPRING FOR WAGON.—A. W. McKown, Honesdale, Pa.
109,034.—BRICK MACHINE.—William Mendham and Cyrus Chambers, Jr. (assignors to Edwin Chambers and Cyrus Chambers, Jr.), Philadelphia, Pa.
109,035.—ANIMAL TRAP.—John B. Merriman and George B. Lewis, Plantsville, Conn.; said Lewis assigns his right to said Merriman.
109,036.—FENCE.—Uriah D. Mihills, Fond Du Lac, Wis.
109,037.—PLANE.—Ellis H. Morris, Salem, Ohio.
100,038.—TOOL HANDLE.—Edgar Murray, New York city, assignor to C. W. Dunlap, Brooklyn, N. Y.
109,039.—SETTING BOILER.—Charles Neames, New Orleans, La.
109,040.—MACHINE FOR SCOURING THE EYES OF NEEDLES.—H. A. Nettleton and E. R. Lawton, West Cheshire, Conn.
109,041.—COMBINED BARROW AND TURNIP DRILL.—A. M. Newland, Olivet, Mich.
109,042.—HYDRAULIC APPARATUS.—Nicholas Nolan, New York city. Antedated October 29, 1870.
109,043.—STOVE-PIPE GRATE.—Joseph O'Malley, Montreal, Canada.
109,044.—PIN CUSHION.—Marcus Ormsbee, Brooklyn, N. Y.
109,045.—APPARATUS FOR TOWING CANAL BOATS.—S. W. Palmer and J. F. Palmer, Auburn, N. Y.
109,046.—MACHINE FOR DRESSING MILLSTONE.—James Pepler, Bath, England. Antedated October 29, 1870.
109,047.—PITMEN.—C. H. Perkins (assignor to Perkins Sheet-Iron Co.), Providence, R. I.
109,048.—DEVICE FOR OPERATING PLOWS.—James O. Potter, Rouseville, Pa.
109,049.—TOP OF GAS AND WATER STOP-COCK BOXES.—W. W. Pullis (assignor to Thomas R. Pullis and John Pullis), St. Louis Mo.
109,050.—PORTABLE CRADLE OR CRIB.—D. M. Reynolds, Chicago, Ill.
109,051.—TABLE.—D. M. Reynolds, Chicago, Ill.
109,052.—SAWMILL.—B. F. Richardson and David Richardson Martinsburg, Iowa.
109,053.—BALANCE SLIDE VALVE.—A. K. Rider (assignor to himself, Cornelius H. Delamater, and George H. Reynolds), York N. Y.
109,054.—LAMP-HEATING APPARATUS.—Alvah Rittenhouse Philadelphia, Pa.
109,055.—HORSESHOES.—John S. Robertson, Wood End, near Cathcart, Scotland.
109,055.—VENTILATOR.—William F. Ross, Davenport, Iowa.
109,057.—PUMP.—Martin Van Buren Rowley, Worcester, N. Y.
109,058.—STOOL AND TRAVELING-BAG.—John Salisbury and Benjamin Wilbur, Scituate, R. I. Antedated October 28, 1870.
109,059.—DYE TUB.—Thomas Sampson, Providence, R. I.
109,060.—SCROLL SAW.—August M. Schilling, Chicago, Ill.
109,061.—CHURN DASHER.—Levi Scott, Burgettstown, Pa.
109,062.—HARVESTER.—Allen Sherwood and Clarence Sherwood, Auburn, N. Y.
109,063.—MILL GEARING.—Henry Shoemaker and J. A. McClintock, Perry, Ill.
109,064.—METALLURGIC GAS FURNACE.—C. W. Siemens, Westminster, England.
109,065.—METHOD OF CUTTING BOOT PACKS.—W. G. Slater, Hart, Mich.
109,066.—THIMBLE-SKEIN AND BOX FOR VEHICLES.—Thomas Smart, Jr., Brockville, Canada, assignor to himself and Elsward Smart, Pittsburgh, Pa.
109,067.—SEWER CATCH-BASIN COVER.—Henry Smith, Jr., Milwaukee, Wis.
109,068.—DRYING AND PRESERVING APPLES.—M. P. Smith, Baltimore, Md.
109,069.—CHAIN WATER WHEEL.—W. M. Starr, Washington, D. C.
109,070.—BUTTER PRINTER.—W. C. Stern and J. W. Robinson, London Grove, Pa.

109,071.—Barrel Filler.—Frederick Stitzel, Louisville, Ky.
109,072.—Hat Finishing Machine.—G. W. Stout, Newark, N. J., assignor to New York Hat Finishing Co.
109,073.—Corner Trowel.—Sumner F. Streeter, Bernardston, Mass.
109,074.—Latch.—A. A. Stuart (assignor to himself and J. D. Eddy), Plainville, Iowa.
109,075.—Relishing Machine for Tenoning Sash.—George L. Sullivan and Edward Lippincott, Chicago, Ill. Antedated October 29, 1870.
109,076.—Adjustable Coat Pattern.—G. P. Sweezy, Riverhead, N. Y.
109,077.—Machine for Laying Channels in Boots and Shoes.—Seth D. Tripp, Lynn, Mass.
109,078.—Boring Machine.—Andrew J. Truxell, Lynchburg, Va.
109,079.—Combined Center and Lathe Dog.—A. J. Truxel, Lynchburg, Va.
109,080.—Iron Lining for Fire Pot.—E. A. Tuttle, Williamsburgh, N. Y.
109,081.—Cook Room Refrigerator and Condenser.—P. Van Deventer, Wright City, Mo.
109,082.—Cultivator Rake.—James T. Van Wyck, Poughkeepsie, N. Y.
109,083.—Floating Velocipede.—C. O. Wederkinch and Archibald Starkweather, Boston, Mass.
109,084.—Brush.—J. L. Whiting, Boston, Mass.
109,085.—Paper File.—F. W. Whitney, Brooklyn, N. Y.
109,086.—Steam Gage and Safety Valve.—I. N. Whittlesey, Mount Vernon, Ind.
109,087.—Curtain Fixture.—John H. Wilhelm, Chicago, Ill.
109,088.—Device for Unloading Wagons.—Isaac Williams, Westfield, Ind.
109,089.—Brick Machine.—John R. Williams, Taunton, Mass.
109,090.—Pot for Glue, Paint, etc.—John J. Wilson, New York city.
109,091.—Ditching and Grading Machine.—H. A. Winter, Windsor, Ill.
109,092.—Machine for Booking Tobacco Leaves.—Joseph Wise, Elizabeth, N. J. Antedated Oct. 22, 1870.
109,093.—Potato Digger.—Albert R. Wixom, Farmington, Mich.
109,094.—Machine for Bending Iron Pipe for Welding.—E. G. Woodworth, John Brawdy, and Fitch Merithew, Birmingham, Pa. Antedated Oct. 29, 1870.
109,095.—Spring for Vehicles.—Enos Wright, Lee county, Iowa.
109,096.—Door Check.—Charles P. Young, Attleborough, Mass.
109,097.—Self-acting Wagon Brake.—Anthony Zink, Lancaster, Ohio.
109,098.—Tree Protector.—Abraham S. Adams, Waynesborough, Pa.
109,099.—Water Wheel.—Benj. J. Barber, Ballston Spa, N. Y.
109,100.—Pencil Sharpener.—Asahel G. Batchelder, Lowell, Mass.
109,101.—Call Bell and Caster Stand.—F. A. Blatterlien, West Meriden, Conn.
109,102.—Clamping Movable Seat for Carriages.—S. W. Beach, Ypsilanti, Mich.
109,103.—Steam Trap.—William H. Bechtel, Philadelphia, Pa.
109,104.—Oyster Dredge Winder.—C. T. Belbin, Baltimore, Md.
109,105.—Malt Kiln.—Charles Philipp Berekhemer, Cincinnati, Ohio.
109,106.—Necktie Fastening.—G. W. Bishop (assignor to himself and John McFarland), Baltimore, Md.
109,107.—Dining Table.—David Boardman, Columbus, Ind.
109,108.—Harness Saddle.—Valentine Borst, New York city.
109,109.—Transposing Scale for Teaching Music.—P. G. Bryan, Louisville, Ky.
109,110.—Drawer for Cabinet Furniture.—Levi Burnell, Milwaukee, Wis.
109,111.—Potato Digging Machine.—Lemuel Cochrane, Penn's Grove, N. J.
109,112.—Animal Trap.—John Cosolowsky, Titusville, Pa.
109,113.—Condenser for Steam Pumps.—Wm. Craig, Newark, N. J., and H. L. Brevoort, Brooklyn, N. Y.
109,114.—Horse-power.—R. W. Crouse, Westminster, Md. Antedated October 29, 1870.
109,115.—Apparatus for Fitting and Setting Axles.—James Cunningham, Rochester, N. Y.
109,116.—Supporting Prop for Folding Buggy Tops.—Alexander Dom, Mount Healthy, Ohio.
109,117.—Rotary Pump.—John Doyle, Hoboken, N. J., and T. A. Martin, New York city.
109,118.—Lubricator.—Isidore Dreyfus, New York city.
109,119.—Railway Sleeping Car.—J. S. Du Bois, St. Louis, Mo., assignor to himself and Thomas Dorwin, Leavenworth, Kansas.
109,120.—Apparatus for Parlor Croquet.—A. P. Eastman, Washington, D. C.
109,121.—Vise.—James Findlay (assignor to himself and Wm. Smeille), Toronto, Canada.
109,122.—Boots.—C. H. Fitch, Worcester, Mass.
109,123.—Dovetailing Machine.—C. S. Griffin and J. W. Wilkins, Stockton, Me.
109,124.—Cotton Scraper and Chopper.—N. M. Hale, Cleborne, Texas.
109,125.—Manufacture of White Lead.—R. F. Hatfield (assignor to "Hannen Lead Co."), New York city.
109,126.—Preserving Beer and Ale on Draft.—C. E. Hayes, Boston, Mass.
109,127.—Fence.—C. N. Hitchcock and Henry P. T. Wilson, Canton, Miss. Antedated Oct. 29, 1870.
109,128.—Gun Lock.—C. B. Holden (assignor to himself and Isaac Fiske), Worcester, Mass.
109,129.—Cultivator.—Henry Howe, Oneonta, N. Y. Antedated Oct. 29, 1870.
109,130.—Flower Stand.—Hiland H. Kendrick, Fulton, N. Y.
109,131.—Burning Hydrocarbon.—Isaac Kendrick, Philadelphia, Pa.
109,132.—Excavating Scoop.—Oscar P. Kniffin (assignor to himself and H. A. Lyne), Clinton, Conn.
109,133.—Neck-tie Retainer.—Henry Laurence, New Orleans, La.
109,134.—Button Fastening.—Edwin F. Lee, New York city.
109,345.—Hide-beaming Machine.—Patrick Lennox, Lynn, Mass. Antedated Nov. 4, 1870.
109,136.—Gang Plow.—William Mason, Independence, Oregon.
109,137.—Variable Cut-off Apparatus.—Thomas May, Brooklyn, N. Y.
109,138.—Pitman.—John H. McGowan, Cincinnati, Ohio.
109,139.—Wood Pavement.—Duncan McKenzie, Brooklyn, N. Y.
109,140.—Cheese Vat.—H. W. Millar, Utica, N. Y.
109,141.—Railway Switch.—John Miner and Silas Merrick, New Brighton, Pa.
109,142.—Condenser for Gas Works.—Peter Munzinger, Philadelphia, Pa.
109,143.—Railroad Car Stove.—John Oliphant (assignor to F. H. Oliphant, Jr.), Spring Hill Furnace, Pa.
109,144.—Nut Cracker.—Joshua Pusey, Philadelphia, Pa.
109,145.—Bit for Harness.—B. S. Roberts (assignor to O. G. North & Co.), New Haven, Conn.
109,146.—Sawing Machine.—D. S. Shanabrook, Green Castle, Pa.
109,147.—Tire Shrinker.—Christian S. Sherk, Grantville, Pa.
109,148.—Apparatus for Carbureting Air.—J. D. Spang, Dayton, Ohio.
109,149.—Boiler Feeder and Low-water Detector.—J. L. Starkey, Worcester, Mass.
109,150.—Brick Kiln.—Edward C. Sterling, St. Louis, Mo.
109,151.—Machine for Filling Barrels.—J. L. Stewart, Philadelphia, Pa.
109,152.—Coffee Pot.—John F. Still, West Farms, N. Y.
109,153.—Cigar-cutting Machine.—Lucius S. Stimson, deceased, by Harriet N. Stimson, administratrix, Lowell, Mass., assignor to himself and M. S. Moulton, said Moulton assignor to Nelson F. Libby.
109,154.—Countersink.—D. F. Sutton, Toledo, Ohio.
109,155.—Grain Separator.—Frank Swift and M. Standish, Hudson, Mich.
109,156.—Garment Holder.—B. Van Campen Taylor, Newark, N. J.
109,157.—Corn Huller, Sheller, and Feed Cutter.—Tower Thomasson, Calhoun, Mo.
109,158.—Rock-drilling Machine.—Nathaniel Tucker, Levi Williams, and Henry H. Coppock, Pleasant Hill, Ohio.
109,159.—Journal Box for Cars.—Ernest Von Jeinsen, Omaha, Nebraska.
109,160.—Privy.—W. J. Warren, Philadelphia, Pa.
109,161.—Type-writing Machine.—C. A. Washburn, San Francisco, Cal.
109,162.—Apparatus for Grinding the Knives of Mowing Machines.—D. F. Welsh, Nevada, Ohio.
109,163.—Mechanical Movement.—John H. Whitney, Rochester, Minn.
109,164.—Stop-motion Gear Wheel.—John H. Whitney, Rochester, Minn.
109,165.—Swing.—Lucius Winston, Pontiac, Ill.

REISSUES.

4,174.—Machine for Husking Corn.—L. A. Aspinwall, Albany, N. Y.—Patent No. 101,809, dated April 12, 1870; reissue No. 4,099, dated August 16, 1870.
4,175.—Heating Stove.—S. H. La Rue, Allentown, Pa.—Patent No. 105,816, dated July 26, 1870.
4,176.—Drip Filtering Oil Fountain.—Eli F. Wilder, Lowell, Mass.—Patent No. 101,069, dated March 22, 1870; antedated September 22, 1869.

DESIGNS.

4,457.—Ornamentation of Glassware.—J. S. Atterbury and T. B. Atterbury, Pittsburgh, Pa.
4,458.—Buckle.—J. I. Bell, Bell's Bridge, Cal.
4,459.—Watch Plate.—F. A. Jones, Boston, Mass.
4,460.—Box for the Top of Bureaus.—Cheney Kilburn (assignor to Kilburn & Gates), Philadelphia, Pa.
4,461.—Rustic Fence.—John Millar, Paterson, N. J.
4,462.—Picture Frame.—Joseph H. Saunders, Johnson, R. I.
4,463.—Toaster and Broiler.—P. B. Sheldon, Rochester, N. Y.
4,464.—Range or Stove.—Nicholas S. Vedder, Troy, and Tobias S. Heister, Lansingburgh, N. Y., assignors to J. L. Mott, New York city.

TRADE-MARKS.

53 to 55.—White Lead.—Brooklyn White Lead Company, New York city. Three Patents.

56.—Cosmoline—a Product of Petroleum.—Edwin F. Houghton, Philadelphia, Pa.
57.—Table Sauce.—William King, Springfield, Ill.
58.—Preparation for the Hair.—J. L. Martin, Baltimore, Md.
59.—Soap.—Alexander Warfield, Philadelphia, Pa.
60.—Superphosphate.—Wattson & Clark, Philadelphia, Pa.

EXTENSIONS.

Smut Machines.—Harvey B. Ingham, of Camptown, Pa.—Letters Patent No. 15,978, dated October 28, 1856; Antedated June 24, 1856.
Cider Mill.—T. K. Kinderberger, Eaton, Ohio.—Letters Patent No. 12,958 dated May 29, 1855; reissue No. 2,832, dated August 14, 1866.

According to the "Commissioners of Patents' Journal," dated October 14, from which the subjoined list was compiled, of the seventy-three new inventions for which British Provisional Protection was granted, seventeen came from this side of the Atlantic. We have repeatedly urged upon American inventors the expediency of patenting their inventions abroad, and are glad to notice that so many are availing themselves of our advice. We would again call the attention of inventors to the fact that, while it is comparatively easy to obtain letters patent in England, it is quite another matter and one that requires not only skill and care, but also an intimate acquaintance with the progress of the arts and foreign patent law and practice, to so draw up the necessary papers that the rights of the inventor may be secured, should the validity of the patent become a subject of litigation.

Inventions Patented in England by Americans.

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

PROVISIONAL PROTECTION FOR SIX MONTHS.

2,536.—Heels for Boots and Shoes.—H. H. Bigelow, Worcester, Mass. September 21, 1870.
2,541.—Sharpening and Polishing Sewing Machine Needles.—E. E. Blyth, Rochester, N. Y. September 21, 1870.
2,560.—Rasps and Files.—Franklin Thompson, Boston, Mass. September 23, 1870.
2,562.—Printing Type.—J. W. Wright, Montreal, Canada. September 24, 1870.
2,577.—Machinery for Twisting and Laying Cords and Ropes.—H. Perkins, Mansfield, Mass. September 27, 1870.
2,574.—Breech-loading Firearms.—Olof Nilson, Red Wing, Minn. Sept. 26, 1870.
2,576.—Apparatus for Supplying Paper to Printing Presses.—Olof Nelson, Red Wing, Minn. September 26, 1870.
2,578.—Electro-Magnets.—E. W. Andrews, Englewood, N. J. Sept. 28, 1870.
2,596.—Valve Apparatus for Vessels for containing Petroleum, and other Volatile Oils and Spirits.—Meissner, Ackermann & Co., New York city. September 30, 1870.
2,608.—Apparatus for Utilizing the Power and Heat of the Steam Used in Motive-power Engines, and for other Purposes.—T. T. Prosser, Chicago, Ill. October 1, 1870.
2,611.—Fixed Ammunition for Firearms and Tools for Manufacturing it.—T. J. Powers, New York city. October 1, 1870.
2,624.—Machinery and Apparatus for Transmitting Passengers, Goods, etc.—M. Cooper, Buenos Ayres, South America. October 3, 1870.
2,628.—Forming Threads in Metallic Nuts.—B. Howard, Paola, Kansas, and E. Fitch, Ravenna, Ohio. October 3, 1870.
2,634.—Chamber Utensil.—V. Rhodes, Memphis, Tennessee. October 4, 1870.
2,652.—Spring Weighing Scales.—J. V. Mathivet, Cleveland, Ohio. October 5, 1870.
2,660.—Instruments for Obtaining Solar Measurements of Latitude and Longitude.—L. L. Truss, Saint Vincents, Pa. October 7, 1870.
2,673.—Steam Engines.—John Houpt, Springtown, Pa. October 10, 1870.

NEW BOOKS AND PUBLICATIONS.

The American Chemist. A Monthly Journal of Theoretical, Analytical, and Technical Chemistry. Edited by Prof. Charles F. Chandler, Ph.D., and W. H. Chandler. New York: Wm. Baldwin & Co.

The American reprint of the London *Chemical News* was discontinued some months since, and its place is now filled by a journal of chemistry which takes rank among the very highest of American periodicals. The name of this monthly, the "American Chemist," is appropriate and significant of its character. While nothing of importance in the entire chemical world escapes the notice of its accomplished editors, the matter is prepared with especial reference to the wants of American chemists and manufacturers. The technical features of the publication are perhaps of even greater value than the theoretical and purely scientific ones, and the whole is arranged and condensed with a skill and care which denotes rare editorial ability on the part of its conductors. It is, so far as we are aware the first publication of the kind ever issued in this country that could be said to do real honor to scientific literature. As such, we doubt not its future will be as brilliant as its early promise is cheering to the lovers of sound science.

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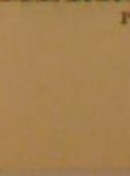

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SCIENTIFIC AMERICAN

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

Vol. XXIII.—No. 22 [NEW SERIES.] NEW YORK, NOVEMBER 26, 1870. $3 per Annum [IN ADVANCE.]

Improved Independent Shuttle-Motion Loom.

The loom and the millstone supply two positive necessities to the human race. Both are old devices, yet notwithstanding they have been so long in use, and though the best minds have for centuries studied them with a view to, if possible, render them more effective, there yet remain in both defects in their operation which inventive talent is seeking to remove.

So far as the loom is concerned the attempts at improvement seem to be in ,considerable degree, toward the modification of the shuttle movement. Of the latter class our readers will recollect we gave something more than a year since a notable example in the Lyall "Positive Motion" Loom. We this week present to our readers engravings and a description of still another shuttle movement, which has claims worthy the consideration of manufacturers, and which, so far as we are aware, employs a radically different principle from any of the looms in modern use.

It is claimed for this loom, that as the shuttle is driven by a motion entirely independent of any other movement in the loom, the shuttle moves at a uniform speed, no matter whether the speed of the loom be one pick or two hundred picks per minute. This claim is sustained in practice, as we can testify, having seen the loom in operation at the recent Fair of the American Institute recently held in this city, and at which this loom received the first premium. This peculiarity of the movement obviates the difficulties arising from irregular speeds, such as smashes, etc., and also secures greater uniformity in the texture woven than can be attained on other looms in which the movement of the shuttle is directly communicated through the agency of cams or other devices.

It requires skill and judgment, acquired by experience, to start the ordinary loom at precisely the right time to throw the shuttle through the web and avoid its lodgment therein. Inexperienced help are apt to err on this point, and cause damage from their awkwardness. With the loom under consideration there is not the slightest danger of such an accident, as the shuttle is always automatically thrown precisely at the right time. It follows that untrained hands may be set to attend it without risk of injury to the texture.

The construction, as will be seen on reference to the engravings, is extremely simple, and it is claimed to be at all times reliable and accurate in its action.

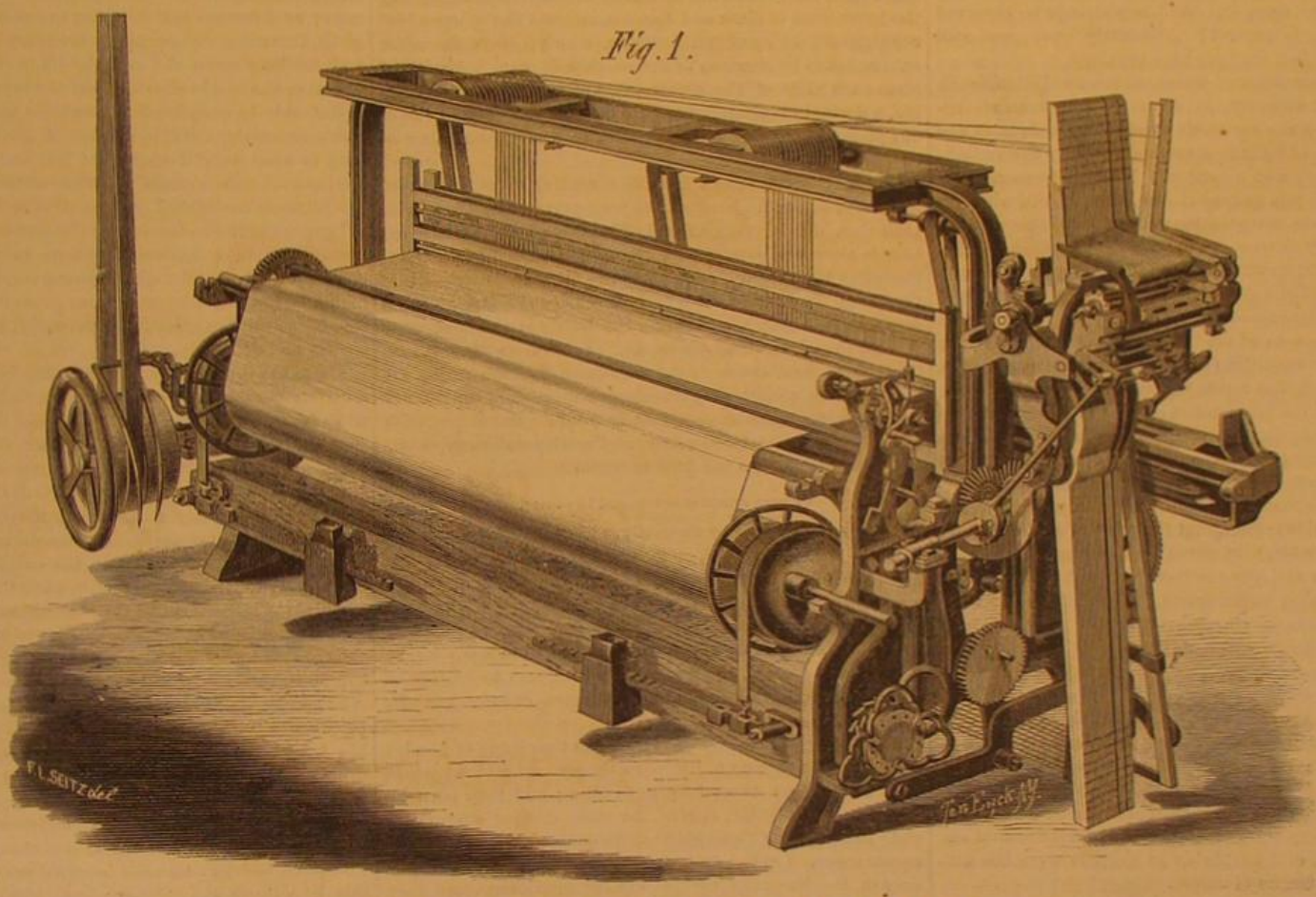
This shuttle movement can be applied to all looms now in use for weaving carpets, woolen, cotton, or silk textures, and it is claimed, costs even less than the ordinary pick movement for which it can be substituted in about two hours. It distributes the power more uniformly to the belt, allowing the lay to run with greater steadiness, and causing no zigzag motion in the travel of the shuttle along the race-board, which arises from the truck and cam pick. The latter derives its power from the speed of the loom, often causing it to force the filling off from the bobbin when moving at high speed. In this movement, however, the power applied to driving the shuttle being always uniform, the difficulty specified is obviated, as the shuttle always passes through the web at the same speed, regardless of the speed of the loom.

It is claimed that it also takes less power to drive the looms owing to the superior steadiness of the movement. It is further claimed that an operator can run one third more looms with this shuttle movement attached than with the old movement, and that the expense of repairing is very largely reduced by its use.

Fig. 1 shows the loom in perspective, as seen from the back side; and Fig. 2 is a detail showing the principle of the shuttle movement.

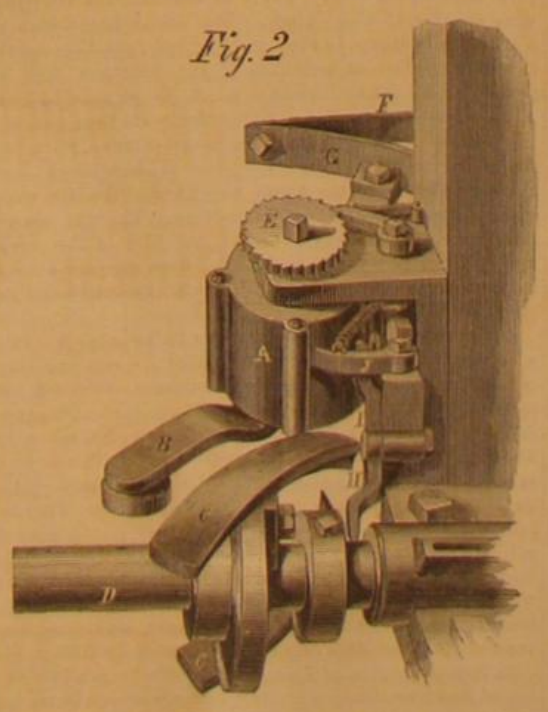
The drum, A, Fig. 2, contains a strong, coiled, flat spring, which is partially wound up by means of an arm, B, having at its extremity a friction roller. The arm, B, derives its motion from cams, C, attached to the shaft, D. The power thus stored up in the spring is retained by a pawl, J, which engages with a projection on A until such time as it is desired to use it in driving the shuttle, when the pawl, J, is released from its engagement with the projection on A by the lever, I; the latter being actuated by a small cam on the shaft, D. Another arm extending from the top of the drum, A, carries at its extremity an arc, G, to which a strap, F, is attached, which strap is held by a ratchet and pawl, as distinctly shown in Fig. 2

Fig. 1.



STEVER'S INDEPENDENT SHUTTLE-MOTION LOOM.

Fig. 2



also attached to the picker bar, as shown in Fig. 1 at F. The recoil of the spring gives a partial revolution to the arc, G, winding up the strap, F, thereon, and causing the picker bar to make its movement. This operation is performed for every throw of the shuttle, the proper tension of the spring being regulated by winding it up on the stem, E, where it is

This description comprises the general features and operation of this simple movement, and will explain how, at either high or low speed of the loom, the shuttle speed will always be uniform, and its throw always take place at the proper time to pass clear of the web.

Patented, January 18, 1870, by Jeremiah Stever, whom address for further particulars at Waterbury, Conn.

How to Save Peach Trees.

A discovery of no small moment, says the Philadelphia *Ledger*, in the interest of agriculture, has been made by Dr. Geo. B. Wood, and communicated by him to the American Philosophical Society, of which he is president.

Peach trees in this vicinity, after producing a few crops, not only cease bearing, but perish in a short time; whereas, the natural life is fifty or sixty years, or more. The cause of this defective power of growth is believed by Dr. Wood to be owing to a deficiency of potash in the soil, and he assures us, that if this alkali be supplied to the tree so that it shall recall the small roots and be absorbed, the fruit-bearing power is restored, and the fruit itself, prematurely perishing, is revived.

Believing, with most persons, that the cause of the decay lay in worms at the root of the peach tree, he put in operation a plan which he had seen his father perform more than fifty years before; viz., of digging around the base of the stem a hole four or five inches deep, scraping away all the worms that could be found burrowing at the junction of the stem and root, and filling the hole thus made with wood ashes from the fire, which, of course, retained all their potash. This was done in the autumn of 1868; and with a result in the following spring at which he himself was astonished. The trees appeared to have been restored to all their early vigor and freshness; they put forth bright green leaves, blossoming copiously, and bore a crop of fruit such as they had never borne before, many of the branches breaking down under the load of peaches.

Dr. Wood, in reflecting on these results, noticed that several of the peach-trees had no worms, and came to the conclusion that we must look for an explanation to some other cause than the destruction of a few worms; and this cause he believed to be the ashes, the potash of which, being dissolved by the rain, had descended along the roots to the rootlets, and presented to them the very food for the want of which they were dying. Decaying apple trees bearing stinted and inedible fruit, have been revived by a similar process, and with like results. Now is the time to adopt the experiment.

SINGER SEWING MACHINE PATENT.—The patent of the Singer sewing machine expires in a few days, and the Commissioner of Patents, after a full hearing of the reasons for renewing the patent, has decided adversely. The refusal to renew the patent does not make it unreservedly available to the public, inasmuch as there are other patents taken out upon improvements connected with the original patent which are still in force. Strong effort was made, however, by the owners of the patent to have it renewed, but the Commissioner inclined to the opinion that all these patents should, as they expire, be thrown open to the public.

ALL the mills in Maine have been started again by the fall rains. Many of them had been stopped a long time for want of water, and the losses to owners and operatives are heavy.

SCIENTIFIC USE OF THE IMAGINATION.

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

[Concluded from page 320.]

I trust, Mr. President, that you—whom untoward circumstances have made a biologist, but who still keep alive your sympathy with that class of inquiries which nature intended you to pursue and adorn—will excuse me to your brethren if I say that some of them seem to form an inadequate estimate of the distance which separates the microscopic from the molecular limit, and that, as a consequence, they sometimes employ a phraseology which is calculated to mislead.

When, for example, the contents of a cell are described as perfectly homogeneous, as absolutely structureless, because the microscope fails to distinguish any structure, then I think the microscope begins to play a mischievous part. A little consideration will make it plain to all of you that the microscope can have no voice in the real question of germ structure. Distilled water is more perfectly homogeneous than the contents of any possible organic germ. What causes the liquid to cease contracting at 39° F., and to grow bigger until it freezes? It is a structural process of which the microscope can take no note, nor is it likely to do so by any conceivable extension of its powers. Place this distilled water in the field of an electro-magnet, and bring a microscope to bear upon it. Will any change be observed when the magnet is excited? Absolutely none; and still profound and complex changes have occurred.

First of all, the particles of water are rendered diamagnetically polar; and secondly, in virtue of the structure impressed upon it by the magnetic strain of its molecules, the liquid twists a ray of light in a fashion perfectly determinate both as to quantity and direction. It would be immensely interesting to both you and me if one here present, who has brought his brilliant imagination to bear upon this subject, could make us see as he sees the entangled molecular processes involved in the rotation of the plane of polarization by magnetic force. While dealing with this question he lived in a world of matter and of motion to which the microscope has no passport, and in which it can offer no aid. The cases in which similar conditions hold are simply numberless. Have the diamond, the amethyst, and the countless other crystals formed in the laboratories of nature and of man no structure? Assuredly they have, but what can the microscope make of it? Nothing. It cannot be too distinctly borne in mind that between the microscopic limit and the true molecular limit there is room for infinite permutations and combinations. It is in this region that the poles of the atoms are arranged, that tendency is given to their powers, so that when these poles and powers have free action and proper stimulus in a suitable environment, they determine first the germ and afterwards the complete organism. This first marshaling of the atoms on which all subsequent action depends baffles a keener power than that of the microscope. Through pure excess of complexity, and long before observation can have any voice in the matter, the most highly trained intellect, the most refined and disciplined imagination, retires in bewilderment from the contemplation of the problem. We are struck dumb by an astonishment which no microscope can relieve, doubting not only the power of our instrument, but even whether we ourselves possess the intellectual elements which will ever enable us to grapple with the ultimate structural energies of nature.

But the speculative faculty, of which imagination forms so large a part, will nevertheless wander into regions where the hope of certainty would seem to be entirely shut out. We think that though the detailed analysis may be, and may ever remain, beyond us, general notions may be attainable. At all events, it is plain that beyond the present outposts of microscopic inquiry lies an immense field for the exercise of the imagination. It is only, however, the privileged spirits who know how to use their liberty without abusing it, who are able to surround imagination by the firm frontiers of reason, that are likely to work with any profit here. But freedom to them is of such paramount importance that, for the sake of securing it, a good deal of wildness on the part of weaker brethren may be overlooked. In more senses than one Mr. Darwin has drawn heavily upon the scientific tolerance of his age. He has drawn heavily upon *time* in his development of species, and he has drawn adventurously upon *matter* in his theory of pangenesis. According to this theory, a germ already microscopic is a world of minor germs. Not only is the organism as a whole wrapped up in the germ, but every organ of the organism has there its special seed.

This, I say, is an adventurous draft on the power of matter to divide itself and distribute its forces. But, unless we are perfectly sure that he is overstepping the bounds of reason, that he is unwittingly sinning against observed fact or demonstrated law—for a mind like that of Darwin can never sin wittingly against either fact or law—we ought, I think, to be cautious in limiting his intellectual horizon. If there be the least doubt in the matter, it ought to be given in favor of the freedom of such a mind. To it a vast possibility is in itself a dynamic power, though the possibility may never be drawn upon.

It gives me pleasure to think that the facts and reasonings of this discourse tend rather towards the justification of Mr. Darwin than towards his condemnation, that they tend rather to augment than to diminish the cubic space demanded by this soaring speculator; for they seem to show the perfect competence of matter and force, as regards divisibility and distribution, to bear the heaviest strain that he has hitherto imposed upon them.

In the case of Mr. Darwin, observation, imagination, and reason combined have run back with wonderful sagacity and success over a certain length of the line of biological succession. Guided by analogy, in his "Origin of Species" he placed as the root of life a primordial germ, from which he conceived the amazing richness and variety of the life that now is upon the earth's surface might be deduced. If this were true it would not be final. The human imagination would infallibly look behind the germ, and inquire into the history of its genesis.

Certainty is here hopeless, but the materials for an opinion may be attainable. In this dim twilight of speculation the inquirer welcomes every gleam, and seeks to augment his light by indirect incidences. He studies the methods of nature in the ages and the worlds within his reach, in order to shape the course of imagination in the antecedent ages and worlds. And though the certainty possessed by experimental inquiry is here shut out, the imagination is not left entirely without guidance. From the examination of the solar system, Kant and Laplace came to the conclusion that its various bodies once formed parts of the same undislocated mass; that matter in a nebulous form preceded matter in a dense form; that as the ages rolled away heat was wasted, condensation followed, planets were detached, and that finally the chief portion of the fiery cloud reached, by self-compression, the magnitude and density of our sun. The earth itself offers evidence of a fiery origin; and in our day the hypothesis of Kant and Laplace receives the independent countenance of spectrum analysis, which proves the same substances to be common to the earth and sun. Accepting some such view of the construction of our system as probable, a desire immediately arises to connect the present life of our planet with the past. We wish to know something of our remotest ancestry.

On its first detachment from the central mass, life, as we understand it, could hardly have been present on the earth. How then did it come there? The thing to be encouraged here is a reverent freedom—a freedom preceded by the hard discipline which checks licentiousness in speculation—while the thing to be repressed, both in science and out of it, is dogmatism. And here I am in the hands of the meeting—willing to end, but ready to go on. I have no right to intrude upon you, unasked, the unformed notions which are floating like clouds or gathering to more solid consistency in the modern speculative scientific mind. But if you wish me to speak plainly, honestly, and undisputatiously, I am willing to do so. On the present occasion

You are ordained to call, and I to come.

Two views, then, offer themselves to us. Life was present potentially in matter when in the nebulous form, and was unfolded from it by the way of natural development, or it is a principle inserted into matter at a later date. With regard to the question of time, the views of men have changed remarkably in our day and generation; and I must say as regards courage also, and a manful willingness to engage in open contest with fair weapons, a great change has also occurred.

The clergy of England—at all events the clergy of London—have nerve enough to listen to the strongest views which any one amongst us would care to utter; and they invite, if they do not challenge, men of the most decided opinions to state and stand by those opinions in open court. No theory upsets them. Let the most destructive hypothesis be stated only in the language current among gentlemen, and they look it in the face. They forego alike the thunders of heaven and the terrors of the other place, smiting the theory, if they do not like it, with honest secular strength. In fact, the greatest cowards of the present day are not to be found among the clergy, but within the pale of science itself.

Two or three years ago in an ancient London college—a clerical institution—I heard a very remarkable lecture by a very remarkable man. Three or four hundred clergymen were present at the lecture. The orator began with the civilization of Egypt in the time of Joseph; pointing out that the very perfect organization of the kingdom, and the possession of chariots, in one of which Joseph rode, indicated a long antecedent period of civilization. He then passed on to the mud of the Nile, its rate of augmentation, its present thickness, and the remains of human handiwork found therein; thence to the rocks which bound the Nile valley, and which teem with organic remains. Thus in his own clear and admirable way he caused the idea of the world's age to expand itself indefinitely before the mind of his audience, and he contrasted this with the age usually assigned to the world.

During his discourse he seemed to be swimming against a stream; he manifestly thought that he was opposing a general conviction. He expected resistance; so did I. But it was all a mistake; there was no adverse current, no opposing conviction, no resistance, merely here and there a half humorous but unsuccessful attempt to entangle him in his talk. The meeting agreed with all that had been said regarding the antiquity of the earth and of its life. They had, indeed, known it all long ago, and they good-humoredly rallied the lecturer for coming amongst them with so stale a story. It was quite plain that this large body of clergymen, who were, I should say, the finest samples of their class, had entirely given up the ancient landmarks, and transported the conception of life's origin to an indefinitely distant past.

In fact, clergymen, if I might be allowed a parenthesis to say so, have as strong a leaning towards scientific truth as other men, only the resistance to this bent—a resistance due to education—is generally stronger in their case than in others. They do not lack the positive element, namely, the love of truth, but the negative element, the fear of error, preponderates.

The strength of an electric current is determined by two things—the electro-motive force, and the resistance that force has to overcome. A fraction, with the former as numerator and the latter as denominator, expresses the current-strength. The "current-strength" of the clergy towards science may also be expressed by making the positive element just referred to the numerator, and the negative one the denominator of a fraction. The numerator is not zero nor is it even small, but the denominator is large; and hence the current strength is such as we find it to be. Slowness of conception, even open hostility, may be thus accounted for. They are for the most part errors of judgment, and not sins against truth. To most of us it may appear very simple, but to a few of us it appears transcendently wonderful, that in all classes of society truth should have this power and fascination. From the countless modifications that life has undergone through natural selection and the integration of infinitesimal steps, emerges finally the grand result that the strength of truth is greater than the strength of error, and that we have only to make the truth clear to the world to gain the world to our side. Probably no one wonders more at this result than the propounder of the law of natural selection himself. Reverting to an old acquaintance of ours, it would seem, on purely scientific grounds, as if a Veracity were at the heart of things; as if, after ages of latent working, it had finally unfolded itself in the life of man; as if it were still destined to unfold itself, growing in girth, throwing out stronger branches and thicker leaves, and tending more and more by its overshadowing presence to starve the weeds of error from the intellectual soil.

But this is parenthetical; and the gist of our present inquiry regarding the introduction of life is this: Does it belong to what we call matter, or is it an independent principle inserted into matter at some suitable epoch—say when the physical conditions become such as to permit of the development of life? Let us put the question with all the reverence due to a faith and culture in which we all were cradled—a faith and culture, moreover, which are the undeniable historic antecedents of our present enlightenment. I say, let us put the question reverently, but let us also put it clearly and definitely.

There are the strongest grounds for believing that during a certain period of its history the earth was not, nor was it fit to be, the theater of life. Whether this was ever a nebulous period, or merely a molten period, does not much matter; and if we revert to the nebulous condition, it is because the probabilities are really on its side. Our question is this: Did creative energy pause until the nebulous matter had condensed, until the earth had been detached, until the solar fire had so far withdrawn from the earth's vicinity as to permit a crust to gather round the planet? Did it wait until the air was isolated, until the seas were formed, until evaporation, condensation, and the descent of rain had begun, until the eroding forces of the atmosphere had weathered and decomposed the molten rocks so as to form soils, until the sun's rays had become so tempered by distance and by waste as to be chemically fit for the decompositions necessary to vegetable life? Having waited through those æons until the proper conditions had set in, did it send the fiat forth, "Let life be!"? These questions define a hypothesis not without its difficulties, but the dignity of which was demonstrated by the nobleness of the men whom it sustained.

Modern scientific thought is called upon to decide between this hypothesis and another; and public thought generally will afterwards be called upon to do the same. You may, however, rest secure in the belief that the hypothesis just sketched can never be stormed, and that it is sure, if it yield at all, to yield to a prolonged siege. To gain new territory modern argument requires more time than modern arms, though both of them move with greater rapidity than of yore.

But however the convictions of individuals here and there may be influenced, the process must be slow and secular which commends the rival hypothesis of natural evolution to the public mind. For what are the core and essence of this hypothesis? Strip it naked and you stand face to face with the notion that not alone the more ignoble forms of animalcular or animal life, not alone the nobler forms of the horse and lion, not alone the exquisite and wonderful mechanism of the human body, but that the human mind itself—emotion, intellect, will, and all their phenomena—were once latent in a fiery cloud. Surely the mere statement of such a notion is more than a refutation. But the hypothesis would probably go even further than this. Many who hold it would probably assent to the position that at the present moment all our philosophy, all our poetry, all our science, and all our art—Plato, Shakespeare, Newton, and Raphael—are potential in the fires of the sun.

We long to learn something of our origin. If the evolution hypothesis be correct, even this unsatisfied yearning must have come to us across the ages which separate the unconscious primeval mist from the consciousness of to-day. I do not think that any holder of the evolution hypothesis would say that I overstate it or overstrain it in any way. I merely strip it of all vagueness, and bring before you unclothed and unvarnished the notions by which it must stand or fall.

Surely these notions represent an absurdity too monstrous to be entertained by any sane mind. Let us, however, give them fair play. Let us steady ourselves in front of the hypothesis, and, dismissing all terror and excitement from our minds, let us look firmly into it with the hard, sharp eye of intellect alone. Why are these notions absurd, and why should sanity reject them? The law of relativity, of which we have previously spoken, may find its application here. These evolution notions are absurd, monstrous, and fit only for the intellectual gibbet in relation to the ideas concerning

matter which were drilled into us when young. Spirit and matter have ever been presented to us in the rudest contrast, the one as all noble, the other as all vile. But is this correct? Does it represent what our mightiest spiritual teacher would call the eternal fact of the universe? Upon the answer to this question all depends.

Supposing, instead of having the foregoing antithesis of spirit and matter presented to our youthful minds, we had been taught to regard them as equally worthy and equally wonderful; to consider them, in fact, as two opposite faces of the self-same mystery. Supposing that in youth we had been impregnated with the notion of the poet Goethe, instead of the notion of the poet Young, looking at matter, not as brute matter, but as "the living garment of God;" do you not think that under these altered circumstances the law of relativity might have had an outcome different from its present one? Is it not probable that our repugnance to the idea of primeval union between spirit and matter might be considerably abated? Without this total revolution of the notions now prevalent the evolution hypothesis must stand condemned; but in many profoundly thoughtful minds such a revolution has already taken place. They degrade neither member of the mysterious duality referred to; but they exalt one of them from its abasement, and repeal the divorce hitherto existing between both. In substance, if not in words, their position as regards spirit and matter is: "What God hath joined together let not man put asunder."

I have thus led you to the outer rim of speculative science, for beyond the nebulæ scientific thought has never ventured hitherto, and have tried to state that which I considered ought, in fairness, to be outspoken. I do not think this evolution hypothesis is to be flouted away contemptuously; I do not think it is to be denounced as wicked. It is to be brought before the bar of disciplined reason, and there justified or condemned. Let us hearken to those who wisely support it, and to those who wisely oppose it; and let us tolerate those, and they are many, who foolishly try to do either of these things.

The only thing out of place in the discussion is dogmatism on either side. Fear not the evolution hypothesis. Steady yourselves in its presence upon that faith in the ultimate triumph of truth which was expressed by old Gamaliel when he said: "If it be of God, ye cannot overthrow it; if it be of man, it will come to nought." Under the fierce light of scientific inquiry this hypothesis is sure to be dissipated if it possess not a core of truth. Trust me, its existence as an hypothesis in the mind is quite compatible with the simultaneous existence of all those virtues to which the term Christian has been applied. It does not solve—it does not profess to solve—the ultimate mystery of this universe. It leaves in fact that mystery untouched. At bottom it does nothing more than "transport the conception of life's origin to an indefinitely distant past."

For, granting the nebula and its potential life, the question, whence came they? would still remain to baffle and bewilder us. And with regard to the ages of forgetfulness which lie between the unconscious life of the nebula and the conscious life of the earth, it is but an extension of that forgetfulness which preceded the birth of us all. Those who hold the doctrine of evolution are by no means ignorant of the uncertainty of their data, and they yield no more to it than a provisional assent. They regard the nebular hypothesis as probable, and in the utter absence of any evidence to prove the act illegal, they extend the method of nature from the present into the past. Here the observed uniformity of nature is their only guide. Within the long range of physical inquiry they have never discerned in nature the insertion of caprice. Throughout this range the laws of physical and intellectual continuity have run side by side. Having thus determined the elements of their curve in this world of observation and experiment, they prolong that curve into an antecedent world, and accept as probable the unbroken sequence of development from the nebula to the present time.

You never hear the really philosophical defenders of the doctrine of uniformity speaking of *impossibilities* in nature. They never say, what they are constantly charged with saying, that it is impossible for the builder of the universe to alter His work. Their business is not with the possible, but the actual; not with a world which *might* be, but with a world which *is*. This they explore with a courage not unmixed with reverence, and according to methods which, like the quality of a tree, are tested by their fruits. They have but one desire—to know the truth. They have but one fear—to believe a lie. And if they know the strength of science, and rely upon it with unswerving trust, they also know the limits beyond which science ceases to be strong. They best know that questions offer themselves to thought which science, as now prosecuted, has not even the tendency to solve. They keep such questions open, and will not tolerate any unlawful limitation of the horizon of their souls. They have as little fellowship with the atheist who says there is no God as with the theist who professes to know the mind of God.

"Two things," said Immanuel Kant, "fill me with awe: the starry heavens and the sense of moral responsibility in man." And in his hours of health and strength and sanity, when the stroke of action has ceased and the pause of reflection has set in, the scientific investigator finds himself overshadowed by the same awe. Breaking contact with the hampering details of earth, it associates him with a power which gives fulness and tone to his existence, but which he can neither analyze nor comprehend.

COL. FISHER, Ex-Commissioner of Patents, has returned to the practice of law at Cincinatti.

NOTES AND MAXIMS ABOUT HEALTH.

BY DR. DIO LEWIS.

Gluttony counts one hundred victims where drunkenness counts one.

To regulate health we must regulate diet.

Certain kinds of food feed the fat and leave the muscles and brain to starve. Certain other foods feed the muscles exclusively, and certain others the brain. A large part of the food of Americans is composed of white flour, sugar, and butter. People who try to live upon such stuff gradually starve to death.

There is a gentleman in Boston who has amassed an immense fortune. His carriage is the finest in the neighborhood, and he wastes money lavishly; but his face is the picture of despair. Life is a torture to him, because he is nervous and dyspeptic. Half the rich men and women belong to the category of the miserable; they cannot digest their dinners.

The common notion that our health and life depend upon a mysterious Providence is downright infidelity. A child goes out of a hot room with naked arms and legs in pursuit of its daily supply of poisoned candies, and then dies of croup. Is that a mysterious Providence? If a man indulges himself until he gets the gout, and the disease attacks his heart and kills him, is his death a mystery?

The reason that the American people are such dyspeptics is, that they eat and drink so much, and eat and drink so fast.

The teeth will not decay if they are kept clean. A toothbrush is a good thing, but one good toothpick is worth an armful of toothbrushes. There is a gentleman now living in New York city who has three beautiful front teeth which he purchased from the mouth of an Irishman. His own teeth were removed and instantly Patrick's were transferred.

The process of digestion begins in the mouth and ends in the lungs. The mouth grinds the food; the lungs supply the oxygen which converts the products of the food into pure and useful blood.

Dr. Lewis once attended the lecture of a Thomsonian doctor who explained the use of mercury as follows:

"And now do you know how marcury produces the rheumatiz? I'll tell you exactly how marcury produces the rheumatiz. You see marcury has a great many sharp pints, and them sharp pints go straight in the flesh, and when the muscles rub over them sharp pints it scratches, and that's the rheumatiz."

Many people imagine themselves afflicted with serious diseases when they are only suffering from dyspepsia. A dyspeptic patient always despairs; a consumptive always hopes.

John Abernethy was the greatest man the medical profession has produced in modern times. Perhaps no other man has contributed so much to temperance in eating as he.

To make the best bread that can be made of wheat, obtain good wheat and grind it without bolting; mix it with cold water until it is as thick as can be well beaten with a spoon; after it is thoroughly beaten down, put it into a large iron pan, composed of many little ones, which must first be made hot; put it then quickly into a hot oven, and bake it rapidly as possible.

Indian corn makes excellent nourishment. It contains a large amount of oil, has remarkable fattening qualities, and is likewise remarkable as a heat producer. Rice keeps its consumers fat, but it lacks the elements which feed the muscles and brain.

Potatoes, both Irish and sweet, are very poor food for brain and muscle.

Of meats, the best for heat and fat are pork, mutton, lamb, beef, and veal; for muscle, beef, veal, mutton, lamb, and pork; for brain and nerve, beef, veal, mutton, lamb, and pork.

In cold weather, fat meat, butter, and the like will keep the body warm; and in warm weather milk, eggs, bran-bread, and summer vegetables will keep it cool.

There is no difficulty in a poor man's having meat for his family every day. Take, for example, what is called a shank of beef. The very best can be bought for a fraction of what the dearest parts cost. A single pound cooked in a stew with dry bits of bread will make a meal for an entire family.

The Greek and Roman armies ate but once a day.

The common impression that tomatoes are the healthiest of all vegetables is a mistake. If eaten at all, it should be with great moderation, and never raw. Tomatoes have sometimes produced salivation. Dr. Lewis knew a young woman who had lost all her teeth from excessive eating of tomatoes.

Pies and cakes are poisonous.

To healthy persons mineral waters are not wholesome.

Corsets are most injurious to digestion. Their use finally results in an immense and very ugly protuberance of the abdomen.

Light and sunshine are indispensable to health, and great curative agents in disease.

Those who suffer from heartburn, should avoid soups, drink nothing at meals, say "No, thank you," to pies and cakes, and go without supper.

If you wish to live to eighty-five in the full enjoyment of all your faculties, go to bed at 9 o'clock, and eat twice a day a moderate quantity of plan food.

The native American requires more sleep than the average European. Nine or ten hours' sleep in a single night is very beneficial. Thin Yankees should go to bed at nine and rise between five and six.

In a girl's school which Dr. Lewis conducted with great success at Lexington, Massachusetts, the health rules were as follows:

"To go to bed at half-past eight every evening, to rise early in the morning and take a walk, to walk a second time during the day, to eat only twice a day plain nourishing food, to wear no corsets, to exercise twice a day half an hour in gymnastics, and to dance an hour for about three times a week. The gymnastic exercises proved invaluable; but the nine hours in bed were still more so."

The word biliousness is a sort of respectful cover for piggishness. People are not bilious who eat what they should.

Weakness of the stomach is a protection against other maladies. So dyspepsia is the safety valve, and may be spoken of as one of the sources of longevity.

People who are fat can easily be reduced by reducing their food and giving them more exercise. Such persons must not sleep too much. Long sleep fattens. Thin people, on the contrary, should sleep a great deal.

Military Chemistry.

There is one department in the British service which has been of the most essential service ever since its establishment, viz., the Department of Chemistry. It was, says the *Public Ledger*, formed during the Crimean war, at the suggestion of the illustrious Faraday, to check the frauds of the contractors for army supplies at that time. The Minister of War allotted to it a large space in Woolwich Arsenal, fitted up with laboratories, provided with every species of apparatus, with fine balances for estimating results, with the most powerful microscopes, with machinery for analyzing gases, with photographic studios, etc., etc., all of which were placed under the control of a distinguished professor of chemistry and half a dozen well-skilled practical assistants, whose time is fully employed in a variety of matters, and just now, especially, in testing metal for the manufacture of guns and projectiles, in examining the elements of gunpowder, in analyzing the stores and food of the soldier, and in many other experiments of a similar kind.

It is somewhat surprising that such an establishment was not founded long ago, familiar as all the world is with the tricks of contractors in times of public necessity, as during a war. It is a melancholy fact that there should exist a class of men who have no scruple in sacrificing, not merely the health and lives of their fellow men, but the very safety and existence of their country, in order that they may make money out of its necessities.

We need only turn our eyes to France at the present moment for a sample of what these men are capable of. What French contractors have done lately, English contractors did during the Crimean war, and American contractors did during our civil war. The guilt seems to be characteristic of the class generally, and not of any one nation in particular. But the good effects of such an institution as the British Military Department of Chemistry were shown in the recent Abyssinian war, when out of a large number of articles supplied to the troops none were complained of, for they had previously been tested by the Department.

The rule now is, that when tenders are sent in for supplying stores to the army, the contractors are bound to forward, at the same time, specimens of the material they intend to supply. These samples are carefully tested in the chemical department, and the firm that offers the most suitable articles at the lowest prices receives an order to supply the goods. Subsequently, when these are sent in, a further examination takes place to ascertain whether they are equal to the samples first submitted, and only if this proves to be the case are the stores accepted and paid for.

The number and variety of the articles operated upon is extraordinary. Almost all the belongings of the soldier pass in one way or other under the eyes of these chemical detectives. The cloth of his coat, the thread with which it is sewn, the gold lace, the accoutrements, are all tested, and the buttons he wears must be covered with a film of metal sufficiently strong to withstand the action of the acid which the chemist applies to them. The bread, milk, flour, biscuit, preserved meat, vegetables, fruit, etc., of his rations are periodically sent to Woolwich to be tested, and it is said that the system has been so rigorously applied throughout the service that, even at remote stations, flagrant cases of fraud are now rare.

Considerable pains are taken to provide wholesome drinking water in barracks, and a very large portion of the work of the chemical department is devoted to this point. Specimens of the water used at the military stations abroad as well as at home are forwarded to the arsenal for analysis, and reports as to its qualities, together with advice to the commanding officers, are sent to the different stations. Barrack and equipment stores are not forgotten. Soap, candles, oils, coal, coke, emery dust, varnish, blacking, paper hangings, and all kinds of paint are analyzed carefully in order to prevent the injurious action of arsenic, lead, and other poisonous metals. Soap, in particular, is always severely tested, by reason of the facility with which it may be adulterated, and because it is used in such large quantities.

Very great vigilance is also exercised over camp equipage; the making of the canvas uninflammable and unfavorable to the formation of mildew, the perfecting of the india-rubber coating for the ground sheets on which the soldier spreads his blankets, and other like cares also occupy the department. The services it has rendered are immense. The condition of the modern soldier is very different from that of the soldier of even half a century ago, when he was looked upon as little better than "food for powder."

THE war is effecting the tobacco trade of this country adversely, France and Germany being the largest consumers of Europe, and with England requiring, during the year ended June 30, 1870, 180,000,000 pounds of leaf tobacco, 2,064,000 cigars, and 20,181 pounds of snuff.

STEAM RAILROAD FERRIES BETWEEN ENGLAND AND FRANCE.

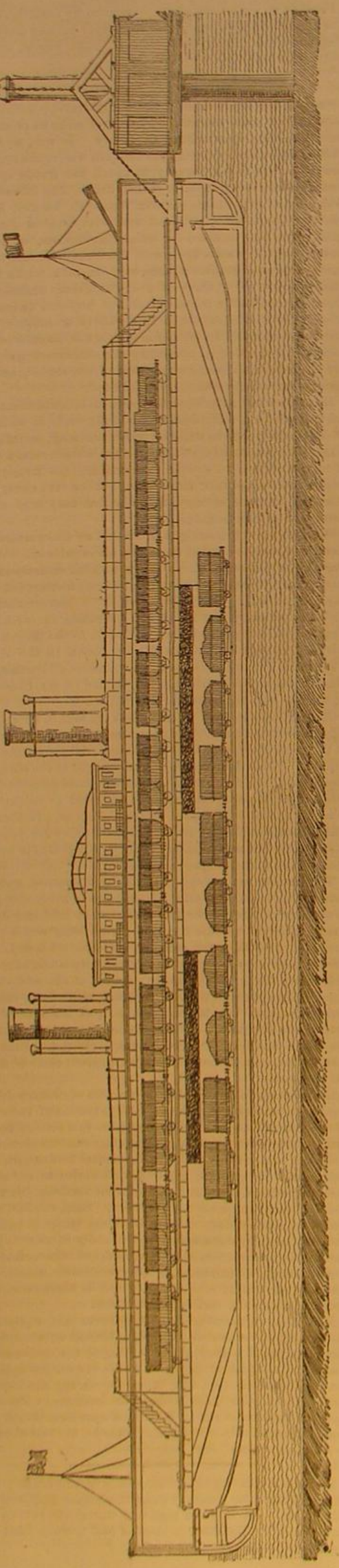
It has been mentioned in these columns that an English company has been formed with a view to effect a simple and practical solution of the problem of quick, safe, and comfortable transportation, across the Straits of Dover, between France and England, for railway passengers. The plan adopted seems to us far more feasible than the bridges and tunnels hitherto proposed.

The method is due to Mr. Fowler, who proposes to use an immense steam ferry-ship, capable of receiving entire trains on its ample decks, with all their passengers, freight, and baggage.

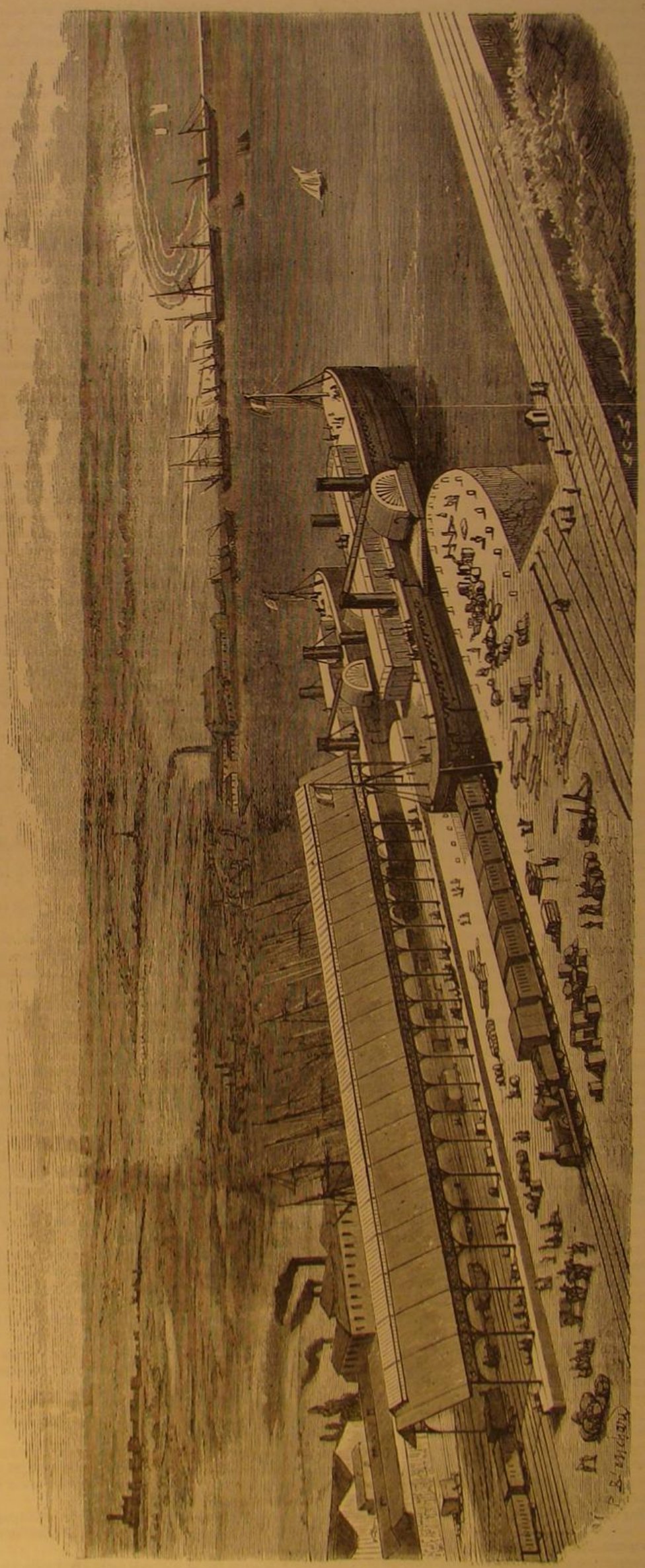
We need not dwell long on the details by which the embarking and disembarking of trains will be accomplished, since the accompanying engravings sufficiently indicate them, and they are in principle the same as those employed on American railway ferries which transport trains.

The differences in the model of the vessel and its details from American vessels used for a similar purpose, are only such as will adapt the ship to the much longer and rougher voyages it will be obliged to encounter.

We may add that the vessel will be only about seventy five feet shorter than the *Great Eastern*, or something more than six hundred feet in length. This great length is intended not only to accommodate the length of trains but also to give immunity to passengers from sea-sickness, as the rolling of the waves cannot much affect the stability of a vessel of this size.



LONGITUDINAL SECTION OF THE BOAT AND LANDING.



BIRD'S-EYE VIEW OF THE DEPOT AND DOCKS TO BE CONSTRUCTED AT ANDRECELLES AND DOVER.

Docks capable of receiving the trains are to be provided at Dover and Andrecelles—the latter point being considered better than Calais for this purpose. The estimates of cost for vessel and docks amount to fifty millions of francs, in round numbers about ten million dollars American currency, and it is thought the execution and putting into operation of the plan will occupy three years.

The system can hardly be regarded as an experiment, except in so far as the magnitude of the vessel and width of water to be traversed are concerned, as it has been already fully tried on American rivers, and even in crossing arms of the sea, in various places. The design of Mr. Fowler is simply, as we have said in substance, a modification of a plan already found feasible.

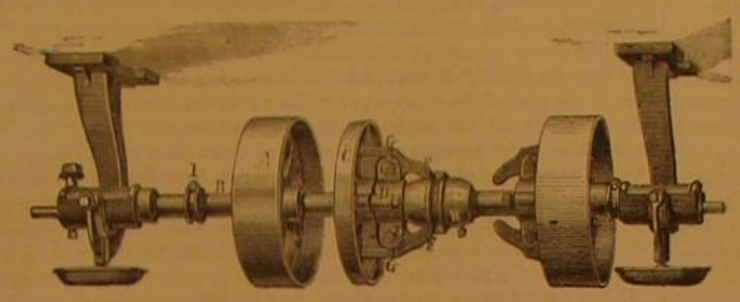
It is thought the passage in this vessel may be made in one hour, under favorable circumstances of wind and tide.

Improved Friction Clutch.

Our engraving exhibits a new form of friction clutch, claimed to be more simple in construction, more positive in its action, and more easily adjusted and kept in working order by ordinary workmen, than other clutches of the same class, thereby combining a greater degree of utility and durability.

A loose pulley, A, fits closely and turns freely on the shaft, B. The inside of the rim of this pulley is beveled, to fit the taper of the wheel, C. The hub of the wheel, C, traverses longitudinally on the shaft, B, or works partially upon the hub of the pulley, A, when it is desired to give the latter a longer and firmer bearing on the shaft. The taper surface of the wheel, C, bears upon the inside of the rim of the wheel, A, throughout its whole circumference when the two are brought into contact.

A collar, D, is fitted to and secured upon the shaft, B, having ears, E, between which are fitted dogs, F, which have a free action on pivots in the ears, E. The ends of these dogs next the wheel, C, take their bearing against prominences, G, formed on the wheel, C, and the opposite ends bear upon the collar, H.



PRATT'S IMPROVED FRICTION CLUTCH

A series of springs act in connection with dowel pins in the collar, D, to throw out the wheel, C, when it is desired to release the pulley, A, from the clutch, the pins also serving to maintain the proper relative position of the wheel, C, to the collar, D.

By pushing the clutch collar, H, toward the wheel, C, in the ordinary way, the outer ends of the dogs, F, are forced apart, their inner ends being at the same time pressed against the prominences, G, on the wheel, C, which is then pressed home to its engagement with the rim of the wheel, A.

The position of these pulleys in the engraving would not admit of this action, the wheels being separated on the shaft in order to show the construction better, but in setting the pulley, A, the collar, I, is employed, by means of which the pulley, A, is held up so closely to the clutch wheel, C, that a very slight motion of the clutch collar, H, is sufficient to complete the engagement.

Patented, Feb. 22, 1870, by Francis A. Pratt. Address for further information Pratt, Whitney & Co., Hartford, Conn

Correspondence.

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

Cleansing Boilers.

MESSRS. EDITORS:—It is well known that water impregnated with earthy matters produces, when boiling in a steam boiler, a scum on the surface. If this scum be collected and blown out, the boiler will seldom require to be opened and cleansed; but if the scum be allowed to accumulate and settle upon the plates where the fire impinges, the injury to the boiler will be in proportion to the thickness of the accumulation, which, according to the nature of the deposit, assumes either the form of scale or mud. When it assumes the first named form, the boiler will require to be often opened and cleansed, or the injury from the burning of the plates will be great.

The arrangements, of which I send you drawings, and which are designed to prevent such deposits, consist of a number of hopper-like mouthed vessels introduced into the boiler standing a little above and below the water-line. These vessels communicate, by means of vertical pipes, with a horizontal pipe that passes through to the outside of the boiler, as the scum arises, and falls again in the water, the open mouthed vessels collect it; and, as at intervals, the valve at the end of the pipe spoken of is opened, the collected scum or deposit is "blown out," and the boiler plates are thus kept clean. (See Nos. 1, 2, and 3).

In diagrams annexed the longitudinal pipe, extending from end to end, is shown at A, Fig. 3, which is perforated with two rows of small holes, communicating by the pipe, to the cock or valve, D. At the top of the longitudinal pipe, A, there are vertical pipes, E, each mouthed by a cast-iron funnel, F, at the level of the water, which funnel faces the front or firing end of the boiler. The cast-iron funnel in diagrams, Nos. 1 and 3, is supplied with elevated partitions, H, leading to the receiving chamber at the top of the vertical pipe, E. The heat from the firing end causes a continual roll or flow of the water towards the back end, by which means the scum enters the funnels, from whence, by opening wide the cock, or valve, D, it is swept away into the sewer or drain.

The apparatus can be so modified as to suit every description of boiler, whether multitubular, two-flued, or cylinder boilers, and of any length, can be cleansed from end to end in less than one minute, without stopping the working. In water there is a great difference in quality for steam purposes, some waters scarcely give out any deposit, while with others the deposit is great, and this is the cause of considerable difficulty, if not constantly removed.

It therefore behooves the engineer, when he has to work with water of the latter description, to be exceedingly attentive, and to look well after the interior as well as the exterior of his boiler, and particularly where the water has spent dyewares and acids mixed up with it, as is often the case in manufacturing districts. In this matter, as in many others, he may lay it down as a rule, that the utmost cleanliness possible will result in a saving of fuel, and in the prevention of much "wear and tear" to the boiler. T. C.

Philadelphia, Pa.

Fig. 1

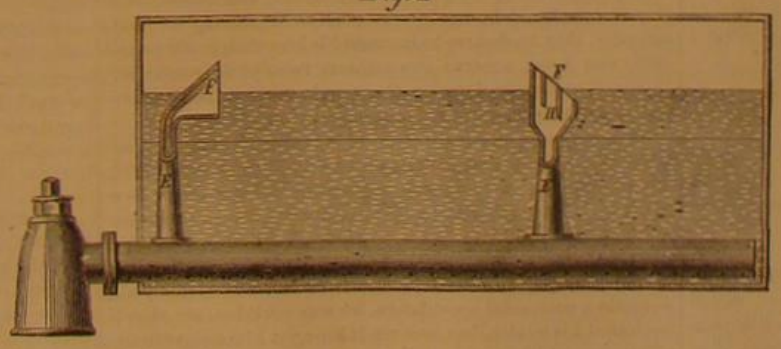


Fig. 2

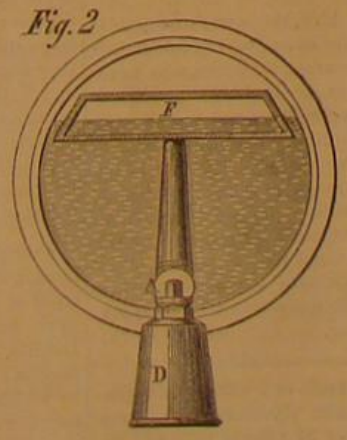
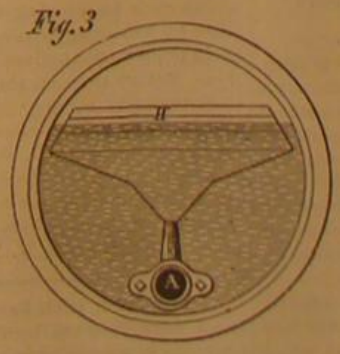
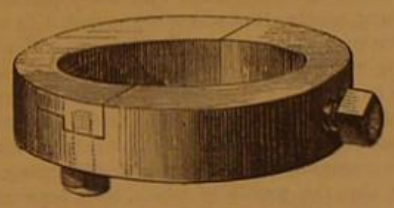


Fig. 3



Securing Collars and Eccentrics to Shafts.

MESSRS. EDITORS:—In the course of travel I came across the device herewith illustrated, for securing collars and eccentrics, particularly those on locomotives, which is a most excellent plan, and one of those simple arrangements that commends itself to all mechanics at a glance. It is as good as a solid collar, and has the advantage that it can be put on or taken off without disturbing any other details of the machine.



This device is the invention of Mr. T. G. Gorman, Master Mechanic of the Toledo, Wabash & Western Railroad shop, at Springfield, Ill., and explains itself to every intelligent person. EGBERT P. WATSON.

Prevention of Incrustation in Boilers.

MESSRS. EDITORS:—Three years ago I had charge of a tubular boiler in the Stanley Rule & Level Co.'s Works, New Britain. The water was hard, forming a hard, brittle scale, and the method tried there was a battery in the inside of the top of the boiler, designed to keep the iron charged with electricity, and prevent the formation of scale. It was effectual, for after something over a year's trial, the tubes and shell were found to be entirely free from scale.

The arrangement alluded to is patented, and I think it is as good as anything that can be used, as it is simple, and causes no trouble after it is put in. I should like to hear from others whether similar success has been met with when water of a different quality has been used.

Waterbury, Conn. W. E. CRANE.

A Cheap and Efficient Low Water Detector.

MESSRS. EDITORS:—Noticing in the last issue of your paper the criticism of Mr. B. Franklin on the use of the fusible plug of common tinman's solder for a low water detector, I desire to ask Mr. Franklin a few questions. First, would any boiler be safe to use with a scale over the iron or the fire-box plate so thick that steam under the usual pressure would not find vent through a ¼-inch hole?

Second. Would not the iron become hot enough to meet solder before a scale would make over the plug, so as to prevent the escape of steam?

Third. Was such a plug ever recommended as a low water indicator, or was it simply as a detector? There is quite a difference between the two purposes.

Fourth. If the water gets below the crowning sheet so as to heat it sufficiently to melt out the plug, is it not time that the fire in the furnace was put out?

Fifth. Would Mr. Franklin recommend keeping up the fire and running right along after it was ascertained that the water was below the crowning sheet? If so, then water must be pumped into the boiler with the crowning sheet red hot. Would not this endanger explosion at once?

In the last report, as published in the SCIENTIFIC AMERICAN, of the Hartford Steam Boiler Inspection and Insurance Company they report twenty-five burned plates. These plates were either burned by the water getting below them or by the collection of scale or sediment, so that the water did not come in contact with the iron.

The fusible plug may be made long enough to project through the inner surface of the sheet half an inch or even more if necessary. This would prevent the scale or incrustation from forming over the end of the plug, so as to prevent escape of steam in case the plug melted.

What objection would there be to the use of such a plug in the boilers of steamers? Could not a ¼-inch hole be stopped at any time by driving in a pine plug if necessary?

INQUIRER.

Shoemakers' Measure.

MESSRS. EDITORS:—Stimulated by your generous invitation to "some one" to state what is the true shoemakers' measure, and gravely concluding that I am "some one," as well as any other man, I betook myself to my footman, *vulgo* shoemaker, and made the necessary inquiry by inspection of his "measure." The same revealed the following facts, to wit:

No. 1 *is* 4⅔ inches, and every additional number ⅓ of an inch more, but only for children's feet. For adults, No. 1 is 8⅓ inches, and every additional number ⅓ of an inch more, so that No. 10 is 11⅓ inches. "Constant Reader," whose No. 10 shoe measures 11¼ inches, does evidently rejoice in the possession of a stout understanding, as the leather thereof adds ¼ of an inch to the length of the last, to which the measure is actually applied. OCCASIONAL READER.

Welding Cast Steel.

MESSRS. EDITORS:—Noticing an inquiry in your paper for a recipe for welding cast steel, and having had considerable experience in that direction, I will attempt a few practical suggestions, and the result of my experience.

So much, however, depends upon the skill of the operator, that in unskillful hands any instructions might fail to be of use.

I have welded stone drills, points into mining picks (into the solid steel, not the iron), points into cold chisels as an experiment, and cast steel bars of various sizes, in the following manner: First, by upsetting the two ends that are to be welded considerably larger than the welded part is to be when hammered down to the proper size; then split one of the ends a little deeper than the bar is thick; draw out the ends of the lips, and narrow them up at the points. The end to be welded into this I draw out into a blunt wedge shape, narrowing the end also. I make a cut with a cold chisel on one side of the wedge-shaped end in order to prevent it from slipping out when sticking them together, as hereinafter explained. I then heat the two ends that are to be united to a cherry red, using common borax, unite them in the usual way, driving them together endwise, then closing down the two lips with the hammer, at a bright cherry red, they will stick together. Then put on plenty of borax, and heat in a charcoal fire to a point just above a bright cherry red, but not to a sparkling heat as in welding iron. At the proper welding heat of cast steel, the borax can be seen in a charcoal fire to run over the steel and curdle, giving the appearance of curdled milk on the bottom of a dish. At this heat, if done quickly, as perfect a weld can be made of common cast steel as can be made in welding iron, and not injure the steel in the least.

In this manner I have welded stone drills and cold chisels

so as to use and wear them right through where the weld was made.

I have tried various materials made under recipes and different compounds for the purpose, and some of them possessed wonderful sticking qualities in holding the parts while being united, but never found anything that would make as sure a weld as borax. J. E. E.

To Pocket Chronometer Makers---A Challenge---A Bomb-Shell in the English Camp.

MESSRS. EDITORS:—In my third challenge to pocket chronometer makers, I propose clearly to explain what I mean by friction-isochronism, as it refers to the isochronism of the pocket chronometer, whether the chronometer or lever escapement is used.

The so called "Isochronal spring" is not isochromal, it makes its shorter vibrations in longer time. With a real isochronal spring the chronometer escapement gains in smaller tension (smaller motion of the balance), and the lever escapement more so; hence the spring must make its shorter vibrations, as above stated, to become the "Isochronal spring" of horology. The isochronal vibrations of a chronometer are made by a non-isochronal spring. This is one condition, and has for its cause reduction in motive force. Friction-isochronism is as different from motor-isochronism as is the duplex from the chronometer escapement; and has for its cause increase of friction per same force against the detent. These two conditions are antagonistic—one gains, and one loses, in smaller tension. Here the "Adjuster" asks the isochronal property of the spring to "serve two gods." Will it do it? Accidental results are to have nothing to do with this challenge.

Thus far, however, the thing is not necessarily impracticable, because the spring can be made to gain in smaller tension, and the motor made equal by the fuzee; but a third condition mixes with the above two, and has for its cause, external motion.

Here my challenge begins, where the two first-mentioned conditions end, and I am to use two, and the competitor one balance. The chronomoters are to be tested in any machine that may somewhat imitate the motion of the pocket.

Hanover, Pa. J. MUMA.

Smoky Chimneys.

MESSRS. EDITORS:—It is a well-known fact that the chimney flues of the upper floors of houses seldom have a good draft. Being one of those who, on account of the enormous rents in this city, are compelled to "live high," or, to use a Yorkism, "in the top of the house," I, or rather my better half, has been afflicted for the last two years with one of the above domestic pests. I remedied the evil as follows:

I went to a stove store and procured four lengths of five-inch pipe with an elbow on one end, and a cap raised about three inches from, and attached to, the other, and had the several joints riveted together. Then I went to the top of the house and lowered it down the flue until the end with the elbow came opposite to the hole in the flue where the stove-pipe from the kitchen entered it, then inserted said pipe in the elbow, making a continuous pipe from the stove, through the flue, and projecting two feet above the top, fastening a collar around it resting on the top of the chimney to hold it in position.

The result was that a smouldering fire in the stove immediately sprang into intense life and heat, and in a very few minutes the stove was red hot. The whole expense of the job was two dollars.

The philosophy of the matter is this: In so short a flue the products of combustion do not remain in it sufficiently long to heat it to a degree sufficient to rarefy the air and give it an upward tendency. But the iron pipe, being thin, is quickly heated, and the air is thereby rarefied and ascends, causing a rapid current through the grate to supply its place. Y.

New York city.

Thermantidote.

MESSRS. EDITORS:—Refering to No. 17 (22d ult.), I would respectfully acquaint "T," Natchez, Miss., that the European residents of British India, have in use a machine such as he desires for cooling purposes.

I am not able to describe it in detail, but I know the principle is the same as a "fanning mill," and the current of air passes through a screen made of an aromatic grass, called "*Kus Kus*," *kept moist*, and consequently rendering all objects in its vicinity cool enough. I am induced to trespass thus much on your valuable time and space, in hopes that some of your readers acquainted with mechanics, may from the hint here given be enabled to perfect a design for the

Brooklyn, N. Y. "THERMANTIDOTE."

How Much Work a Horse can Do.

At a former meeting of the British Association in Dublin, Mr. Charles Bianconi, of Cashel, read a paper relative to his extensive car establishment, after which a gentleman stated that at Pickford's, the great English carrier's, they could not work a horse economically more than ten miles a day, and wished to hear Mr. Bianconi's opinion on the subject. Mr. Bianconi stated, he found, by experience, he could better work a horse eight miles a day for six days in the week, than six miles a day for seven days in the week. By not working on a Sunday he effected a saving of 12 per cent.

Mr. Bianconi's opinion on this point is of the highest authority; for although the extension of railways in the land has thrown thirty-seven of his vehicles out of employ, which daily ran 2,446 miles, still he has over nine hundred horses, working sixty-seven conveyances, which daily travel 4,244 miles; it is also founded on the result of forty-three years' experience.

Peter Cooper and the Cooper Institute.

At the head of the famous street called the Bowery, in the city of New York, stands the lofty edifice of brown stone which is known throughout the country as the Cooper Institute. There is a little park in front of it; and, standing unconnected with other buildings, at the point where the Bowery divides into two avenues, it makes a noble termination to the broadest and not least imposing of our streets. The ground floor of the building is occupied by showy stores, and the second story by the offices of various public institutions, the rents of which, amounting to about thirty-five thousand dollars a year, are the fund which supports the institution.

Under ground is a vast cavern-like lecture-room, in which political meetings are held, and where courses of popular lectures are delivered upon art and science. In the third story there is an extensive reading-room, furnished with long tables and newspaper stands, wherein the visitor has his choice of about three hundred journals and periodicals from all parts of the world.

This room is not much frequented in the daytime; but in the evening every seat is filled, and every stand is occupied by persons, well dressed, and polite indeed, who observe the strictest order, and yet have evidently labored all day as clerks, mechanics, or apprentices. Several ladies are generally present, reading the magazines; for this apartment is free to all of every age, sex, condition, and color, provided only that they are cleanly dressed and well behaved. On a platform at one end of the room a young lady sits, the librarian, who exercises all the authority that is ever needed. The most perfect order prevails at all times, and no sound is heard except the rustling of leaves. In all the city of New York, a more pleasing spectacle cannot be found than is exhibited in this spacious, lofty, and brilliantly-lighted room, with its long tables bordered on both sides by silent readers, presided over by a lady quietly plying her crotchet needle.

If you ascend to the stories above, you behold scenes less picturesque, but not less interesting. The upper stories are divided into class-rooms and lecture-rooms. In one you may see fifty or sixty lads and lasses listening to a lecture upon chemistry, illustrated by experiments. In another, a similar class is witnessing an exposition of the electric telegraph. In another apartment, there will be a hundred pupils seated at long tables, drawing from objects or copies; and in another, a smaller class is drawing a statue, or a living object, placed in the center of the room. Drawing, indeed, would appear to be a favorite branch with the frequenters of this establishment, nearly all of whom are engaged in some mechanical business which drawing facilitates. Young machinists and engineers, young carpenters and masons, who hope one day to be builders and architects, young carriage makers, upholsterers, and house painters, who aspire to exercise the higher grades of their vocation, are here in great numbers in the various rooms devoted to drawing and painting. There are classes, also, the pupils of which, both boys and girls, learn to model in clay, several of whom have produced creditable works.

In the day time most of these upper class rooms are empty; but, soon after seven in the evening, crowds of young people begin to stream in from the streets, ascend the stairs, and fill all the building with eager young life. At half-past seven work begins, and after that time no one is admitted. The classes continue for an hour or two hours, according to the nature of the subject or exercise. By half-past nine the rooms are again silent and deserted. The reading-room closes at ten; the lights are extinguished, and the Cooper Institute has discharged its beneficent office for one day more.

All this is free to every one on two simple conditions; first, that the applicant knows how to read, write, and cipher; and, secondly, that he desires to increase his knowledge. Of course every one must observe the ordinary rules of decorum; but this is so uniformly done by the pupils that it scarcely requires mention.

Such is the Cooper Institute. This is that Evening School which Peter Cooper resolved to found as long ago as 1810, when he was a coachmaker's apprentice looking about New York for a place where he could get instruction in the evening, but was unable to find it. Through all his career as a cabinet maker, grocer, manufacturer of glue, and iron founder, he never lost sight of this object. If he had a fortunate year, or made a successful speculation, he was gratified, not that it increased his wealth, but because it brought him nearer to the realization of his dream.

When he first conceived the idea, there were no public schools in the city, and such a thing as an evening school had not been thought of. His first intention, therefore, was to establish such an evening school as he had needed himself when he was an apprentice boy, where boys and young men could improve themselves in the ordinary branches of education. But by the time that he was ready to begin to build, there were free evening schools in every ward of the city. His first plan was therefore laid aside, and he determined to found something which should impart a knowledge of the arts and sciences involved in the usual trades; so that every apprentice could become acquainted with the mechanical or chemical principles which his trade compelled him to apply. —*James Parton in the N. Y. Ledger.*

SATISFACTORY trials have been made of a mitrailleuse procured from Belgium by the Spanish Government, and discharging in a minute ten volleys of 37 conical balls of 1 oz. weight apiece. These projectiles pierced a 3-in. metal plate at 1,400 yards, at which distance three per cent reached the mark. The weight of the mitrailleuse was 336 pounds, and its cost about $1,000.

A Wonderful Toy---An Automatic Masterpiece---Reducing the Pictorial Arts to Machinery.

Joseph Bergmann, who lives in a little wooden house on Farm street, Job Hill, has for fourteen years been steadily working with one object in view—the perfection of a wonderful piece of mechanism. One night, fourteen years ago, he dreamed of a machine such as he has constructed. At first he thought little of it. Then it began to occupy his mind to the exclusion of other subjects, and after a time he began the work, at first at odd spells, and then continuously for days. Some inexplicable power was urging him on whenever he thought of giving it up. When the spells of infatuation came upon him everything had to be abandoned. His ordinary work had to be laid aside, even though there was no bread upon the cupboard shelf, and many a night the poor artisan went hungry to bed. But after years of anxious toil the dream is verified, the work is completed.

But before we describe, even most imperfectly, the machine, let us say something of its author. Bergmann is a German about fifty years of age, and speaks English imperfectly. He is a little diminutive man, with a pale, sallow countenance, and a look which speaks of care and thought, if not of positive suffering. He is very poor—the house is almost bare of furniture—and in speaking of the dream and the work which had so infatuated him, he said it would have been better for him if he had never experienced the one or undertaken the other. He is a cabinet-maker, and the skill of an almost marvelous handiwork, as well as the stamp of remarkable inventive genius, is to be seen in the construction of the machine.

The machine eclipses all the automatons in the world. The reader must imagine a beautiful miniature structure set upon a huge mass of rocks, with road-beds winding up the sides of the rocks, and streams of running water coursing down precipitous bluffs. This miniature house represents the residence of a wealthy old miller, with his grist mill, saw mill, oil mill, etc., adjoining. There are some thirty figures to be seen in the foreground and about the buildings and mills. There is also a little fountain in the foreground, with the water playing, and a lake with a boat and oarsmen.

All these mills and figures and playing waters are set in motion by means of a combination of machinery similar to the works of a clock, and when these are wound up and set running every figures takes up its automatic movement. The old miller sits in an elegant apartment reading a newspaper. His eyes follow the column downward. His head inclines with a corresponding motion. The column is finished, and the sheet is turned over, and the eyes are attracted to another portion of the paper. Every movement is wonderfully life-like.

The miller's wife sits in another apartment industriously spinning. The domestics are going about performing their daily toil. The saw mill is a *fac-simile* of such an institution. The log is in its place, and slides along to meet the teeth of the saw, which is working up and down cutting it in two. The attendants are all busy in their several duties. The grist mill is also going. One man is tending and feeding the hopper. Every now and then he goes back and forth with a tray upon his shoulders, the contents of which he pours into the mouth of the hopper.

The great water wheel is moving steadily under the pressure of water from above, and the elevator keeps up its show of relieving a canal boat of its load of grain. Teams loaded with sacks are seen going to and from the mills. A man is perched upon the gable of the miller's home, adjusting a little bird cage to the eaves, and doing his work most perfectly.

The oil mill is also at work, and the figures are all busy about it performing their several missions. The boatman on the lake is rowing backwards and forwards, and apparently having a good time all by himself. Thus the entire operations of an immense establishment are carried on with as much definiteness and aim as in real life, every figure doing its work with the utmost exactness—the whole forming a wonderful combination of machinery.—*Troy Times.*

California and Oregon Railroads.

The original estimate of railroad distance between Sacramento, California, and Portland, Oregon, was 750 miles. The cars of the California and Oregon Railroad Company are now running for 115 miles of the distance in California, and those of the Oregon and California Company seventy-one miles in Oregon, making 186 miles in all, and leaving the space between 564 miles. The Oregon end of the road is graded ready for the track about thirty miles further, the company have a large quantity of iron on the way, and early in the spring they expect to reach Eugene City, at the head of the Wallamet Valley and 125 miles south of Portland. A large force of men is at work on the California end of the road, which is to be rapidly pushed. Probably the opening of next summer will see the staging distance between the railroad track in either State reduced to little more than 400 miles, possibly to 300.

As illustrative of the beautiful influence of furnishing an attractive and elevating means of amusement and entertainment at such prices as will render them generally accessible to the poorest classes, the experience of the Crystal Palace, in London, is in point. For sixteen years that institution has been in operation under a wise and charitable arrangement by which musical entertainments and amusements of every sort have been furnished at a merely nominal expense to visitors, during which time 24,000,000 people, workmen and those of the poorer classes, have availed themselves of its privileges, and not more than a dozen cases of intemperance or irregularity have been reported by the police as connected with the numerous gatherings at the place.

THE BALLOON AS AN AID TO METEOROLOGICAL RESEARCH.

A PAPER READ BY PROF. JOHN WISE BEFORE THE FRANKLIN INSTITUTE.

In the science of meteorology there is no instrumentality competent to do so much good, and which has as yet received so little attention as the balloon. The phenomena of the atmosphere, in their relations to climate and sanitary effects—to agriculture, to physiology—to our mental forces and temperaments, are more fertile in scientific developments than an observer from the earth would suppose. Meteorological investigations are as occult, tame, and spiritless, without the aid of an air-ship, as would be hydrographical investigations without the water ship. The deep-sea soundings, so pregnant with interest in their revelations of infusorial life at the bottom of the ocean, find their counterpart in the deep-air soundings in the opposite direction, in the myriads of vegetable life floating upon the currents of the atmosphere. It is not an uncommon thing to see the air currents above the clouds teeming with thistle seed, each one with its silken parachute sailing along in the grand procession. And so, too, is it with the pollen of other plants, moving along in little nebulous cloud patches.

The upper air is not so barren of scientific interest as its apparent vicinity, when viewed from the earth, would indicate. It is a marvel that so fruitful a subject, and one so easily to be explored, is so much neglected. The science of light seems almost reversed in looking down through the atmosphere to the earth from an insulated position of two or three miles of altitude. The earth looks concave, and the horizon is loomed up above the level of the observer. Sometimes a city five or ten miles off may be seen hanging in the heavens upside down, and illuminated by three suns. When this phenomenon presents itself above the cloud region it is more distinctly defined than when it occurs near the surface of the earth.

The phenomena of the clouds are full of interest. Some are dense, and some are attenuated. Some are warm, and some are cold. Some are light and some are dark. Some are charged with ozone. Passing through an ozone cloud causes hoarseness; it acts upon the mucous membranes, and is first perceptible by smell, and the twinging sensation it produces upon the cuticle of the hands and face. When the balloon comes near a cloud, electrical excitement takes place; it also occurs when the balloon is passing from one current of air into another. The finer part of the light sand ballast, used by the aeronaut, is drawn in a stream from the car up and against the body of the balloon. Also, the fine-cut index paper, used by aeronauts, is, in such cases, drawn up against the balloon, hanging there for a while with a tremulous motion, and then falling off. I have heard it making a crepitating noise when thus thrown out by handfuls. The stillness is so profound above the clouds that a noise, not perceptible on the earth, is quite discernible there.

It is remarkable how suddenly, at times, the currents of air strike the balloon, causing it to swing slightly to and fro, as well as to rotate on its vertical axis. These sharp crossing currents are always attended with marked electrical evolutions. The gas in a balloon, that is perfectly transparent when it leaves the earth, is changed into a cloud when it gets into a region of clouds. And it assumes this character of cloud in a perfectly clear atmosphere, when the balloon reaches the region of frost. I have had my hair thickly covered with hoar frost on a Fourth of July, and cloud issuing from the neck of the balloon, at an elevation of 19,000 feet.

The atmosphere is always clear and transparent after a rain storm; it is only then that an observer aloft has a great scope of view of mundane objects. On such occasions, the view in ascending from the seashore is very imposing. It is well known that from the land, or the surface of the sea, a ship is not visible when twenty miles off. The earth's convexity being about eight inches to the mile, and this obstruction of convexity, increasing as the squares of the distances, limits the sight of a ship within moderate scope. Thus, in ascending from a place like Boston harbor, the scene becomes very interesting. As you gradually go up, so come up the ships behind the horizon. It looks like magic. Of a clear day you can see ships at sea a hundred miles off, when the sun is in the opposite direction. With cloud fields between the observer and the ships, they have the appearance of sailing above and over the clouds. So the meandering of a river is sometimes seen convoluting itself over and under the clouds in the distance. These unique sights are, of course, optical illusions, but, without a knowledge of the science of optics, would be deemed mysteries. They prove, however, how subject we are to be misled by our senses in cases where science is not available to correct their errors.

The most marked difference between an earth view and a sky view occurs in the storm cloud. The nimbus, or thunder cloud, when viewed from the earth level, looks like an agitated and confused mass of leaden-colored vapor. When viewed from a little above its level, and from a few miles distance, it looks symmetrical. Bulged out above and below, and contracted in its middle, it trails along over the earth like a huge smoking, fuming engine, dragging its lower part slightly behind, like the trail of a court lady's garment. The electrical cannonading as it passes along, gives it quite a grand and imposing effect. It is quite practicable to sail above, behind, or in the midst of these imposing meteors. Sailing behind one, and between its upper and lower cloud, I saw a beautiful prismatic-colored grotto, and, apparently from within this grotto, came terrific peals of thunder. This grotto was, no doubt, produced by the refractive power of the gas in the balloon, as the sun was shining in between the upper and lower cloud, and through the balloon, and the grotto appeared on the opposite side of it; that is, the grotto was on the east side, and the sun on the west side of the balloon, and it was late in the afternoon. That such was its cause is inferred from the fact that prismatic circles of light had appeared in the upper cloud surface, when the sun's rays passed through the gas of the balloon when sailing above it. This phenomenon only occurred with a silken balloon; silk becomes transparent when varnished; cotton does not. A silken balloon is also more susceptible of electrical excitement, than one of cotton. A silken flag crepitates in passing from one current of air into another, a phenomenon not perceptible in a cotton one.

Storm clouds do not all discharge thunderbolts. When a certain field space of atmosphere contains a number of them—and I have seen seven at one time, small ones—they deposit rain in fitful showers, but discharge no thunderbolts. When two or more of them coalesce, then discharges of electricity follow. These detached nimbus clouds are prevalent in the month of April and May, and produce what we term "April showers."

During the heat of summer the thundergust proper prevails. Its constant attendant is heat. We all know this from common experience, the precedent suffocating heat before a thundergust When these meteors are generated suddenly they give out snow hail, and rain. The snow melts partly into hail, and partly into rain. Hailstones contain in their center a nucleus of snow. In rising up from the earth the deposition from a cloud grows diffuse, more and more, until you enter the base of the cloud, where it is a dense mist; and as you rise in the cloud, this mist becomes thinner, until near the top when it ceases entirely; at this point the cloud becomes warm, and when emerging from its top still warmer, caused by radiation and reflection; and then follows a twinging sensation in the cuticle of the face and hands like the pricking from bunches of needles, also slight hoarseness, with more or less pain in the base of the brain, and in the ears, when the ascent is sudden.

It is impossible to hold a level position in the body of a thunder cloud. You are all the time going up or down. The vortex current carries you up through the central part of the cloud, diverging the balloon outward with the outspreading vapor, upon which it describes its outward and downward course, generally to be drawn in again near the base of the cloud, and from thence upward on the uprising stream, and so on, like an endless chain, until you leave it by an increase of levitating force from its top, or an increase of gravitating force at its base; in the one case by a copious discharge of ballast, in the other by a copious discharge of gas.

To explore one of these meteors is, at first, calculated to produce a degree of anxious solicitude, but when experienced for a while, and duly considered, the experience becomes interesting and sublime, and well calculated to inspire the meteorologist with a desire to renew the investigation of atmospheric phenomena.

There is no disk rotation in a storm cloud, but there is a vortical rotation in its center caused by the two forces of the inrushing and uprushing air, shown in the swinging and rotating motion it gives to the balloon. This inward motion of the air toward the vortex of the cloud extends beyond the outer margin of the meteor, and will gradually draw the balloon toward and into the vortex. This can be prevented by giving the balloon an upward or downward motion, as, in either case, the center of the storm will recede from the air ship, and thus we have the power of riding in the wake or in the midst of a thundergust.

It may be deemed a hazardous mode of investigation to sail up into the air three or four miles high, but when we take into comparison the number of air voyages made, and the accidents related to them, we shall find as favorable results as in sea voyages. I have accounts of thirteen balloons that exploded while high in the air with their occupants, two of them with myself, while above the clouds, and in none of these was any one harmed. The law of atmospheric resistance is as certain as the law of atmospheric buoyancy. I even controlled the collapsed descending balloon from falling into a piece of woodland by lightening the weight in the disposal of ballast, and thus drifted beyond the trees.

So far as I have investigated accidents with balloons, not a single case occurred from any intrinsic principle of danger connected with the art. Not so with the sea ship. These two elements, wind and water, coming in conflict, cause the destruction of the vessel. Water, nearly a thousand times denser than air, and the air moving against the ship with a velocity of a hundred miles per hour, and the immense mast leverage, must necessarily bring a tremendous force upon its framework. Not so with the air ship. It has but one element around it, and, once free in the air, it matters not, so far as its ability to stand the strain is concerned, whether the wind moves one mile or one hundred miles per hour. Even with the latter velocity, your vessel glides along so smoothly and gracefully as not to ruffle a cobweb suspended from its flagstaff. Did you not perceive objects on the earth receding and approaching, it would be impossible to discern that you were moving at all. I traveled forty miles in forty-eight minutes in the midst of a cloud stratum, without being aware that I had moved forty rods before landing.

When accidents have occurred with balloons, they were always attributable, either to defective construction or a want of ordinary skill in the persons operating them. It is a deplorable truth that many, if not most, persons who use balloons are not scientific. And yet, this class have generally the most marvelous stories of blood oozing from their finger ends, and the balloon turning topsy-turvy, and the miraculous escapes they have made, to relate.

I trust enough has been said and done to show that we can go up into the air, into the cloud, into the storm, by day or by night, to investigate the phenomena of the upper air without incurring the accusation of being reckless, especially when high officials of state use them to escape from a beleaguered city, and governments send them off with mail-route agents to distribute daily mails.

The Franklin Institute, a time-honored school of art and science, is worthy of the establishment of a section of meteorology for the purpose of exploring the wonders of the atmosphere with the aid of a balloon and meteorological instruments. An air ship can be constructed for such purpose at a trifling cost as compared to the advantages to be derived; and the cost of inflation is now vastly reduced in the facilities afforded by the coal gas; and with such men as Dr. Wahl, our efficient secretary, to make the investigations, and an experienced air navigator to take charge of the air ship, and if my experience is worth anything, it would be voluntarily given, much can be done toward the establishment of certain scientific data as related to meteorological phenomena in the course of a year.

Dr. Wahl allows me to say, that he has not only no hesitation in making such explorations, but that he would most earnestly and cheerfully engage in the pursuit. The barometer, hygrometer, and electrometer, in the corner of the house, may hang there a century, and not reveal as much to the explanation of meteorological science as they will in one day up in the clouds, in the hands of a well-trained person.

We owe such a course of investigation to the age we live in. The onward march of knowledge exacts it and demands it at the hands of the learned institutions, and there is none so well adapted to its prosecution as the Franklin Institute.

When it is considered that we do not know, to this day, from whence the source of electricity in cloud phenomena—whether in storms it is a primary or a resultant; whether there is one kind or two kinds developed in a thundergust; whether the thunderbolt makes its detonation forcing its passage through the air, or in its percussion upon more solid matter; whether the bolt darts from one cloud to another, or whether it invariably darts to the earth—we should use all reasonable means to find out. The European scientists shot arrows into the air to learn something of atmospheric electricity. Franklin, always practical, not being able to get up into the clouds himself, sent up his representative, the kite, and, in a moment, demonstrated a fact, which, for a thousand years, had been held in abeyance—the identity of cloud and machine electricity. The great philosopher, fearing the ridicule of the unlearned over a man flying a kite, went clandestinely out to Bush hill, under cover of his son, to try the mission of his aerial messenger, and it proved and settled the long-mooted question.

The air-ship is destined to settle the question of the relation of atmospheric with terrestrial electricity, and how this pervading agent—gravitation *per se*, or intrinsic motion, or vis-vitæ, or whatever we may term it—is to be appropriated to our common welfare; for in it we live, and move, and have our being.

Buhl Work and Reisner Work.

Buhl was a cabinet-maker in the days of Louis the Fourteenth, and was instrumental in bringing into use a kind of decorative furniture, or furniture decoration, which has been more or less in favor ever since. It was not usually, in his work, actual wood that formed the surface; more frequently it was brass, silver, or some other metal, inlaid in tortoise-shell, on a wood backing. The mode of procedure was curious. A layer, say, of brass, and a layer of tortoise-shell, each as thin as veneer, were glued on opposite surfaces of a piece of paper; another piece of paper was glued outside, a pattern or device was drawn on the outside paper, and all the lines of the device were cut through and through with a fine saw. A little moistening removed the papers, and separated the inlay. What followed? Two patterns could be produced out of the two veneers: a brass inlay in tortoise-shell, and a tortoise-shell inlay in brass. The inlays, thus fabricated, were applied as veneers to the surface of a cabinet or other article of furniture. Old cabinets, thus adorned by Buhl and his cotemporaries, are now eagerly bought up at high prices by art collectors.

Another cabinet-maker of the same period, Reisner, varied the form of his productions by employing two kinds of wood instead of brass and tortoise-shell: usually selecting tulip wood and some darker variety. This was called Reisner work; like real Buhl work, it now commands high prices. It is evident that, the principle once being clearly understood, its application may be almost infinitely varied, according to the choice of materials, whether tortoise-shell, ivory, mother of-pearl, ebony, fancy woods, gold, silver, brass, copper, or what not. Cheap imitations of Buhl work are now produced by cutting out the veneer patterns with a stamping press, instead of by the slower aid of a saw. Other cheap imitations are made in the papier-maché workshops of Birmingham; fanciful patterns in brass, stamped out, are fastened down upon papier-maché, and the interstices of the device gradually filled up with successive coatings of black japan varnish. As to the devices that may be cut out with a fine saw, the fretwork of a pianoforte furnishes a very good example; although it is not often that the workman attempts anything of a pictorial character therein.

Of the 20,000 horses captured by the Prussians at the surrender of Sedan and elsewhere the best have been picked out and supplied to the German artillery and cavalry. These include many capital Norman horses for the cavalry, and heavy animals for the artillery. The Barbary horses of the African troops, excellent as they are, are deemed too small for the Prussian cavalry.

It is now said that the Mont Cenis tunnel will be completed in 1871. The Hoosac tunnel will require three years more for its completion. Both affairs are great bores.

THE WYCKOFF WOOD PAVEMENT.

The accompanying engravings exhibit the construction of the Wyckoff wood pavement, for which the following advantages are claimed: Superior cheapness and ease in construction, with durability. It can be taken up for the purpose of laying water pipes, gas pipes, or other purposes, and relaid without injury.

Fig. 1 represents the upper surface of the pavement, and Fig. 2 is a section of the same.

The openings being irregular in form and position, afford a good foothold for horses, and being filled with gravel and cement from top to bottom, make a solid and easy roadway. The courses being irregular prevent sweeping out of the material between joints, and also produce less jar upon vehicles than regular courses.

This pavement is very simple in its construction, and not liable to get out of order, a split block being irregular in surface, gives the cement a better chance to adhere, forming a key, so to speak, which prevents their moving out of place. Split blocks are more durable than sawed, for the same reason that split shingles are better than sawed; they will repel instead of absorb moisture. The blocks are cut off the log, six inches in length, and split into an irregular shape, of sufficient size for openings to accommodate the horses' foothold. These blocks are then thoroughly saturated in boiling tar. Upon the street being properly graded, a close flooring of boards is laid down, both sides of which are previously mopped with a coat of hot tar, care

Fig. 1

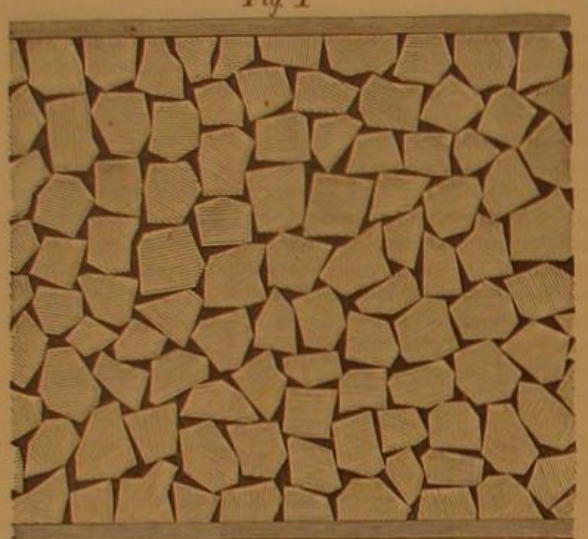


Fig. 2

being taken to make a perfectly even surface. Then upon this the tarred blocks are set up endwise, side by side against each other, without an intervening board partition, as is required by another method; and sawdust, tan bark, or any other fibrous material, is put in the crevices, to the depth of about one inch, which forms a perfect packing around the blocks, preventing the gravel from working under them. The remaining spaces are then filled up with heated gravel, and hot tar poured over it, after which the whole surface is cemented over with tar, gravel, and sand, which may be left on until thoroughly packed in the openings, which gives a hard, smooth surface. The longer it is used, the smoother and more compact it becomes, as the gravel and sand are being constantly tamped into the crevices. After a sufficient time has elapsed, the gravel and sand may be swept off the surface. It has been extensively laid down in the city of Elmira, and also in Pittsburgh, Pa.; Detroit, Mich.; Williamsport, Bellfonte, and Towanda, Pa.; at which places it can be seen and tested. Patented June 2, 1868. Further information can be had at the office of the Wyckoff Wooden Pavement Company, Elmira, N. Y.

Rating Steam Engines.

Messrs. Barnet, Le Van & Co., of Philadelphia, Pa., write us that they are glad we are agitating the question of uniform standards in rating steam engines. We are sure our views will also commend themselves to other manufacturers of steam engines. This firm has adopted a standard for rating, making the cut off at two-thirds stroke, and seventy-five pounds boiler pressure. The mean effective pressure, calculated from these data, should be, in a well constructed engine, 0·82 of the boiler pressure, or 61·40 lbs. We do not think this firm is the only one that is using some such standard of calculation; what we contend for, is, however, a uniform standard for general adoption and use.

POISONOUS CHEMICALIZED WOOD.—Mr. John O. Connell, whose communication in regard to the poisoning of workmen by chemicalized wood, in the erection of a railroad depot, recently appeared in these columns, now writes that the wood was prepared by a process known as the Foremaniger Patent. Another victim has since died. We have sought to find this patent in the published reports, but have failed, and can therefore give no details of the process.

STRONG'S PATENT FIREPLACE.

The accompanying engravings represent an improvement in fireplaces patented by James C. Strong, of Buffalo, N. Y., Sept. 21, 1869. The object of the invention, which is constructed on correct principles, is to increase combustion by a consumption of the gases which in ordinary fireplaces mostly pass off through the chimney.

The back of the fireplace recedes from the bottom toward

the top, as shown in both engravings, thus forming a deep space or chamber above and in rear of the fire basket, in combination with an inclined corrugated top, inclining upward from the back toward the front. Back of this recess or chamber is an air chamber, supplied with air by means of two apertures, *b b*, under the fire basket. From this air chamber many small holes are perforated through the back of the fireplace, *a*, through which currents of heated air are continually distributed into the back of the fire, thus supplying the gases evolved by the burning coal, with much more oxygen than they could receive from the front alone, at a place where the temperature is always high enough to ignite them, thereby creating more perfect combustion, and, of course, obtaining more heat from the same amount of fuel.

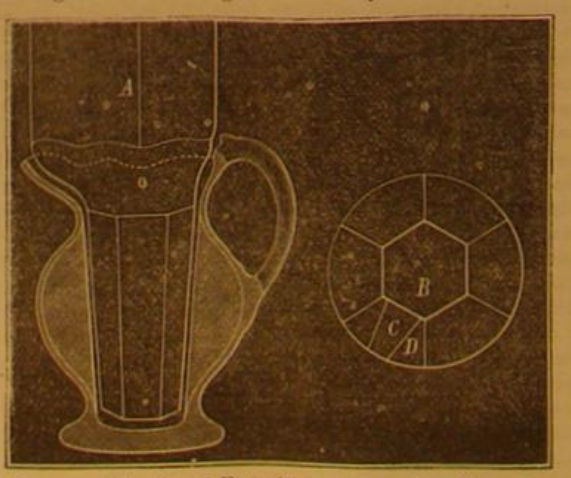
FIG. 2.

The corrugations in the top, more clearly shown in Fig. 2, retard the gases in their passage to the throat of the chimney, and keep them rolling back into the fire, thus giving more time for them to unite with the oxygen. The inclination of the top assists greatly in reflecting the heat into the room. The consuming of the gases greatly lessens the amount of smoke, so that this fireplace can be used in chimneys that sometimes smoke with an ordinary open fire. These fireplaces are made for both hard and soft coal; the only difference being that the fire baskets for soft coal should be much deeper on the bottom than those for hard coal, simply to give more room for the soft coal; but hard or soft coal will burn equally well in either kind of fireplace.

This fireplace has taken the first premium at fairs wherever exhibited, and has given perfect satisfaction to all who have tried it. Any information respecting the fireplaces may be obtained by addressing the patentee, James C. Strong, Buffalo, N. Y.

PIERCED CORES IN METAL CASTING.

Mr. William Porteous sends us the accompanying diagram showing how the castings exhibited by Mr. Lankenheimer



at the recent Cincinnati Exposition were made. The engraving shows the principle as applied to casting a cream pitcher.

The core is made in pieces, similar to those of a hat-block with bearing, A, Fig. 1, to rest in the sand. The central part of the core, B, Fig. 2, is hexagonal, and, when withdrawn, the pieces, C and D, are taken out and the remaining pieces can then be removed.

We are quite certain this principle is not a new one in the making of cores, but it may, nevertheless, give a useful hint to many of our mechanical readers. Mr. Porteous, who sends the drawing, is the maker of the articles mentioned as exhibited at Cincinnati.

IMPROVED BREAST-STRAP PROTECTER FOR HARNESS

Our engravings show an improved method of protecting the breast straps of harness, by which they are saved from rapid wear. It consists in the combination of a curved shield with two links, which are hinged to the ends of a shield, and clamp the latter to the breast strap.

Fig. 1 is an edge view of the whole attachment, and Fig. 2 a side view of the shield with the links. A represents the breast strap, and B the curved metal shield, placed against the inner side of the breast strap, and its curvature being such as to fit the strap, as shown in Fig. 1.

To the ends of the shield are pivoted central cross-bars of the two links, C. These links are made of iron or other suitable material, in the form shown in Fig. 2. Their sides are slightly bent, to give the peculiar shape shown in Fig. 1.

The strap is drawn through both links, and rests against the outer surface of the shield. As draft is applied, the links firmly clamp the shield against the strap. The ring of the neck yoke will wear against the shield instead of cutting away the strap as has hitherto been the case. Instead of merely being drawn through the links, the ends of the breast

Fig. 1

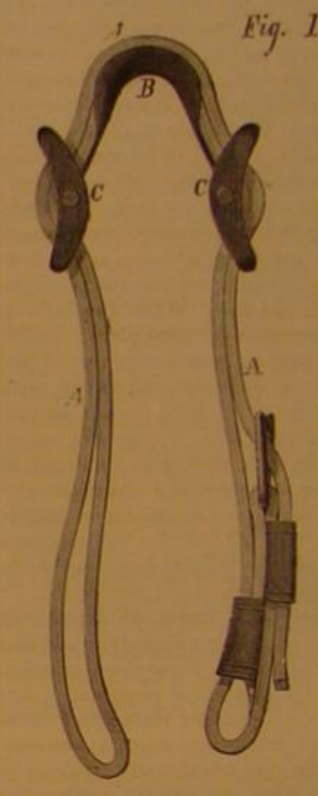
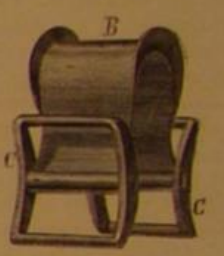


Fig. 2



strap may be attached to the outer ends of the links. The strap would in that case, extend from the link to the collar, and thence forward through the link and around the shield, the action of the apparatus being the same as in the other method of attachment above described.

Patented, Sept. 6, 1870, through the Scientific American Patent Agency, by Lorenzo R. Ward, of Ward's Corners, Iowa.

PERPETUAL MOTION.

We shall commence in our next issue a series of illustrated articles on Self-Motive Power. We have ample material for extending the subject through the year 1871, but shall continue their publication no longer than they are likely to prove of interest to our readers. For many of the designs and descriptions we shall lay tribute to a recent London work, edited by Henry Dircks, C.E. Others will be obtained from local sources, many of which possess most melancholy interest to those who have expended a life of study and a fortune in pursuit of the chimerical "*Perpetuum Mobile*."

How to Stop the Leakage of Gas-Taps.

Many people are annoyed by the slight leakage of gas-taps, causing an offensive odor deleterious to health in the apartments where they are placed, and also increasing their bills. In many cases they may easily remedy the evil without sending for a plummer or gas-fitter. To do this they should turn off the gas back of the meter; then take out (a screw driver is all the tool required) the plug. Next light a wax, sperm, or paraffin candle, and drop the melted wax, sperm, or paraffin upon the surface of the plug, till it is covered with a thin layer. Next, screw in the tap, and in nine cases out of ten the leak will be stopped, and remain stopped.

THE manufacturers of Berlin who have given employment to German workmen expelled from Paris, are said to be extremely well satisfied with the result. A great number of handsome and useful objects, known as *articles de Paris*, can be already produced in Berlin, quite as elegant as those of the French capital, and considerably cheaper. We believe the French will one day discover that they made a grand blunder in driving beyond their frontiers an industrious population who have so largely contributed to the prosperity of France.

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THE "SCIENTIFIC AMERICAN"—WHAT IT HAS DONE AND WHAT IT EXPECTS TO DO.

What might seem egotistical in an individual—a talk solely about himself—is pardonable in a newspaper, in placing before the public its claims for support and patronage, and the proprietors and publishers of the SCIENTIFIC AMERICAN would certainly prove themselves far superior to the ordinary weaknesses of mankind could they suppress all expression of gratification at the splendid and growing success of their journal.

The increase in quantity and variety of its contents, secured by contributions from the most popular scientific writers of the day, has been amply repaid in increased popularity and enlarged circulation; and our promise to maintain our paper at the very head of all papers of its class published in the world, has been kept, not only to our own satisfaction, but to that of our readers, as our numerous correspondents daily testify.

It has been the aim of the publishers rather to lead the minds of readers into new, suggestive, and profitable channels of thought, and to open the way for new applications of useful discoveries in the arts, than to dwell, at the risk of self-repetition, upon worn-out and thread-bare topics. To this end the foreign and home scientific publications have been ransacked for additions to useful knowledge, and the condensed results of these researches are weekly laid before our readers.

Our mechanical descriptions and illustrations are highly valued at home and abroad, and the most important are constantly reproduced in foreign engineering and scientific publications, and full credit given to their source.

Wherever the English language is spoken or read, our paper finds its way; and our advertisers are constantly surprised by letters of inquiry from distant and out-of-the-way places, from which they had no thought of patronage.

Our correspondence columns have been ably sustained, and the discussion of the single topic of balancing cylinders, etc., in the present volume, is worth more to any mechanic than the price of subscription.

Of the editorial department, we need only say, that the extensive copying of its articles sufficiently indicates their practical and scientific value, while their suggestiveness is shown by the correspondence, inquiries, and inventions they call forth.

Thus much for what we have already done. A word now in regard to the future conduct of the paper.

We are approaching the end of the volume and the end of the year, and our subscribers may rest assured that our motto is still "*Excelsior*." There is to be no retrograde movement. We shall advance with the general advancement of the period. And while we shall, in future, perhaps pay more attention to matters of general scientific interest, we shall do this in such a popular style, that all our readers shall be interested, and without lessening the practical character of our eminently practical journal.

While we are thus laboring to our utmost to make the SCIENTIFIC AMERICAN a necessity to every individual desirous of a reliable and thorough record of scientific and mechanical facts and progress, we are sure our legion of friends will continue their efforts to extend its influence and circulation. The best assurance that a subscriber can give of his satisfaction with our paper is the name of a new subscriber won by his solicitation. It is only by increase of circulation that we can increase our scope and variety of matter; and subscribers, who now get more for their money than any other paper in the world gives, will get still more for all the increase of our subscription list effected by their aid.

BEET-ROOT SUGAR—HOW THE WAR IS LIKELY TO AFFECT THE MANUFACTURE IN FRANCE.

As we have anticipated, the production of beet-root sugar in Europe is likely to be very largely diminished. In view of this prospect prices are advancing, and as the proportion of beet-root sugar in the world's consumption is a very large percentage of the entire aggregate, it is probable that for some time to come high prices in all kinds of sugar will be the rule.

The recent terrific hurricane in Cuba has probably done serious injury to the cane-growing regions, and the news has at least temporarily stimulated the market.

The Department du Nord, in which the German forces are now operating is one or the richest of the beet-producing regions of the earth. The effect of the campaign upon the sugar industry is thus described by a resident of the North of France:

"What is the result to us? Why, ruin. In my *pays* no less than twenty-two beet-root mills were to have been set in motion this year. They are built—they are ready, but we have no workmen, and no coals. The young men who were exonorated, and who had drawn good numbers—who had, in short, settled to industrious lives, thinking that the State had no further military claims upon them—are drafted off absolutely like *les moutons de monsieur!*"

In England the effect of this has been to stimulate efforts to introduce the beet-root sugar manufacture into that country, and the English journals are at the present moment discussing the subject with vigor. A prominent journal, hitherto of decided free-trade proclivities and antecedents, admits that but for a rigid protective policy there would never have been a beet-root sugar industry anywhere. The admission, however, is salved over by the expression of a doubt as to whether, after all, the "game was worth the candle," and this concession to a protectionist policy is made with ill grace and wry faces.

How the war will affect, if it affect at all, this infant industry with us, it is hard to say. If prices should be greatly stimulated it may temporarily assist in the development and prosperity of the establishments already in operation, but can we think, not permanently influence the manufacture one way or the other.

SHAD VS. BLACK BASS.

An important and interesting discussion has recently been conducted in *Forney's Weekly Press*, in which all pisciculturists, sportsmen, and even the general reader ought to be interested, since it intimately relates to the stocking of our rivers with fish. The controversy may be said to be that of Shad vs. Black Bass, in which Black Bass has been called upon to show cause why he should not be laid under perpetual injunction not to enter the waters of the Delaware.

The plaintiff in the case brought numerous witnesses on the stand to prove the ruffianly and predatory character of the defendant, and to show that his entrance into the peaceful waters of the Delaware, would result ultimately in the extinction of that branch of the Shad family now inhabiting and holding peaceable possession of the said Delaware River, as the powerful Black Bass race were known to be of so warlike a disposition, and so prone to kill and devour the infants of the Shad family, as also the infants of all other honest, peaceable, and innocent fishes; that the two races could not live together in the same waters, consistently with the welfare and peace of the commonwealth; and that the superior prowess of the said Black Bass, his heirs, and assigns would enable him and his descendants to drive out and destroy all members of the house of Shad from their present habitation.

The principal witness on the part of the plaintiff was Dr. Slack, of Troutdale, the extensive and well-known pisciculturist, who testified as follows:

"The black bass is one of the most voracious of our fresh-water fishes. Breeding rapidly, and, it is said, guarding the nest in the manner of our common sunfish, it can bid defiance to any other denizen of our waters. Even the pike will disappear in waters in which the black bass has been introduced. It frequents the upper portion of rivers above tide water, and its food is almost entirely young fishes, of which one bass will destroy an immense number.

"Now, what will be the effect of the introduction of this fish in the Delaware river? Certainly our young shad have already too many enemies without our having recourse to a new and extremely dangerous one. Frequenting, as I have said, the upper portion of our river, they will certainly encounter the young shad in their descent toward the ocean. It has been asserted that they will not inhabit the same waters as other valuable fishes.

"In opposition to this statement, I would say that on the evening of October 10, 1870, Mr. Williams, of Upper Black Eddy, while seining the river for rock-fish, captured a bass of two pounds weight, which had probably escaped from the Schuylkill. At that date, as is well known, the river was filled with young shad on their downward trip. I must therefore state that I oppose in toto, as do many of our oldest and most experienced fishermen, the introduction of black bass or any other carnivorous fishes into the Delaware, believing that such introduction would seriously affect, if not totally destroy, the shad fisheries of that river."

The Commissioners of the State of New Jersey concur in the opinion of Dr. Slack, who is himself one of the Commissioners. They say:

"We decidedly object to the introduction of black bass into the Delaware river, believing it will be detrimental to the shad fishing interests. This is our honest, unbiased opinion, and as such we have never hesitated to express it."

On the other hand, a man who signs himself "Fisherman," believes the bass will not interfere with the shad to their detriment. He says, in addition to this opinion, that the principal cause of the fall off in shad is the unrestrained pouring in of refuse and filth from the drains of coal oil refineries and the like into the creeks, and thence to the rivers. Whenever a freshet has occurred in the Schuylkill the river is poisoned to such a degree as to kill the shad and other fish in great numbers. Stop the filth and you need not fear the bass. On the other hand, he has fished considerably on the Potomac river where bass and other fish, even more voracious are abundant, and yet the shad fail not to increase in that river ten times as fast; perch and rock-fish are at the same time a hundred times more abundant, millions upon millions of eels swarm its waters (than whom no fish in inland waters is more predatory), and catfish are considered refuse at the fisheries on account of their great numbers. They predatory, and yet they all thrive. Let the proper authorities prevent the cause of the disease and all will go well enough, but until then all will be in vain."

Notwithstanding the facts stated by "Fisherman" go to show that various kinds of predatory fishes may inhabit the same waters in company with those less formidable, and without the total extinction of the latter, and notwithstanding the facts he states are familiar to all sportsmen, it is nevertheless a fact, that numerous instances are on record of the extinction in streams of weaker fishes by the introduction of more powerful ones, and the great diminution of the numbers of certain fishes from this cause is a fact of which every neighborhood almost has its legend. If the authorities are wise the bass will be excluded from the fair waters of the Delaware, as in point of value to man they are incomparably inferior to the shad, although their being "game fish" renders them more desirable to those who fish only for amusement.

THE PRINCIPLE OF BRACING.

Very few mechanics understand the true principle of bracing, but they may readily discover it by performing a very simple experiment. If four bars of wood be joined together by pins in the form of a square, each corner being joined by a single pin, it will be found that the square thus formed may be altered to the form of a rhombus, by an exertion of force only sufficient to overcome the friction of the pins and the inertia of the bars. If three bars be joined by pins at the corners to form a triangle, it will be found that not the slightest change in form can be produced except by the rupture of the bars or pins, or such as is due to the elasticity of the materials.

If any number of bars more than three be joined in a similar manner to inclose an area, no matter what may be its shape, that shape may be altered without rupturing the pins or bars. The triangle is then the only figure, the shape of which cannot be altered without breaking or stretching the sides. For the alteration of the form of a triangle involves the lengthening or shortening of at least one of its sides, while the alteration of form in any figure having more than three sides may be made without any change in their length.

To secure the greatest possible rigidity then, the sides should, if made of homogeneous material, be equal in length and size, for, as elasticity will always admit some flexure, that side will stretch most which has the greater length. But an equilateral triangle cannot have a right angle, and hence is not practical in bracing under ordinary circumstances of construction where the corners to be braced are mostly right angled.

The next most rigid form would be to have the two legs of the triangle terminated by the brace equal, but this involves, in calculating the length of the brace, the use of the square root of 2 as a multiplier—a cumbrous decimal. Carpenters, for the most part, adopt the plan of laying out the legs of the right angle in the ratio of three to four, then the proportional length of brace will be five of the same denomination of length. This is a very convenient rule, depending upon the fact that the square root of the sum of the squares of three and four is five, and another fact that the hypothenuse of a right-angled triangle is equal to the square root of the sum of the squares of the other two sides. This gives sufficient stiffness for ordinary purposes, but where very heavy strains are to be sustained it is better to make the brace cut off equal distances on the post and beam.

The principle of bracing might be advantageously employed in many cases where it is not at present used. We were once much pleased with a very light, yet strong, ladder, which owed its strength in great measure to a series of wire

braces extending from a flat ring around the middle of each rung, to the side pieces, and tightened by a nut and washer. This ladder, though much lighter than ordinary ones of equal length, was yet more rigid, and was free from the springing of ordinary ladders under the step. A good tension brace is oftentimes more effective than those which offer resistance in both directions, and this form of bracing is becoming more and more used in modern bridge building, and in the construction and setting up of machines. But with these, as with the other class of braces, it is true that the nearer equal they can be made to the other sides of the triangles of which they form the third sides, the more rigid will be the structures they are designed to strengthen.

PYROTECHNIC MIXTURES.

Lieutenant Harder, of the Artillery Corps, recently presented to the Physical Society of Frankfort the following table of mixtures for producing colored lights. As they are founded upon practical experience, we copy them for the benefit of our readers:

1. White light: 8 parts saltpeter, 2 parts sulphur, 2 parts antimony.
2. Red light: 20 parts nitrate of strontia, 5 parts chlorate of potash, 6½ parts sulphur, 1 part charcoal.
3. Blue light: 9 parts chlorate of potash, 3 parts sulphur, 3 parts mountain blue (carbonate of copper).
4. Yellow light: 24 parts nitrate of soda, 8 parts antimony, 6 parts sulphur, 1 part charcoal.
5. Green light: 20 parts nitrate of baryta, 18 parts chlorate of potash, 10 parts sulphur.
6. Violet light: 4 parts nitrate of strontia, 9 parts chlorate of potash, 5 parts sulphur, 1 part carbonate of copper, 1 part calomel.

For the so-called stars, the ingredients of which are to be stirred in with alcohol, the following mixtures can be recommended:

1. White stars: 9 parts saltpeter, 3 parts sulphur, 2 parts antimony.
2. Red stars: 20 parts nitrate of strontia, 12 parts chlorate of potash, 11 parts of sulphur, 2 parts charcoal, 2 parts antimony, 1 part mastic.
3. Blue stars: 20 parts chlorate of potash, 14 parts carbonate of copper, 12 parts sulphur, 1 part mastic.
4. Yellow stars: 20 parts of chlorate of potash, 10 parts of bicarbonate of soda, 5 parts of sulphur, 1 part of mastic.
5. Green stars: 12 parts of nitrate of baryta, 28 parts of chlorate of potash, 15 parts of sulphur, 1 part of mastic.
6. Violet stars: 9 parts chlorate of potash, 4 parts nitrate of strontia, 6 parts sulphur, 1 part carbonate of copper, 1 part calomel, 1 part mastic.

APPLICATION OF RUHMKORFF'S INDUCTION COIL TO THE COPYING OF DRAWINGS.

All draftsmen are acquainted with the simple device of puncturing holes through a drawing for the purpose of obtaining an outline and afterwards transferring the outline by sifting fine plumbago or other powder through the small holes. The fatigue of making the holes by hand is very great, and M. Canderay, of Lausanne, proposes to employ the induction coil for this purpose.

A table covered with tin foil is connected with the negative pole; on it may be placed as many sheets of paper as the spark will pass through. The positive pole, consisting of a metal bar, insulated with gutta-percha, can serve as a pencil for copying the tracings. The metal point of the pencil being moved about on the contour and outline of the engraving, electric sparks spring across every time a connection is made, and puncture fine holes through the paper.

It is said to require little skill to guide the pencil, as the ink tracings being good conductors, carry the pencil easily along. In the case of valuable engravings it is better to make a copy with the pantograph and use that for the punching process. The pantograph is connected with the positive pole of the induction apparatus, and it is placed upon a table, one half of which is covered with tin-foil. The drawing to be copied lies upon the insulated half, and the sheets of paper to be punctured are laid upon the tin-foil. The pointer of the pantograph moves around the outlines of the engraving and between the pen and the foil the sparks pass to pierce the paper upon which the outline is to be made. In this way the engraving or original drawing is in no way injured.

Important to Manufacturers.

The law granting to foreigners patents on designs and trade-marks, is of great importance to manufacturers abroad, whose goods are brought to the American market; and it is well they should know that manufacturers in this country who have been in the habit of copying foreign designs in the fabrication of their goods are opposed to this law and will besiege Congress during the winter session for its repeal or modification, so as to discriminate against foreign manufacturers. It is therefore important to manufacturers abroad to avail themselves at once of the law as it now exists. Pamphlets of information furnished free at this office.

Female Type-Setters.

"It is said that there is no hope of there ever being a large supply of female type-setters in the market. As soon as a girl becomes a proficient and valuable compositor some male printer marries her, and that puts an end to her work in the printing office."

So says one of our exchanges, and there is considerable truth in its statement. We have had female compositors in our office for several years, and like them very much indeed. They have proved sober, truthful, and faithful in the discharge of duty. It is true that we have lost some excellent girls in consequence of the greater attractions of matrimony, but what we lost in this way was gained by the man fortunate enough to find so good a partner. We have found it somewhat inconvenient to tolerate much courting in our office, but this intrusion upon business hours done away with, makes us decidedly favor the employment of female type-setters.

LETTERS FROM THE SOUTH.

ATLANTA, Ga., Oct. 23, 1870.

Atlanta—Great Progress—Future—Rolling Mill—The Fair—Climate of Northern Georgia—Marietta and Dalton Railroads—New & Old Ga. R. R.—Athens—Cotton Factories—Augusta and its Surroundings.

Twenty years ago Atlanta was a place of about 2,000 inhabitants. Previous to the war it contained nearly or quite 15,000. Almost totally destroyed by the misfortunes of war in 1864, it has rallied, and the census now gives 29,000 inhabitants. The traveler who looks on the thriving, rushing city of to-day is little disposed to believe that the fires of the war left only 3 business and 300 dwelling houses in the place, yet such is the fact. It truly deserves the name an enthusiast gave it of the "Chicago of the South." It has been much improved by the burning out, as hardly a house or store has been erected that is not of brick, and many new streets have been opened. The influx of settlers is great, as much as 2,000 in six months. What makes the place grow is hard to tell, but it grows, and grows with a solid class of inhabitants—mechanics and their families. It has one of the finest climates in the world. A number of railroad workshops are located here, as are also a large rolling-mill, a paper-mill, and other large manufactories, while a cotton factory to be run by steam is talked of, and will soon be built. The enterprising Kimball Bros. have it in hand, and they stop at nothing, and everything they touch seems to flourish.

The two great wonders of Atlanta just now are the Kimball House, and the new railroad passenger depot. The first is the largest, finest, and most complete hotel in the South, and if kept as well as it is fitted up, will bring many travellers to the place. It was commenced on the 28th of March, 1870, and the brick work was fully completed, and one half the house ready for guests on Oct. 17. This rapidity of construction would seem to make it insecure, but my Northern readers must remember first that Atlanta is a very dry climate, then the warm summer gave an advantage.

The railroad depot is entirely of iron, with galvanized roof, and with a row of brick offices on one side. It is 355 feet long, and 120 feet wide in one span. Its cost was $135,000, and the work is being done by a Philadelphia firm. It is to contain at least five tracks, to accommodate the five railroads which center at Atlanta.

Just in the city limits is the large rolling mill of Messrs. Scofield & Co. They roll railroad rails and merchant bars. The same firm own a couple of furnaces near Cartersville, on the Western & Atlantic R. R. Previous to the war they only re-rolled old rails; they have since placed the mill in a better location and enlarged it. They employ a large number of hands, and, I am informed, have made it a profitable business.

This is the week of the State Fair, and it has been in progress since last Wednesday. The show of machinery is very good, but nearly every piece of it is from the Northern or Western States. The engine which drives the shafting is from Corning, N. Y., and the boiler one of Root's patent.

The great increase in the use of improved plows and other agricultural labor-savers at the South was very apparent throughout my trip, and it is easy to see the great interest taken in them here. In vehicles the Atlanta manufactory makes a handsome show, fully equal to those from the North. In the line of cotton and woolen manufactures, the latter is creditable, the former almost disgraceful to a State which has 25 cotton factories, and raises so much of the staple. Only five are represented—one of these strictly woolen, another part cotton and part woolen. Two paper mills exhibit their products—the Atlanta and the Pioneer. The factories are the Eagle & Phœnix, Columbus, Chattahoochee, Kemp, and Concord—last woolen.

Dr. Land, a chemist, with Pemberton, Taylor & Co., exhibits for that firm numerous chemicals and perfumes, all manufactured in Atlanta. They are as good as I ever saw.

In stock there is not a great variety, though some very fine. Mr. Peters, of Calhoun, exhibits some fine bloods and crosses. I mention his name, for to him and his neighbor, Dr. Woring, is due much credit for improving the grade of Georgia stock.

The grounds are well arranged, and the buildings of a good character, and the general management of the Fair is very good. The officers of the society are polite and attentive, and but for that nonsensical show called a Tournament, in which a young man was killed, all would have passed off well. Col. D. W. Lewis, the present secretary, held the same position in the first State Society, twenty-five years ago.

At a County Fair which I attended at Dalton, in Northern Georgia, I saw some household furniture manufactured there from native woods, which in every respect would compare favorably with any of Northern make. Here all is from the North. But there is a rapidly growing sentiment here in favor of building up home manufactures, and Northern mechanics who come in and establish such are eagerly welcomed.

Atlanta has four daily papers, all supposed to be flourishing, though one of them said a day or two ago that all put together did not have the circulation one should have. The *New Era* and the *Constitution* seem to take the lead. Besides these there are two agricultural, and several religious weeklies.

I have spoken of the fine climate of Atlanta, the same may be said of all Northern Georgia. It is invigorating, never intensely hot in summer, or severely cold in winter. From Atlanta to Dalton is high ground, thence the grade descends to the Valley of the Tennessee, at Chattanooga. Dalton is the terminus of the Selma R. & D. R. R., and the commencement of the Ga., East Tenn. & Va. R. R.; the Western & Atlantic runs through the place. Then a railroad is chartered from Dalton to Western North Carolina, and another to Stevenson, junction of Nashville & Chattanooga, and Memphis & Charleston Railroads. As with all other charters in this State, these roads have $16,000 in bonds per mile as each twenty miles are finished. The soil is good; on the west of the town the rocks are limestone mostly, and the soil likewise, while on the east the primitive rocks and soil prevail. Water power is not convenient, but coal is within fifteen miles by one of the projected railroads. It is now brought from Tennessee. Wood is abundant, cheap, and good. Iron ore is found close to the town.

Marietta, on the Western & Atlantic R. R., twenty miles north of Atlanta, is a beautiful town, noted for its delightful climate, especially in summer. The place itself has no manufactories except two tanneries, which seem to be flourishing. In fact, the whole line of this road seems to abound with good locations for this business. Near Marietta is the Concord Woolen Mill, mentioned as exhibiting at the State Fair. They employ 42 hands, and run 360 spindles and 16 Crompton looms. They get their fine wool from Pennsylvania, and get abundance of coarse from the surrounding country. The superintendent told me that near him on the Nickajack was a fine water power, about three miles from the railroad, that would run 4,000 spindles, and which might be bought cheap.

I consider the line of the A. & W. R. R. as particularly inviting to Northern people, and especially mechanics. Water power and coal are abundant. The best kinds of wood are cheap, and wagon-making and other species of wood-work might be made very profitable. The railroad is now under very liberal management, and Col. Blodgett, the superintendent, is desirous in every way of encouraging the incoming of settlers. Dalton, I think, is particularly a place of promise. It has been proposed to continue the railroad from Bainbridge to Columbus up to Rome, and thence to Chattanooga; this would open a new and good country to the westward, and perhaps injure Atlanta, but I do not think it will be so extended.

Traveling eastwards from Atlanta, we pass over the Georgia Railroad, which runs through a country that in the hands of good cultivators will be a fine region. It is already improving, especially near the town of Madison. By a branch road I reached Athens. This place is the seat of the State University, the residence of many of the wealthy and educated men of the State. It is probably the most polished town of the State, and is not the less famous for the talent of its men than the beauty of the ladies. And here I may say that the rich mountain air of this Northern Georgia produces that healthy glow and robust form seldom seen in the Southern beauty, the finest types of which are found in this region.

The town itself has but little vigor and enterprise, but there are located in its immediate vicinity five cotton factories, and one cotton and woolen factory in the town. The last runs 4,488 spindles and 78 looms on cotton, and 260 spindles and 6 looms on wool. It is one of the neatest factories I have been in. The Pioneer Paper Mill is also near the town, and a machine shop and foundery, which have a wide reputation for good work, are in the town itself. There are many other water powers unimproved. The Georgia Factory, one of the five, is the first factory ever built in the State, and some say in the South. None of these suffered from the war. The Athens Company's works have been built since 1860. They prefer American machinery.

North of Athens is a country almost unknown. It is rich in minerals, especially iron and gold, and is also a fine farming region. It is being opened to the world east and west by the Air Line R. R. from Atlanta to Charlotte, and another line is to built from Athens to Clayton, connecting them with Knoxville & Charleston R. R. Cotton grows well near Athens and for many miles above. There are two small cotton factories in this northern section.

The country surrounding Augusta is a cotton-growing region. It is frequently called the Black Belt because it was a section where many slaves were owned, and cotton almost exclusively grown. They are now rapidly learning that they can grow other crops as well as cotton.

Augusta is a place of considerable business, having a large trade from South Carolina, as well as Georgia. The river is navigated to Savannah by steamboats which might be better and run lighter. It has new railroads to Atlanta, Macon, Savannah, Charleston, and Columbia. I believe no new ones are prepared in the State direct to the place, though the Georgia Road is building several branches which will benefit the place.

There is one cotton factory in the city, which has become somewhat famous by large published profits. It should be remembered in looking at these figures that these profits are made not on the actual cost of the factory, but its present capital. It is certainly a well-managed concern, but I doubt if so well arranged or so perfect as the Eagle and Phœnix, at Columbus. This Augusta factory is stated to contain 15,000 spindles and 600 looms. The water power is apparently inexhaustible, but I was informed that the canal will have to be enlarged to meet the increasing wants of this factory. The canal has three levels, and a fall of 45 feet. Several good sites for small factories are for sale.

The city has water-works, using river water, filtered and

pumped to a tower reservoir. The gas works use coal, some Tennessee and some Northern. It is a beautiful city, and the broad streets with their rows of trees render it very attractive to the eye of the pleasure tourist, but extremely odd to a business man.

On the line of the Ga. R. R., sixteen miles from Atlanta, at Flat Shoals, I was told that Mr. Christy, of the Passaic (N. J.) mills, had purchased, and would there build a factory and remove his machinery.

East of Augusta, and but a few miles over South Carolina boundary, is the well-known Graniteville Factory and the Bath Paper Mills, both said to be flourishing institutions. On the east side of the river a railroad is being built to connect the city with Port Royal, S. C.

Augusta is a far better cotton country than Atlanta, yet it has not the climate of that place, and while the latter has been growing with astonishing rapidity the former has been almost at a standstill. There is, however, much solid wealth in Augusta, and its people do well what they undertake.

I cannot close without mentioning the new and really superb bridge built over the Savannah by the Charlotte & Augusta R. R. Co. It is a credit to their enterprise, especially when the old dangerous affair of the South Carolina road has become a time-honored institution. H. E. C.

American Silk and Steam Plowing.

From an address delivered by the U. S. Commissioner of Agriculture at the Illinois State Fair, held in September, we cull the following extracts:

SILK PRODUCTION.

It is not strange, in the beginning of our career of industrial development, that the little silk worm has been neglected as a source of employment and wealth, and the national appreciation of *Bombyx mori* may have been modified by a remembrance of the *Morus multicaulis*. It would be creditable and profitable to us, as a nation, could we outgrow the tendency to *mania* in the initiation of a new rural pursuit, and thus avoid its disastrous abandonment and deep-seated prejudice, which long prevent its successful introduction. The signs of the present time indicate, for the rearing of silk worms, an assured success, and a permanency of decided promise. As labor multiplies, an interest like this, capable of almost indefinite extension in manufacture, acquires vastly increased importance. Already four of the seven branches of silk production can compete with foreign nations, namely, "Throwing" of the silk or preparation of the threads, the dyeing of silk, the regeneration and spinning of silk waste, and the automatic weaving of plain stuffs. In silk-weaving England now employs 200,000 persons, and the utilization of silk waste in France requires 30,000 workmen, and realizes $20,000,000.

We believe we can yet compete with outsiders in rearing the worms, reeling the cocoons, and weaving figured goods. California already produces millions of cocoons, in a climate in which the worms are thus far as healthy as any in the world; and the Eastern and Southern States are beginning to embark in the business. The sale of eggs for exportation at $4 to $10 per ounce, has been temptingly remunerative since the prevalence of the silk worm disease in Europe, which inflicts an annual loss upon France alone, according to M. Thiers in a speech in the Corps Legislatif, of $20,000,000 annually. In eighty years, the annual value of the silk manufacture of France has advanced from $5,000,000 to $150,000,000.

Who will venture to estimate the value of silk goods in the United States thirty years hence, manufactured from American cocoons? Thousands of individuals (in suitable climates) incapacitated for the severe labors of agriculture, can compete successfully for the supply of the raw material.

It may be an interesting fact to the dwellers in these prairies, begirt with osage orange hedges, that the naturalist of the Department of Agriculture has readily obtained cocoons of beautiful silk, from worms feed exclusively upon the *Maclura aurantiaca*; this experiment has been confirmed by a late communication received at the Department, from a reliable correspondent, who states that he has, the past season, fed upwards of ten thousand worms, with perfect success, upon the osage orange alone.

STEAM PLOWING.

Among the improvements of the future, inevitable in successful accomplishment and beneficent in its results, I deliberately place that of steam culture. Its success is already assured in Europe. Five sets of steam machinery are now in active and profitable operation in this country—three upon sugar plantations in Louisiana, and two on a cotton plantation in Mississippi. A set run by two 20-horse power engines, cultivating to the depth of twenty inches, last year produced a hogshead of sugar more per acre than horse-power culture by its side.

We shall make changes in this English machinery—we may perfect a thoroughly American machine (though it should not be forgotten that the Fowler method is based upon an American invention) before the use of steam in culture becomes general upon our farms; but that result is sure to come, and I see no reason why it should not soon be reached. It is folly to assume that the noble art of agriculture is to derive no benefit from steam, or that commerce and manufactures must exclusively appropriate an invention which has already wrought a revolution in the industries of the earth.

THERE are probably 50,000,000 acres of sterile plains between the Mississippi river and the Rocky Mountains. Some of them are too barren to produce anything, while some could be made productive by irrigation.

Tanning in Pennsylvania.

The Philadelphia *North American* states that new tanneries, on the most improved plans, are being established in the immense bark regions of northern Pennsylvania, on the line of the Philadelphia and Erie Railroad and its tributaries, and infers that these are for the supply of the New York hemlock sole leather market, as the bark is exhausted in Wayne county, Pennsylvania; and Greene, Delaware, Ulster, and Sullivan counties, New York State, which have for nearly half a century been the headquarters of the hemlock tannage for New York market. But the whole of the mountain regions of Pennsylvania are covered with such boundless forests of oak, hemlock, and chestnut, that the facilities for tanning are unlimited. Philadelphia has been and still is the center of the oak sole leather business.

Philadelphia, formerly a market chiefly for Yankee boots and shoes, is now a great manufacturer of all kinds of footgear herself; and her products are preferred generally by the buyers from the interior, south, and west. This should give a great impetus to the tanning business in the interior of the State, along all the lines of railway traversing the forest regions. The preference, however, seems to be given to Philadelphia, on account of the facility of access to ample supplies of hides, foreign and domestic. Three thousand head of cattle are sold there every week, and the consumption of meat by such a city throws a constant fresh supply of hides on the market. For this reason, the preferred plan is to gather the bark in the forest, ship it to Philadelphia, and tan the hides there; since, if the tanneries be established in the forest, the hides must be shipped thither. In New York operations the plan pursued is to establish the tanneries in the bark regions, and send the hides to them by rail. As the supply of hides, both foreign and domestic, is much larger there than in any other part of the country, the dealers are able to keep these tanners always busy. But in many cases the city houses engaged in the hide and leather trade own and work the country tanneries. In other cases the large city houses sell on commission for the country tanners, to whom they make cash advances, the same as in the domestic dry goods trade.

By these arrangements the large importations of foreign hides, and the heavy sales of cattle in the New York market, have a direct relation to the tanning and leather trades, and the great operators in cattle are aided in their efforts to command the meat market of the whole region near New York. The importers of hides are, of course, sure of a market at all times among the country tanners; while, at the same time, the live stock dealers of New York seek to increase the local consumption of meat in suburban towns, to enhance their marketable supply of hides.

CURIOUS PHENOMENON.—J. S. McKinsey, of Caddo Grove, Johnson Co., Texas, writes us that in some of the wells in that vicinity, the water always sinks during the prevalence of a north wind, and refills again on the change of the wind to another quarter. The wells are about 300 miles from the Gulf of Mexico, and at a considerable distance from any river. If the facts are as stated, this is a most singular phenomenon, and one for which no explanation which occurs to us seems adequate.

SMOKY CHIMNEYS.—I. S. Clough has tried D. R. Miller's plan of curing smoky chimneys, recently published in our correspondence columns, and writes that it works admirably. The plan is, substantially, to fill up the chimney to where the pipe enters it.

THE silver mine in Sterling, Mass., which was worked before the revolution and its ore carried to England, has been leased by Fitchburg parties, and is to be at once reopened.

APPLICATIONS FOR THE EXTENSION OF PATENTS.

MACHINERY FOR FORMING HAT BODIES.—Ira Gill, Walpole, Mass., has petitioned for an extension of the above patent. Day of hearing Dec. 28, 1870.

PLATFORM SCALES.—Thaddeus Fairbanks, St. Johnsbury, Vt., has petitioned for the extension of the above patent. Day of hearing Dec. 28, 1870.

FEEDING LUMBER LATERALLY IN SAWING MACHINES.—Samuel R. Smith, Cincinnati, Ohio, has applied for an extension of the above patent. Day of hearing Jan. 4, 1871.

STRIPPING THE TOP FLATS OF CARDING ENGINES.—William B. Bates, Mansfield, Mass., administrator of George Wellman, deceased, has petitioned for an extension of the above patent. Day of hearing Jan. 11, 1871.

HARROW.—Daniel W. Shares, Hamden, Conn., has petitioned for an extension of the above patent. Day of hearing Jan. 11, 1871.

MACHINE FOR CUTTING TENONS ON BLIND SLATS.—Seth C. Ellis, Jersey City, N. J., has petitioned for an extension of the above patent. Day of hearing Jan 18, 1871.

METHOD OF JOINING BOXES, ETC.—James Stimpson, Baldwinsville, Mass., has applied for an extension of the above patent. Day of hearing January 18, 1870.

ACCELERATING FIRE-ARM.—Azel S. Lyman, New York city, has applied for an extension of the above patent. Day of hearing Jan. 18, 1871.

MACHINES FOR CUTTING VENEERS.—Peter Cook, Tonawanda, N. Y., has petitioned for an extension of the above patent. Day of hearing Jan. 18, 1871.

Facts for the Ladies.

Mrs. Alfred Tennyson (Isle of Wight), is glad to say, that the Wheeler & Wilson Sewing Machine, furnished Mrs. Tennyson some months ago, answers extremely well, and is liked better and better the longer it is used.

Every Person Thinking of Advertising

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Business and Personal.

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

Rawhide Sash Cord has no equal for heavy windows or dumb-waiters. Makes the very best round belting. Darrow M'f'g Co., Bristol, Ct.

"507 Mechanical Movements."—This Book embraces all departments of mechanics. Each movement finely illustrated and fully described. To mechanics and inventors it is invaluable for references and study. Price $1. By mail $1·12. Address Theo. Tasch, 37 Park Row, N.Y.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin. $4·00 a year. Advertisements 25c. a line.

Manufacturers and Patentees.—Agencies for the Pacific Coast wanted by Nathan Joseph & Co., 619 Washington st., San Francisco, who are already acting for several firms in the United States and Europe, to whom they can give references.

L. R. Ward, of Ward's Corners Iowa, wants the address of manufacturers of harness mountings. See illustration of breast strap in this No. Scientific American.

A fine location for a factory for sale. Seven lots on Jamaica avenue, 3 miles from 34th st. ferry. The rear bounded by a trout brook. Address C. F. Erhard, Woodside, L. I.

To Cure a Cough, Cold, or Sore Throat, use Brown's Bronchial Troches.

For Sale—The entire right of the best adjustable wrench. Price $5,000. J. F. Ronan, at Chickering's factory, Boston, Mass.

Machinery for two 500-tun propellers, 60-Horse Locomotive Boiler, nearly new, for sale by Wm. D. Andrews & Bro., 414 Water st., N.Y.

A very Valuable Patent for sale, the merits of which will be appreciated at sight. Apply to or address Jewell & Ehlen, 93 Liberty st., N.Y.

Thrifty Mechanics, who require no discounts, but desire a safe place of deposit for their earnings, in an institution where they can enjoy all the advantages possessed by Banks of Circulation, with the additional one of drawing interest on their accounts, are referred to the advertisement of the Mutual Benefit Savings Bank, published in our advertising columns.

Wanted—Small Patent Articles, to sell through Agents South and West. J. H. Orr, Cincinnati, Ohio.

Unpatented invention for sale. N. Porter, Youngstown, N.Y.

Capital Wanted—To bring out an invention. Article small. Hardware. Address W. R., P. O. Box 2220, New York.

Apply to J. Dane, Jr., Newark, N.J., for the best hand lathes, slide rests, presses, Jewelers' rolls, models, dies, and light machinery to order.

India-rubber articles of every description for Inventors and others furnished by W. G. Vermilye, 6 Park Place, New York.

Peteler Portable R. R. Co., contractors, graders. See adv'ment.

Crampton's Imperial Laundry Soap, washes in hard or salt water, removes paint, tar, and grease spots, and, containing a large percentage of vegetable oil, is as agreeable as Castile soap for washing hands. "Grocers keep it." Office 54 Front st., New York.

Dickinson's Patent Shaped Carbon Points and adjustable holder for dressing emery wheels, grindstones, etc. See Scientific American, July 24th, and Nov. 20, 1869. 64 Nassau st., New York.

Peck's patent drop press. Milo Peck & Co., New Haven, Ct.

Improved Foot Lathes. Many a reader of this paper has one of them. Catalogues free. N. H. Baldwin, Laconia, N. H.

Foreman Machinist wanted. See advertisement.

James Jenks, Detroit, Mich., is agent for the celebrated Lathes and Drills made at the Thomas Iron Works, Worcester, Mass.

A Superintendent in the Machinists' Tool & Jobbing business will take a position in the U. S. or Canada, on any work. Understands making and running machinery for working iron or steel, hot or cold. Responsible parties address, with particulars, A Mechanic, Boston, Mass.

Lighting Gas in Streets, Factories, etc., with Bartlett's Patent Torch saves great expense, all risks, etc. It is being adopted everywhere. Address J. W. Bartlett, 569 Broadway, New York.

Self-testing Steam Gage. The only reliable Steam Gage. Send for circular. E. H. Ashcroft, Boston, Mass.

Combined Boring and Mortising Machine—Bores and mortises at one operation. In constant use for several years, at our own works. Satisfaction guaranteed. Price $150. The Allen works, cor. Jay and Plymouth sts., Brooklyn, N. Y. Send for circulars.

Japanese Paper-ware Spittoons, Wash Basins, Bowls, Pails, Milk Pans, Slop Jars, Chamber Pails, Trays. Perfectly water-proof. Will not break or rust. Send for circulars. Jennings Brothers, 393 Pearl st., N.Y.

Agents Wanted to sell the Star Bevel. It is destined to supersede entirely the old style. R. Hallett & Co., West Meriden, Conn.

Belting that is Belting.—Always send for the Best Philadelphia Oak-Tanned, to C. W. Arny, Manufacturer, 301 Cherry st., Phil'a.

For Fruit-Can Tools, Presses, Dies for all Metals, apply to Mays & Bliss, 118, 120, and 122 Plymouth st., Brooklyn, N. Y. Send for circular.

Practical Treatise on Soluble or Water Glass, just published. Price $3 30, mailed free, by L. & J. W. Feuchtwanger, Chemists and Drug Importers, 55 Cedar st., New York.

Parties in need of small Grey Iron Castings please address Enterprise Manufacturing Co., Philadelphia.

Excelsior Stump Puller & Rock Lifter. T. W. Fay, Camden, N.J.

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

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

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.

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 or boiler. Price 25 cents per lb. 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.

Inventions Patented in England by Americans.

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

PROVISIONAL PROTECTION FOR SIX MONTHS.

2,626.—BRUSSELS AND TAPESTRY CARPETS.—George Crompton, Worcester, Mass. October 5, 1870.

2,642.—WORKING OF GALVANIC BATTERIES.—E. D. McCracken, H. J. Newton, H. B. Kirkland, and J. R. Husson, New York city. October 5, 1870.

2,662.—HOOPS, SCARVES, ETC.—E. H. Clark, Chicago, Ill. October 7, 1870.

2,668.—PROCESS FOR TREATING THE ORES OF METALS, AND THE APPARATUS AND MECHANICAL APPLIANCES USED THEREIN.—R. Spencer, New York city. October 8, 1870.

Caveats are desirable if an inventor is not fully prepared to apply for a patent. A Caveat affords protection for one year against the issue of a patent to another for the same invention. Patent Office fee on filing a Caveat, $10. Agency charge for preparing and filing the documents from $10 to $12. Address MUNN & CO., 37 Park Row, New York.

New Patent Law of 1870.

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We can say nothing further for this book than is said in its title as given above, except that the designs are such as, in our opinion, are calculated to prove of much service to suburban builders. The book is got up in creditable style in respect of text, engraving and binding, and is of quarto form.

SIGN, CARRIAGE, AND DECORATIVE PAINTING. Including Full Instructions in Fresco Painting, and a vast amount of Useful Information derived from Practical Experience. By S. Gibson, Practical and Decorative Painter. New York: Jesse Haney and Co., Office of "Haney's Journal," 119 Nassau street. Price, 50 cents.

This is one of a series of small, but thoroughly practical trade manuals, which are proposed to be issued by Messrs. Haney & Co. We judge the aim has been to give practical directions and plain recipes calculated to guide the ordinary workman in his processes rather than to dwell at length on the theory of the harmony and mixing of colors, although on the latter head there are some useful remarks. The amount of information condensed into this work could scarcely be greater, considering its size and price.

DIRECTORY OF THE PLUMBERS, GAS AND STEAM FITTERS, AND COPPERSMITHS. Also the Gas Companies, with the Names of their Presidents, Secretaries, and Treasurers in the United States for 1870. Comprising a List of the Names and Addresses of Persons and Companies in these Trades in every City and Town in the United States. New York: J. Arthurs Murphy & Co., Publishers, 111 Nassau street. 1870.

This is one of a series of directories for these and other trades which are designed to be issued by these publishers.

DYSPEPSIA: Its Varieties, Causes, Symptoms, and Treatment, by Hydropathy and Hygiene. By E. P. Miller, M.D. New York: Miller, Haynes & Co., No. 41 West Twenty-sixth street. 1870.

This is a little work bound in pamphlet form, which discusses the function of digestion, the causes of dyspepsia, its symptoms and treatment, general and special. It is written in a plain style, and will be read with interest by all who expect to have, or do not wish to have the harassing and undermining disease of which it treats.

SNAIL SHELL HARBOR. INTO THE HIGHWAYS. CHARITY HURLBURT. Boston: Henry Hoyt.

These three volumes are issued from the well-known publishing house of Henry Hoyt, of Boston, and are handsomely printed and bound. The works are primarily intended for the young, and are designed to enforce upon their minds in an easy and graceful manner the great lessons of the Bible. Henry Hoyt never publishes a book which may not be safely recommended on sight, and these three volumes are not exceptions to this well-merited confidence in whatever issues from his press. The volumes before us are excellent gift books, and can be obtained in this city of N. Tibbals & Son, No. 37 Park Row.

QUERIES.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true but we prefer to elicit practical answers from our readers, and hope to be able to make this column of inquiries and answers a popular and useful feature of the paper.]

1.—What kind of mold is necessary to cast articles out of ordinary soft solder, or similar composition of alloy?—T. P.

2.—How can buckskin gloves be made soft, white, and pliable after they have been washed?—G. C. L.

3.—Can small zinc shafts be turned in a lathe? If so, what form of tools is necessary? I have tried it and don't succeed to my satisfaction. G. D. B.

4.—How can I make long leather cord of even thickness and perfectly cylindrical for small belts—the diameters to not exceed one tenth of an inch? What is the best leather for this purpose?—A. R. K.

5.—I wish to make a number of holes one tenth of an inch in diameter in a brass plate. It is absolutely essential that they should be exactly uniform in size, and bored perfectly true. The plate is an inch and one half thick. I find I cannot drill them with sufficient accuracy. Will some experienced workman tell me how I can make a good job of this?—G. F.

6.—Is there no way in which atmospheric pressure may be made to force water in a pump higher than the general average of thirty feet? I think I have read of some method for doing this, but cannot now remember where I saw it or what it was.—J. K. F.

7.—Will some one inform me how the coating on oiled silk is spread so uniformly and thinly?—J. D.

8.—Can the cutting power of a glazier's diamond be restored when it ceases to work well? I have such a diamond, but it does not cut properly.—E. P. G.

9.—What is the cement used for putting the plush on hat bodies, and how is the operation performed?—R. B. S.

10.—I wish to know from practical millers the proper speed for millstones to do the best work in grinding the various cereals milled in this country. I find little or nothing in the practical (?) works on milling I have purchased to gain knowledge on this and other points.—J. Y.

11.—I wish to make several ladders twenty feet in length. How shall I make them to combine greatest strength with least weight? Can such ladders be practically made to fold up to the length of an ordinary truck wagon without making them so weak as to be unsafe?—L. A.

12.—I wish a good recipe for cheaply bleaching woolen rags.—S. T. D.

13.—Will some practical mechanic tell me how I can bore out true a segment of a hollow cylindrical ring, the segment being the sixth part of such a ring, the diameter of which is two feet, and the diameter of the bore being required to be six inches?—L. V.

14.—How are the hollow hemispheres in bullet molds made so accurately?—J. B. C.

15.—Can wind wheels or feather wheels, such as are used in the striking movements of clocks be relied upon to give a perfectly uniform motion to a train of wheel work?—L. M. M.

16.—I wish to run down from a steep side hill this winter a large quantity of logs. Will some reader of the *Scientific American* tell me the best way to make a sliding way, as is done in Maine and Vermont?—A. R. B.

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.

S. L., of ——.—We repeat our answer to A. M. T., of Mass., in regard to the aggregate pressure of the atmosphere upon the earth's surface being less than the entire weight of the atmosphere. Your illustration of your argument against this proposition of the water in three tumblers, the first being shaped like the frustum of a cone, the second a cylinder, and the third an inverted frustum of a cone, and each weighing the same, has no point bearing on the question at issue. If your argument is correct, and the pressure on each square inch of surface is more than the weight of a vertical column, this pressure would increase with decrease of the size of the earth. Let us now suppose the earth reduced to an infinitely small sphere, a material point. The pressure on this point would be, according to your theory, infinitely greater than on the same area of surface now, and you then have the mechanical and mathematical absurdity of a definite weight, producing an infinite pressure, without antecedent motion. Take another look at this subject.

W. H., of ——.—Authorities differ as to the mechanical power of the human frame, compared with that of the horse. Hassenfratz considers the power of a man in carrying loads on a level road to be one eighth that of the horse, and in drawing loads one seventh horse power. Coulomb makes it from one-seventeenth to one twenty-fourth horse power in drawing loads, the man using a wheelbarrow, and the horse using a four-wheeled or two-wheeled vehicle, the ratio being greater when the horse is attached to a two-wheeled vehicle than a four-wheeled one. We consider a fair average would be to allow for the power of a man one tenth that of the horse.

B. F. W., of Ga., says W. H. L., of Pa., and his neighbors can destroy "small red ants," by placing cracked hickory nuts (or shell barks are the best), in plates; the ants will collect in large numbers to eat the cracked nuts, then throw them (the ants and nuts) into the fire, or into boiling water. This plan has been practiced successfully in ridding houses of this pest. Cracked chicken bones or sugar may be used for the same purpose, but are not so good, as the ants become sooner satisfied, and retire; whereas they can only nibble off minute portions of the nuts and collect in larger numbers on them. Persevere in the above plan and the ants will be destroyed.

W. L. J., of ——.—Any solvent you may use to remove the tar spilled upon the granite block will be apt to stain the stone permanently, by carrying into the texture tar in solution. If this is not an objection, soften the tar by holding near it or over it a heated stone, or a hot plate of iron, then dilute it with oil, and scrape off as much as you can get off. Add a little more oil, and wash with soft soap and water. Wipe dry, and complete the washing with benzine.

J. R. St. C., of ——.—The speed of the Irish mail train from Chester to Holyhead, England, is between forty-two and forty-three miles per hour. Forty miles per hour is about the average speed for fast trains in England. No train has ever run at eighty miles per hour, and in our opinion never will. Single locomotives have sometimes accomplished sixty miles an hour, and it is possible they have drawn light trains at that speed, but if so the instances are not numerous.

A. D., of N. Y.—From your statement we infer that you are attempting to raise the water from your well through a greater distance than an ordinary suction pump will raise water in your locality. If this be correct you will have to use a combined suction and force pump, the barrel of which is placed below the top of the well. The fact that the bottom of the well is drilled through rock, will prevent your using a chain pump.

D. D. K., of ——.—If you mean what expenditure of coal is necessary to get up a pound pressure in an ordinary boiler, your question cannot be answered. The larger the boiler the more it will take, if you wish to know how much coal it will take to evaporate a pound of water; the question is also indefinite. It will vary from three to ten pounds of water per pound of coal in the different kinds of boilers in use.

F. H. H., of Mass.—Commercial zinc, whether in ingots or sheets is liable to contain, and generally does contain, one or more of the metals, lead, iron, tin, cadmium, arsenic, and copper. It is rolled into sheets while heated between 200° and 300° Fah., at which temperature it is quite ductile and malleable. At higher temperatures it is extremely brittle, and volatilizes at a red heat.

E. M. C., of Pa.—With the ordinary run of engines, it is not safe to estimate the amount of evaporation per horse power per hour, as less than a cubic foot of water, but many of the most improved engines, using variable cut-offs, do much better than this.

N. S., of Conn.—Your question is utterly unintelligible. The answer to it, as it reads would be, "to ascertain the number of revolutions of a water wheel per minute, count them," but this cannot be what you mean. What do you mean?

A. H., of Mo.—Steam pipes, one and one half inches in diameter, nearly closed with a limestone deposit, are ruined. There is no practical way to get off this scale, of which we are aware

Recent American and Foreign Patents.

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

SECURING STONES TO GRINDING AND SCOURING CYLINDERS, ETC.—H. C. Havemeyer and David P. Burdon, New York city.—This invention relates to a new method of securing stones or equivalent grinding or scouring articles to the rims of wheels or cylinders, with an object of insuring a simple method of fastening said stones, and of securely retaining the same in place.

MOSAIC FLOOR.—Joseph Stegmiller, New York city.—This invention has for its object to prepare a mosaic floor in such manner that the same can be prepared for use in the shop, and transported in a perfect state to the place where it is to be laid down.

FOLDING CHICKEN COOP.—J. R. Achenbach, Saddle River, N. J.—This invention has for its object to furnish a simple and convenient folding coop for chickens, young ducks, or other fowls.

ADJUSTABLE DRAFT DEVICE FOR PLOWS.—C. L. Jackson, Millersburgh, Ill.—This invention relates to a new and useful improvement in a device for varying the line of draft of plows, when in motion or at rest, so that the depth of furrow may be varied, according to the form or surface of the ground.

SILICIOUS COMPOUND.—William A. Battersby, Williamsburgh, N. Y.—This invention relates to a new composition for casting or molding pipes, tiles, and other similar articles, as well as for sidewalks, streets, flooring, and similar purposes, and has for its object to so fuse together and combine the inexpensive and abundantly silicious matter that the same can be advantageously utilized for the above purposes.

CEMENT FOR ROOFING AND OTHER PURPOSES.—Oliver Porter, Waterford, Me.—This invention relates to a new and useful improvement in a cement, more especially designed for roofing, but which may be used for other purposes where it is desired to exclude moisture and form a fireproof surface.

BOILING SICCATIVE OIL.—James B. Pollock, Port Richmond, N. Y.—This invention consists in an improved and economical arrangement of apparatus for making siccative oils or varnishes, in a safe and cheap manner and short time, as compared with the usual mode of boiling or making a siccative oil or varnish from linseed oil.

MITER BOX.—Justin Devoge, Meadville, Pa.—This invention relates to improvements in miter boxes, and consists in a combination with a box for holding the stuff of a saw clamp or guide, arranged for holding the saw above the article to be sawed near the end, and adjustable either to a vertical plane, or to any oblique plane across the box, also adjustable to a perpendicular or any other angle with the box. The said box having a vertically adjustable bottom and a secondary bottom made in two parts, which may be adjusted to suit the requirements of strips or pieces which have oblique sides, the said two parts being on opposite sides of a dividing wall.

OPERATING WINDOW CURTAINS.—John Stephens, Fairview, Ohio.—The o ject of this invention is to provide suitable and efficient means for lowering and raising the upper ends of window curtains, without reference to or disturbing the lower end, and it consists in an upper roller, to which the curtain is attached, which is operated on vertical cords, and held in position by a weighted tassel and band or cord.

CULTIVATOR.—Isaac Low, East Fairfield, Ohio.—This invention has for its object to furnish an improved cultivator, simple in construction and effective in operation, and conveniently operated.

COMBINATION MATCH PLANE.—Lewis Bundy, Moore's Forks, N. Y.—This invention relates to a new and useful improvement in a combined match plane and plow for working in wood, whereby tongues and grooves of variable depth and of variable width of margin may be cut.

PISTON PACKING.—Wm. Ord, Brooklyn, Ohio.—This invention relates to new improvements in the construction of the rings for pistons in steam engines, pumps, etc., and has for its object to provide a convenient packing for the split parts of the same, and, also, to regulate the elasticity of the rings, making the same equal throughout.

WAGON BOLSTERS.—J.W. Pearman and J. F. C. Lutz, Holden Mo.—This invention relates to improvements in bolsters for wagons, and consists in ironing the ends with cast metal attachments, cast with two leaves or plates one for the top and the other for the bottom of the bolster, the ends of which are fitted between these leaves and bolted to them, and the standards are cast with the solid part at the ends.

COTTON-SEED PLANTER.—John C. King, Spring Place, Ga.—This invention relates to a new and useful improvement in a machine for planting cotton seed, and all other seed for which it is adapted, and also for distributing guano and other fertilizers, and the invention consists in the manner of delivering and regulating the quantity of seed, and in the manner of covering the same.

PROCESS OF DECOLORIZING ANILIC AND PHENIC COLORS ON FABRICS.—Jean Lambert, Jr., New York city.—The object of this invention is to produce white designs or ornaments on fabrics that have been steeped in or dyed by anilic or phenic coloring matter, by bleaching certain portions of such coloring matter on or in the fabric. The invention consists in the application of powdered metals or soluble cyanides to the said fabrics, for the purpose of producing the stated local bleaching or decoloration.

STRAW CUTTER.—G. S. Garth, Mill Hall, Pa.—This invention relates to improvements in cutting machines for cutting hay, straw, and other long feed, and consists in improvements in the construction and arrangement of the same, calculated to facilitate the feeding and cutting, and to produce a durable and simple machine that will be more efficient than any now in use.

OIL-CAKE PACKING.—Washington Hawes, Port Richmond, N. Y.—This invention relates to improvements in apparatus for forcing one or more of the last cakes into the sacks previously filled, or nearly filled, by hand, to pack the said sacks as much as possible, and it consists in a vertically working follower, actuated by a winding drum and cord, for forcing it down, which drum is connected with a driving shaft, for working it, by a friction clutch, having a foot-lever attachment for varying the friction and the power on the follower, while in action, so that the same may be regulated according to the capacity of the oil cake, whereby the great losses by breaking the cakes in the common hand process of packing may be avoided.

GRINDING MILLS.—J. M. Westmoreland, Danville, Texas.—This invention relates to improvements in grinding mills, and consists in a novel and simple mode of obtaining the motive power for working the grinding stones, or other devices, by arranging them on spindles placed radially in a frame supported on a center pivot, around which it is capable of revolving, and at the outer end on wheels upon the spindles of the grinding stones, resting on a circular track, so as to be set in motion by the friction thereon, or it may be by cog teeth, gearing with teeth on the said wheels, when the frame is drawn around the central pivot by horses or other animals.

DITCHING MACHINE.—J. W. Roberts, Hartford City, Ind.—This invention has for its object to furnish an improved machine for opening ditches which shall be so constructed as to open the ditch, raise the dirt, and deposit it at the sides of the ditch.

MATCH-BOX.—John Monaghan, Tuckahoe, N. Y.—This invention has for its object to furnish an improved match-box which shall be so constructed as to hold the matches securely, without having a cover, and keep them dry, while leaving their ends exposed, enabling them to be conveniently removed as may be required.

FAUCET.—C. A. Douglas, Franklin, N. Y.—This invention has for its object to furnish an improved faucet for drawing off liquids from vats or other vessels placed one within the other, and which shall be so constructed that the liquid may be drawn from either vessel as may be desired.

BOTTLE STOPPER.—W. L. Hoefer, Jeffersonville, N. Y.—This invention has for its object to furnish a simple, convenient, inexpensive, and effective stopper for bottles containing soda water or other liquid exerting an outward pressure, and which shall be so constructed that after being once applied to the bottle it can neither be pushed fully in nor drawn fully out of the bottle, but may be readily pushed far enough inward to allow the liquid to flow out freely.

FAMILY FRUIT DRYER.—J. P. Miller, Somerville, N. J.—This invention has for its object to furnish a simple, cheap, and convenient fruit dryer or kiln which shall be so constructed and arranged as to enable the heat in the stove, when the cooking is finished, and which has hitherto been wasted, to be utilized in drying the fruit for the family or for market, so that each one may furnish himself with or prepare for market a supply of clean and wholesome perfectly dried fruit at scarcely any expense.

DOOR STOP.—L. C. Wemple, Rockford, Ill.—This invention has for its object to furnish an improved device for stopping a door, when it is swung open, before it may strike the wall, and which will hold the door open, and thus prevent it from slamming and swinging shut accidentally.

APPARATUS FOR CUTTING OR GIVING FORM TO WOOD.—G. R. Mather, Wellingborough, England.—This invention relates to the use of stone, artificial stone, or other gritty composition adapted to cut into wood and give form thereto. For this purpose the natural or artificial stone or composition is fitted to a spindle, which is caused to revolve, and the form desired to be given to the wood is produced as a counterpart on the edge or other surface of the stone or composition. The wood to be cut if of continuous length, as in the case of moldings, is conducted by guides to the surface of the revolving stone or composition. If the articles in wood to be cut are circular they are supported on spindles or centers, carried by levers or other arms or guides in series and by bands, or otherwise caused to revolve, and they are replaced in succession as the forms desired are obtained.

ROACH AND BUG TRAP.—Thomas Williams, Tompkinsville, N. Y.—This invention relates to a new device for catching Croton bugs, cockroaches, and other creeping insects, and consists in the arrangement of a smooth entrance, which is so placed that the animals cannot crawl out through the same.

WASHING MACHINE.—Horace Warner, Ridgway, Pa.—This invention relates to a new and useful improvement in machines for washing clothes, having especial reference to a washing machine for which letters patent were granted the inventor, dated November 19, 1867. The present invention consists in the mode of raising the vertical shaft and cones from the tub, and in the mode of fastening them down and keeping them in place when in the tub.

WASHING MACHINE.—H. E. Smith and G. F. Spear, New York city.—This invention relates to a new power washing machine of that class in which a rotary cylinder is arranged within a cylindrical case.

ELEVATOR.—G. C. Timpe, New Orleans, La.—This invention comprises an improved arrangement of differential gears and shifting devices therefor for varying the connection according to the weight of the load.

ROTARY STEAM ENGINE.—James Constantine, Mansfield, La.—This invention relates to improvements in rotary steam engines, and consists in a novel arrangement with a piston, through which the steam is admitted from a hollow shaft constantly open to the live steam, of two cut-offs working through the periphery of the cylinder at opposite points, and an exhaust through a hollow boss on the shaft.

MACHINE FOR SHAVING SHINGLES, ETC.—Charles Shelmidine, Summit, N. Y.—The object of this invention is to construct a machine by means of which shingles can be shaved and edged, and other articles, such as barrel staves, etc., finished and planed. The machine is intended to operate in one continuous process, and to be fully adjustable to all shapes and sizes of articles to be finished.

FEED CYLINDER FOR ROSSING MACHINE.—Charles Gilpin, Cumberland, Md.—This invention relates to a cylinder intended for tanners' use in connection with a knife, in taking off the epeidermiss or "ross" from bark previous to grinding the same. The invention consists of a cylinder divided into a number of lengths, all forming parts of the same piece however, and all having different diameters, the length at one end having the greatest diameter the next length less, the third less, and so on in a regularly-decreasing series to the opposite end, and least length which is of the least diameter, the object of this construction being to adapt the cylinder to pieces of bark of different thickness, so that the proper quantity of ross in each case may be taken off without changing the position of the knife.

DEVICE FOR DELIVERING MAIL BAGS TO RAILROAD CARS.—James B. McLain, Newark, Ohio.—The object of this invention is an improved device for saving the necessity for stopping mail trains in order to take on board the mails at the way stations. The apparatus, designed to stand by the side of the track, has a pivoted arm upon which the mail bag is hung in such a position that a suitable device on the car can grasp the bag as the car passes by, and take it on board; in doing this the support is knocked from under the arm and the latter falls out of the way of the other cars.

PLOW.—L. W. Richardson, Roscoe, Ill.—The object of this invention is an improvement in the construction of mold boards, and consists in forming them double—that is, of an iron and steel plate, the latter being made in sections, which are bolted to the former. This construction allows the exterior plate to be hardened to any required degree so that it may be highly polished, or to be conveniently repaired when broken, or otherwise injured, in any part.

SWITCH LOCK.—Alonzo W. Cram, St. Louis, Mo.—This invention consists of an apparatus attached to a switch lever, and provided with a bolt which when thrust into one of the holes in the switch frame, holds the lever fast, and may be locked so as to prevent the moving of the lever, and may also be unlocked and withdrawn from the hole in the switch frame, in order to the changing of the lever.

FLOOD GATE OR FENCE.—S. Rowland and T. C. Tipton, Williamsport, Ohio—This invention has for its object to furnish an improved flood gate or fence to be used in streams or in low lands subject to being overflowed, and which shall be simple in construction, and effective in operation, yielding to allow drift wood and other floating substances to pass freely, and again rising into a vertical position.

CARRIAGES.—Charles N. Dennett, Amesbury, Mass.—This invention has for its object to furnish an improved turn-out seat and extension front for light carriages, which are desired to be used sometimes with one and sometimes with two seats, which may be applied to open buggies, covered on top buggies, and four-post carriages with equal facility, and which shall be simple in construction and easily operated.

APPARATUS FOR MOVING HAY, ETC.—John H. Violett, Goshen, Ind.—This invention has for its object to furnish an improved apparatus for carrying the hay fork in moving hay from one part of a barn or other building to another, especially in unloading hay, and which shall be simple in construction and effective in operation.

SEWING MACHINE TABLE.—E. L. Morgan, Rivesville, W. Va.—In the Official List of Patents and in a notice of Mr. Morgan's invention, which appeared in our issue of November 12, Riversville in the address should have been Rivesville.

Official List of Patents.

Issued by the United States Patent Office

FOR THE WEEK ENDING Nov. 15, 1870.

Reported Officially for the Scientific American.

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109,166.—CHICKEN-COOP.—J. R. Achenbach, Saddle River, assignor to himself, Thomas Terhune, and P. O. Terhune, Hoboken, N. J.
109,167.—STEAM ENGINE.—Herman F. Ambos, Columbus, Ohio.
109,168.—TESTING INSTRUMENT FOR BREWERS AND DISTILLERS.—Moritz Augenstein, Brooklyn, N. Y.
109,169.—ELEVATOR.—C. W. Baldwin, Boston, Mass.
109,170.—WATER WHEEL.—William Blake (assignor to himself and C. H. Parkton), Buchanan, Mich.
109,171.—MACHINE FOR MAKING SCREWS AND SCREW NAILS.—Reinhold Boekler, Brooklyn, N. Y., assignor of one half his right to Henry Torstrick, New York city. Antedated November 10, 1870.
109,172.—PIANO.—Ole Bull, New York city.
109,173.—FURNACE FOR DEOXIDIZING IRON ORE.—A. H Brainerd, Rome, N. Y.
109,174.—PLANE.—Lewis Bundy, Moores Forks, N. Y.
109,175.—FRUIT CRATE.—George Clapp, Geneva, N. Y.
109,176.—HAY BINDER.—Augustus R. Clark, Onondaga, N. Y.
109,177.—APPARATUS FOR BLEACHING THREADS, YARNS, ETC.—J. E. Clarner, Pawtucket, assignor of one half his right to B. F. Green and Horace Daniels, Smithfield, R. I.
109,178.—SEWING MACHINE.—J. C. Clime, Philadelphia, Pa. Antedated November 11, 1870.
109,179.—ROTARY ENGINE.—James Constantine, Mansfield, La.
109,180.—ROCKING CHAIR AND STEP LADDER.—William H. Cook, Bergen, N. J. Antedated November 5, 1870.
109,181.—GUN CARRIAGE.—Thomas Coughlan, Newton, Mass.
109,182.—LOCK FOR RAILROAD SWITCHES.—A. W. Cram, St. Louis, Mo.
109,183.—STEAM TILLER.—Robert Creuzbaur, Williamsburgh, N. Y.
109,184.—SHEAVE.—Alvin Matthew Cushing, Lynn, Mass.
109,185.—MACHINE FOR SPINNING AND DOUBLING SILK, ETC.—T. N. Dale, Jr., and George Kraink, Paterson, N. J.
109,186.—MACHINE FOR SQUEEZING PUDDLERS' BALLS.—Samuel Danks (assignor to himself, Joseph C. Butler, and Lewis Worthington), Cincinnati, Ohio.
109,187.—OVEN PLATE FOR COOKING STOVES.—W. C. Davis, Cincinnati, Ohio.
109,188.—DUMPING CAR.—Peter K. Dederick, Albany, N. Y
109,189.—CARRIAGE.—C. N. Dennett, Amesbury, Mass.
109,190.—MITER-BOX.—Justin Devoge, Meadville, Pa.
109,191.—FAUCET.—C. A. Douglas, Franklin, N. Y.
109,192.—DEVICE FOR CUTTING AND SHEARING METALS.—Isaac Dubois, Boonesborough, Iowa.
109,193.—ELECTRO-MAGNETIC APPARATUS FOR PROTECTING SAFES.—William Duncan and C. C. Rowell, Lebanon, N. H.
109,194.—DOVETAILING MACHINE.—J. P. Flanders, Vergennes, Vt.
109,195.—STEAM BOILER.—Daniel Flynn, Fall River, Mass.
109,196.—MILL FOR POWDERING ROOTS, ETC.—H. D. Garrison (assignor to Garrison & Murray), Chicago, Ill.
109,197.—STRAW CUTTER.—George Sutton Garth, Mill Hall, Pa.
109,198.—GATE.—Wm. Gause, Indianapolis, and J. C. Curryer, Thorntown, Ind.
109,199.—FEED-ROLL FOR ROSSING MACHINES.—Charles Gilpin, Cumberland, Md.
109,200.—CLOTHES DRYER.—Joseph Gnau and Wm. Gnau, Louisville, Ky.
109,201.—BEE HIVE.—L. L. Goodwin, Toronto, Ind.
109,202.—CHAIR AND LOUNGE.—Edward Hagan, New York city.
109,203.—HORSE AND CATTLE LINIMENT.—H. H. Hanmer Nashville, Tenn.
109,204.—TOY BALL.—George Hartz, New York city. Antedated November 3, 1870.
100,205.—ATTACHING DICING-STONES TO WHEELS FOR POLISHING LEATHER.—Hector C. Havemeyer and David P. Burdon, New York city.
109,206.—OIL-CAKE PACKING APPARATUS.—Washington Hawes, Port Richmond, N. Y.
109,207.—GRAPE TRELLIS.—William M. Heath, Watagu, Ill.
109,208.—ADVERTISING APPARATUS.—William Hebdon, New York city.
109,209.—SPOOL STAND.—Edwin C. Heywood, Worcester, Mass.
109,210.—RAILWAY RAIL-JOINT.—Noah Hill, Leavenworth City, Kansas.
109,211.—POTATO DIGGER.—George M. Hoag, Muscatine, Iowa.
109,212.—BOTTLE STOPPER.—Wm. L. Hoefer, Jeffersonville, N. Y.
109,213.—PORTABLE BOOK CLAMP.—C. W. Holbrook and E. F. Butler, Windsor Locks, Conn.
109,214.—WELL AUGER.—James Ingels and T. J. Ingels, Atchinson, Kansas.
109,215.—ADJUSTABLE DRAFT DEVICE FOR PLOWS.—C. L. Jackson, Millersburg, Ill.
109,216.—MEDICAL COMPOUND FOR CURE OF RHEUMATISM.—A. J. Jenkins, Virginia City, Nevada.
109,217.—POTATO DIGGER.—William Joseph, Quincy, Mich. Antedated November, 5, 1870.
109,218.—BREECH-LOADING FIRE-ARM.—B. F. Joslyn, New York city.
109,219.—CLOTHES DRYER.—John Kaspar, Pomeroy, Ohio.
109,220.—COMBINED LOCK AND LATCH FOR SLIDING DOORS.—Edward J. Kehoe (assignor to W. A. Hopkins and F. Z. Dickinson), New York city.
109,221.—SCAFFOLD BRACKET FOR ROOFING.—J. R. Kennett, Geddes, N. Y.
109,222.—COTTON-SEED PLANTER.—John C. King, Spring Place, Ga.
109,223.—(Suspended.)
109,224.—PAPER-FEEDING MACHINE.—Margaret E. Knight, Boston, Mass.
109,225.—CORN PLANTER.—Hermann Koeller, Camp Point, Ill.
109,226.—COMBINED AGRICULTURAL IMPLEMENT.—Leopold Lehmann, Monee, Ill.
109,227.—MACHINE FOR ATTACHING STUDS OR TUBULAR-SHANKED BUTTONS TO FABRICS.—J. H. Lewis, Providence, R. I., assignor to A. R. Field, Greenfield, Mass. Antedated Nov. 5, 1870.
109,228.—COFFEE-ROASTER.—Nicholas Linden, Chicago, Ill.
109,229.—CULTIVATOR.—Isaac Low, East Fairfield, Ohio, assignor to himself and Ephraim Phillips, Cross Cut, Pa.
109,230.—DRY GAS METER.—Geo. Lowen and S. H. Goldthorp, Pittsburgh, Pa.
109,231.—ARTIFICIAL FUEL.—P. Miott McGill, Washington, D. C.
109,232.—ELEVATOR.—George McKenzie, Zanesville, Ohio.
109,233.—DEVICE FOR DELIVERING MAIL BAGS TO CARS.—J. B. McLain (assignor to R. M. Wyeth), Newark, Ohio.
109,234.—DRYER.—John P. Miller, Somerville, N. J.
109,235.—MATCH BOX.—John Monaghan, Tuckahoe, N. Y.
109,236.—WATER ELEVATOR.—A. A. Moulton, Providence, R. I.
109,237.—MODE OF PREVENTING THE HEATING OF AXLES OR JOURNALS.—E. D. Murfey, New York city.
109,238.—SPINDLE STEP.—E. D. Murfey (assignor to "The Manhattan Packing Manufacturing Co.,") New York city.
109,239.—MATERIALS FOR BEARINGS AND JOURNALS.—Eliza D. Murfey (assignor to "The Manhattan Packing Manufacturing Co.,") New York city.
109,240.—CLOTHES POUNDER.—James W. Norton, Pioneer, Pa.
109,241.—CURTAIN FIXTURE.—James Lloyd Oliver, Boston, Mass.
109,242.—PISTON PACKING.—William Ord, Brooklyn, Ohio.
109,243.—BOLSTER FOR WAGONS.—J. W. Pearman and J. F C. Lutz, Holden, Mo.
109,244.—CUTTER HEAD.—Daniel W. Perry, Wilkesbarre, Pa.
109,245.—MANUFACTURE OF VARNISH.—J. B. Pollock, Port Richmond, N. Y.
109,246.—ROOFING CEMENT.—Oliver Porter, Waterford, Me.
109,247.—CULTIVATOR.—John Rebman, Binkley's Bridge, Pa.
109,248.—PROPELLING CANAL BOATS.—James Reid, Catskill, N. Y. Antedated Nov. 5, 1870.
109,249.—PAPER-CUTTING MACHINE.—I. L. G. Rice, Cambridge, Mass.
109,250.—PLOW.—L. W. Richardson, Roscoe, Ill.
109,251.—DITCHING MACHINE.—J. W. Roberts, Hartford City, Ind.
109,252.—FLOOD GATE.—Samuel Rowland and Thomas C. Tipton (assignors to themselves and G. W. Wiggins), Williamsport Ohio.
109,253.—PAPER FILE.—William W. Russell, Malden, Mass.
109,254.—ROOFING COMPOSITION.—Albert Ruttkay, New York city.
109,255.—BREECH-LOADING FIRE-ARMS.—E. L. Sargent, Watertown, N. Y.
109,256.—EXTENSION PLATFORM STEP LADDER.—George A. Schachtel, Newark, N. J., assignor to himself and R. B. Sanderson.
109,257.—FOUNTAIN PEN.—Fridolin Schifferle, St. Louis, Mo.
109,258.—SHINGLE MACHINE.—Charles Shelmidine, Summit N. Y.
109,259.—WASHING MACHINE.—H. E. Smith and G. F. Speer (assignors to M. J. Smith), New York city.
109,260.—TACKLE BLOCK.—R. J. Smith, North Haven, Me. Antedated Nov 5., 1870.
109,261.—HAY-RACK FOR WAGON.—S. J. Smith, Farmington N. Y. Antedated Oct. 29 1870

109,262.—WASHING MACHINE.—Thomas Snow, Social Circle, Ga.

109,263.—TAG.—T. J. Southworth, Rochester, and W. H. Lawton, Elmira, N. Y. Antedated Nov. 3, 1870.

109,264.—FEEDING HYDROCARBON LIQUIDS TO A HOT GAS RETORT.—Theodore G. Springer, St. Louis, Mo. Antedated November 3, 1870.

109,265.—MOSAIC FLOOR.—Joseph Stegmiller (assignor to himself and L. H. Rueckenbag), New York city.

109,266.—CURTAIN FIXTURE. — John Stephens (assignor to himself and Jairus Collins), Fairview, Ohio.

109,267.—RULING MACHINE.—James Stewart, Washington, D. C.

109,268.—PURIFYING ILLUMINATING GASES.—W. H. St. John, and Peter Cartwright, New York city.

109,269.—COMBINED HARROW AND SEEDER.—Ezra Stoner, Greencastle, Pa.

109,270.—STEAM ENGINE.—Charles Strong and A. W. Stickney, Lebanon, N. H.

109,271.—WINDOW SHADE.—William Strunk, Nettle Lake, Ohio.

109,272.—MOLDED CARRIAGE TOP.—G. L. Swett and J. P. Lockey, Leominster, Mass.

109,273.—ROTARY PULVERIZER.—John Thompson, Louisville, Ky.

109,274.—HOOK FOR DUMPING TUB.—J. R. Thorn, Waldoborough, Me.

109,275.—ELEVATOR.—Gustavus C. Timpe, New Orleans, La.

109,276.—EARTH CLOSET.—Elias W. C. Vanderveer, Linden, N. J.

109,277.—BREECH-LOADING FIRE-ARMS.—Frederick Vetterlin, Neuhausen, Switzerland. Antedated Nov. 11, 1870.

109,278.—HOISTING APPARATUS.—John H. Violett, Goshen, Ind.

109,279.—WASHING MACHINE.—Horace Warner, Ridgway, Pa.

109,280.—MACHINE FOR MAKING CIGAR BUNCHES.—Wendelin Weis, St. Paul, Minn.

109,281.—DOOR STOP.—L. C. Wemple, Rockford, Ill.

109,282.—ROACH AND BUG TRAP.—Thomas Williams, Tompkinsville, N. Y.

109,283.—MEASURING CAN.—A. G. Wilson, Chicago, Ill. Antedated Nov. 5, 1870.

109,284.—ROTARY PUDDLING FURNACE.—Enoch Wood (assignor to himself, Edward Perry, Richard Perry, William McPherson, and Edward Williams), Pittsburgh, Pa.

109,285.—GRATE BAR.—James Yocom, Jr., Philadelphia, Pa.

109,286.—PADDLE WHEEL.—Samuel Bateman, Asniere, near Paris, France.

109,287.—WASHING MACHINE.—Wm. B. H. Beach, Naples, N. Y.

109,288.—FILTER.—John Bean, Hudson, Mich.

109,289.—COMBINED THRASHING MACHINE AND CORN SHELLER.—John Bowman, Princeville, Ill.

109,290.—PLOW.—T. E. C. Brinley, Louisville, Ky.

109,291.—PLOW.—T. E. C. Brinley, Louisville, Ky.

109,292.—CONNECTING FIRE DETECTOR WITH THE ALARM.—H. L. Brower (assignor to C. D. Fredericks), New York city.

109,293.—MACHINE FOR CUTTING LOAF SUGAR.—Adolphus Brown and Felix Brown, New York city.

109,294.—HAND-DRAG RAKE.—Edward Brown, Kennebunk, Me.

109,295.—MACHINE FOR CUTTING LOAF SUGAR. — Felix Brown, New York city.

109,296.—MACHINE FOR CUTTING LOAF SUGAR.—F. Brown, New York city.

109,297.—COMBINED CANE AND WHIP.—C. L. Bushnell, Cherry Valley, Ohio. Antedated Nov. 5, 1870.

109,298.—COMBINED LATCH AND LOCK FOR SLIDING DOORS.—Jacob Caproa, New York city.

109,299.—FRICTION CLUTCH.—Thomas Coldwell, Newburgh, N. Y.

109,300.—APPARATUS FOR TRIMMING HEELS OF BOOTS AND SHOES.—Louis Cote, St. Hyacinth, Canada.

109,301.—HARVESTER RAKE.—A. G. Crane and W. T. Johnston, Ottumwa, Iowa.

109,302.—CANCELING STAMP.—C. E. Donnellan, Indianapolis, Ind.

109,303.—APPARATUS FOR BURNING PARAFFINE AND OTHER HYDROCARBON OILS.—H. H. Doty, London, Eng.

109,304.—SCHOOL DESK.—W. E. Doyle, Eaton, Ohio.

109,305.—HORSE HAY FORK.—Alvin T. Dunbar and James H. Fellows (assignors to A. T. Dunbar and George H. Dewey), Alba, Pa.

109,306.—SAD IRON.—T. G. Eiswald, Providence, R. I.

109,307.—MOP WRINGER.—Homer L. Ennes, Birmingham, Ohio.

109,308.—STONE TRUCK. — Washington Evans, Ontario, Ohio.

109,309.—SKIRT-SUPPORTING HOOK FOR CORSETS.—David H. Fanning, Worcester, Mass.

109,310.—RAILWAY CAR WHEELS.—J. N. Farrar, Pepperell, Mass.

109,311.—WATER ENGINE. — Russel Francis, Woodstock, Wis.

109,312.—RAILWAY CAR SPRING.—Heman Gardiner, New York city. Antedated Nov. 12, 1870.

109,313.—BRICK MOLD.—Gottlieb Graessle, Hamilton, Ohio, assignor to himself and L. E. White.

109,314.—APPARATUS FOR THE MANUFACTURE OF SUGAR.—J. W. Hahn, San Francisco, Cal.

109,315.—CORN SHELLER.—Jonathan R. Hamilton, Kingston, Minn.

109,316.—STUMP EXTRACTOR.—Samuel Harman, La Porte, Ind.

109,317.—APPARATUS FOR TRANSPORTING LOADS ON WIRE ROPE.—Charles Hodgson, Richmond, England.

109,318.—CLOTHES-LINE REEL.—George Holman, Waterville, N. Y.

109,319.—JOURNAL BEARING.—D. A. Hopkins, Jersey City, N. J.

109,320.—RAILWAY CAR WHEEL.—Lewis B. Hunt, New York city.

109,321.—BUCKLE.—J. C. Hyde (assignor to the West Haven Buckle Co.), West Haven, Conn.

109,322.—MOWING MACHINE. — Benjamin Illingworth, Le Roy, Minn.

109,323.—MUFF AND COLLAR BOX.—G. L. Jaeger, New York city.

109,324.—FIRE KINDLER.—Jeremiah Kenney, Sr., Baltimore, Md.

109,325.—MACHINE FOR GRINDING AND POLISHING LENSES, ETC.—H. D. Knight, Elgin, Ill.

109,326.—OPENING AND SHUTTING DEVICE FOR RAILROAD-CAR WINDOW.—J. F. Lash, Toronto, Canada.

109,327.—INK FOR WRITING.—R. G. Loftus, Chelsea, assignor to himself and O. W. Farrar, Boston, Mass.

109,328.—DETACHING HOOK.—J. A. Lord, Jr., Middletown, Conn.

109,329.—SHUTTER FASTENER.—Ira O. Luey, Bernardston, Mass.

109,330.—VESSELS' HATCH.—J. P. Maddox, Belfast, Me.

109,331.—ELEVATOR.—W. K. Marvin, New York city.

109,332.—PIPE COUPLING.—J. H. McGowan, Cincinnati, Ohio.

109,333.—CONCRETE PAVEMENT.—A. B. McKeon, Rutherford Park, N. J. Antedated November 5, 1870.

109,334.—CORN AND COTTON SCRAPER.—George Milliorn (assignor to himself and P. T. Raiford), Pyhalia, Miss.

109,335.—WATER WHEEL.—J. A. Morgan, Navasink, N. J.

109,336.—DIE FOR FORGING CARRIAGE CLIPS.—F. B. Morse (assignor to himself and H. D. Smith & Co.), Plantsville, Conn.

109,337.—SCREW PILE.—T. W. H. Moseley, Boston, assignor to R. P. Moseley, S. R. Moseley, and A. M. L. Moseley, Hyde Park, Mass.

109,338.—AIR ENGINE.—David Myers, Chicago, Ill.

109,339.—OFF-BEARING TRUCK FOR BRICK MACHINES.—Walker Olds, Albany, N. Y. Antedated November 5, 1870.

109,340.—PLOW.—Ornan Osborn, Erie, Pa.

109,341.—MANUFACTURE AND APPLICATION OF COLORS FOR PRINTING AND DYEING.—Alfred Paraf (assignor to E. S. Renwick), New York city.

109,342.—DOOR CATCH.—R. V. Phillips, Council Bluffs, Iowa.

109,343.—SAWING MACHINE.—R. J. Poston, Mainville, Ohio.

109,344.—SHAFT COUPLING.—W. M. Pratt, Chicago, Ill.

109,345.—TAKE-UP DETAINING PAWL.—George Richardson, Lowell, Mass.

109,346.—WOOD AND COAL DUMPER FOR RAILWAYS.—R. B. Robbins, Adrian, Mich.

109,347.—RAILWAY-CAR BUMPER AND DRAW-HEAD.—Alexander Ross and John Arthur, Freeport, Ill.

109,348.—TAKE-UP NUT.—Thomas Ross and W. W. Graham, Rutland, Vt.

109,349.—PUMP.—Alonzo Sherman and J. W. Sheaffer, Sterling, Ill.

109,350.—APPLE PARER, CORER, AND SLICER.—James Shobe, Upper Principio, Md.

109,351.—SAWING MACHINE.—F. D. Smith, Chicago, Ill.

109,352.—PLOW.—Hugh Smith, Moline, Ill.

109,353.—DRAFT DEVICE FOR HARVESTER.—J. M. Smith, Jerseyville, Ill.

109,354.—MACHINE FOR SEPARATING MAGNETIC IRON ORES FROM OTHER SUBSTANCES.—J. Y. Smith, Pittsburgh, Pa.

109,355.—FURNACE AND PROCESS FOR TREATING IRON AND OTHER ORES.—J. Y. Smith, Pittsburgh, Pa.

109,356.—BLAST APPARATUS FOR FURNACE.—R. A. Smith, Newburyport, Mass.

109,357.—WINDOW FASTENING.—Hiram St. John, Wilton, Conn.

109,358.—SPRING FOR RAILWAY-CAR TRUCK.—W. M. Taylor, Newburgh, Ohio.

109,359.—FLUID METER.—Franzis Wagner, New York city.

109,360.—FUNNEL.—Albin Warth, Stapleton, N. Y.

109,361.—GRINDING MILL.—J. M. Westmoreland, Danville, Texas.

109,362.—SASH HOLDER.—E. H. Wheeler, Scranton, Pa. Antedated November 5, 1870.

109,363.—CULTIVATOR.—B. F. Young, Toulon, Ill.

109,364.—FLAVORING COMPOUND.—William Zeigler and J. H. Seal, New York city.

109,365.—CARTRIDGE BOX.—J. R. King (assignor to W. M. Tileston), Washington, D. C.

109,366.—BINDING ATTACHMENT FOR SEWING MACHINE.—W. N. Martin, Boston, Mass.

REISSUES.

4,177.—ICE-CREAM FREEZER.—B. G. Martin, Williamsburgh, N. Y.—Patent No. 100,205, dated March 1, 1870; antedated February 14, 1870.

4,178.—Division A.—BRICK MACHINE.—James Sangster, Buffalo, N. Y.—Patent No. 59,080, dated October 23, 1866.

4,179. — Division B.—BRICK MACHINE. — James Sangster, Buffalo, N. Y.—Patent No. 59,080, dated October 23, 1866.

4,180.—BED BOTTOM.—Edward Yeoman, Waukegan, Ill.—Patent No. 67,698, dated August 13, 1867.

DESIGNS.

4,465, 4,466.—BRACKET.—J. H. Bellamy, Charlestown, Mass., assignor to S. D. Niles and B. A. Ward. Two Patents.

4,467.—LOCK FRONT.—F. W. Brocksieper (assignor to Sargent & Co.), New Haven, Conn.

4,468.—PIANO.—Ole Bull, New York city.

4,469.—STOVE SHELF.—W. C. Davis, Cincinnati, Ohio.

4,470.—FACE PLATE OF A SASH LOCK.—C. H. Eccleston, Oxford, N. Y.

4,471.—BOX FOR PUTTING UP PAPER CUFFS.—George Faul, Boston, Mass., assignor to S. F. Hilton, Providence, R. I.

4,472.—DOOR BOLT.—Ferdinand Fogelstrand (assignor to Sargent & Co.), New Haven, Conn.

4,473.—THUMB LATCH.—Ferdinand Fogelstrand (assignor to Sargent & Co.), New Haven, Conn.

4,474.—CAR LOCK.—William Gorman (assignor to Russell & Erwin Manufacturing Company), New Britain, Conn.

4,475.—SAD IRON.—W. M. Griscom (assignor to Harbster Brothers & Co.), Reading, Pa.

4,476.—SPOON AND FORK HANDLE.—E. C. Moore, Yonkers, N. Y., assignor to Tiffany & Co., New York city.

4,477.—SHOW CASE.—W. H. Grove, Philadelphia, Pa.

4,478 and 4,479.—CENTER PIECE.—Samuel Kellett, San Francisco, Cal. Two patents.

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62.—COUGH BALSAM.—William Maddox, Ripley, Ohio.

63.—WHISKY.—C. P. Moorman, Louisville, Ky.

64.—WHISKY.—C. P. Moorman, Louisville, Ky., and M. J. Hardy, New York city.

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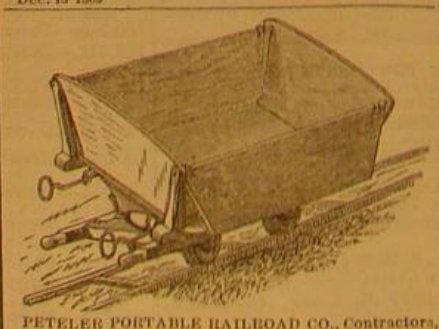

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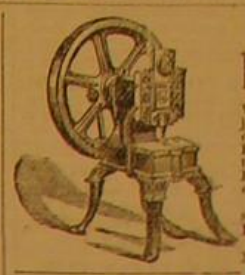

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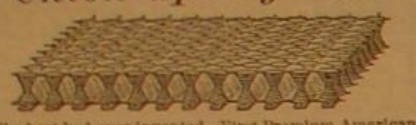

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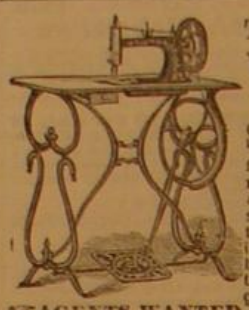

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SCIENTIFIC AMERICAN

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

Vol. XXIII.—No. 23 [NEW SERIES.] NEW YORK, DECEMBER 3, 1870. $3 per Annum [IN ADVANCE.]

Molding, Carving, and Paneling Machine.

This machine, of which Fig. 1 is a perspective view, is designed for molding irregular forms and panels upon surfaces in the manufacture of furniture, cars, organs, buildings, etc., of which work it will perform an unlimited variety of styles, combining the advantages of three distinct machines, performing three distinct lines of work.

1st. It is a shaper or irregular molding machine.

2d. It is a carver, cutting and molding any design, or panel upon the surface of work in the solid wood, for which a form or pattern has been prepared; cutting grooves in any direction, either plain or molded; and doing as great variety of work upon the surface, in as expeditious a manner as has been done heretofore upon the edge, by the shaper, and saving the many glue joints heretofore necessary.

3d. It molds brackets and delicate fret-work, however complicated, in a perfect manner; dovetails drawers strongly and neatly, and, in short, has a general and broad application in the useful manufactures.

By reference to Fig. 1 will be seen a guide point, A, suspended over the cutter, B, whose centers are in line with each other. The guide point is vertically adjusted by a screw wheel, C. The cutter, B, is attached to the spindle, D, which obtains its motion from the belt on primary shaft, E. A form or templet is prepared, as shown in No. 1, Fig. 4, and is attached to No. 2, on the side opposite to where the cutting is to be done. The piece is placed under the guide point, which is then lowered to the pattern. The cutter being, when not in use, below the table, is now brought up by pressing the foot upon the lever, F, Fig. 1 connecting with the bridgetree, G, to the desired hight, which is regulated by the adjusting rod, H. These means govern the depth to which the cutters penetrate. The form is then moved around against the guide point, and its shape and design transferred to the piece worked, as at No. 2, Fig. 4.

Fig. 5 represents a pew end, ornamented on one side by molding, and grooved, by the cutter, K, Fig. 3, on the other, as shown by dotted lines, to receive the seat and back.

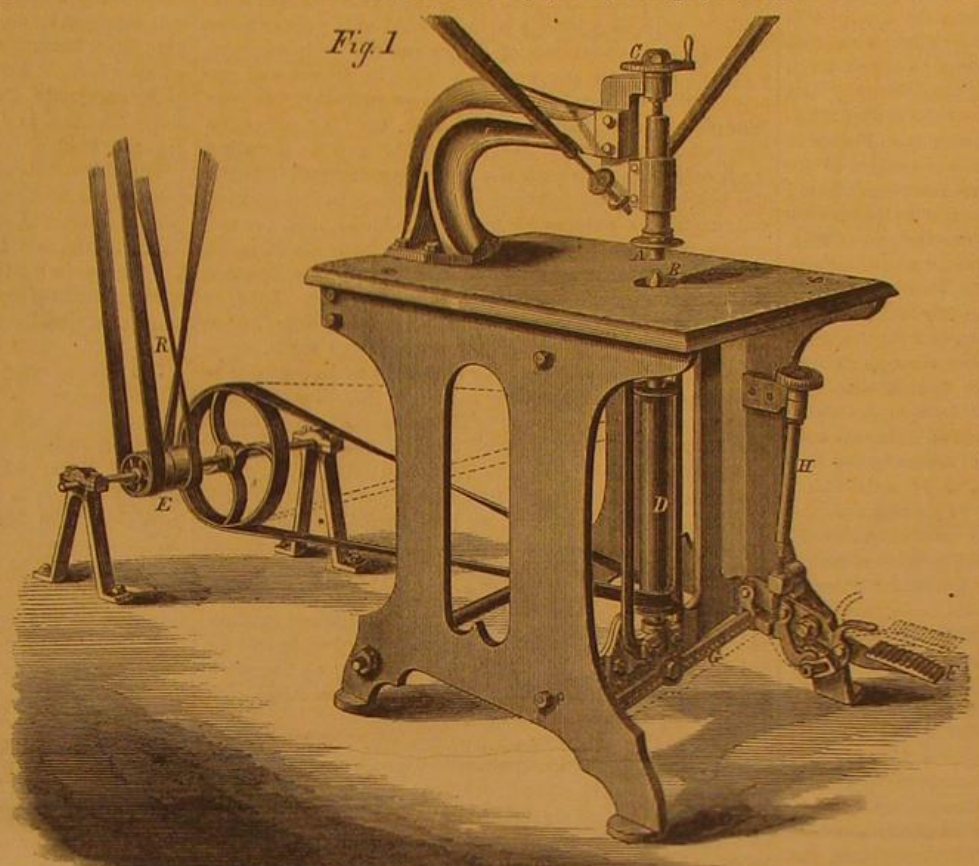
Any number of designs may be cut without change of machinery. The cutter, N, is held in the chuck, M, Fig. 3, and any of the cutters placed upon the spindle, as at B, Fig. 1, may be changed and replaced instantly.

For molding upon the edge, the guide point is run up out of the way or entirely removed, and the stem chuck, I, is placed upon the spindle instead of M, as before described; the cutter, O, is then slipped on the stem, and is held by the nut, P, and washers, Q.

These cutters are made from solid steel turned into any desired shape, and cut in either direction, right or left, as do all the cutters used on this machine. All these cutters work as freely as the ordinary open cutters. Reverse motion is given to the spindle by means of the belts, R, which secures the motion of the cutter with the grain of the wood. The usual open cutters may be used when desired. This style of machine has many advantages; namely, it has but one spindle, giving free surface of table; the cutters always run smooth, and are not liable to sliver or break the wood; and, chiefly, its scope of work is much greater than that of any similar machine yet introduced. Its sphere of work is limited only by size of material and pattern, as any distance can be cut in one direction.

Molding brackets or fret-work is done, as shown at Fig. 6. A spindle head is placed upon the arched arm, S, Fig. 2. The spindle is driven by a belt passing over pulleys, T, from the primary shaft, heretofore described. For this work the double-stem cutter, shown in Fig 3, at L, is employed, with which the smallest openings may be molded. An adjustable table is placed upon the bed, and the double stem-cutter adapted to the work is inserted in the spindle by which any style of fret-work may be molded, on the inside as well as on the outside edges, as well as thick stuff is now done on the ordinary shaper.

Fig. 1



M. T. BOULT'S MOLDING, CARVING, AND PANELING MACHINE.

Fig. 2

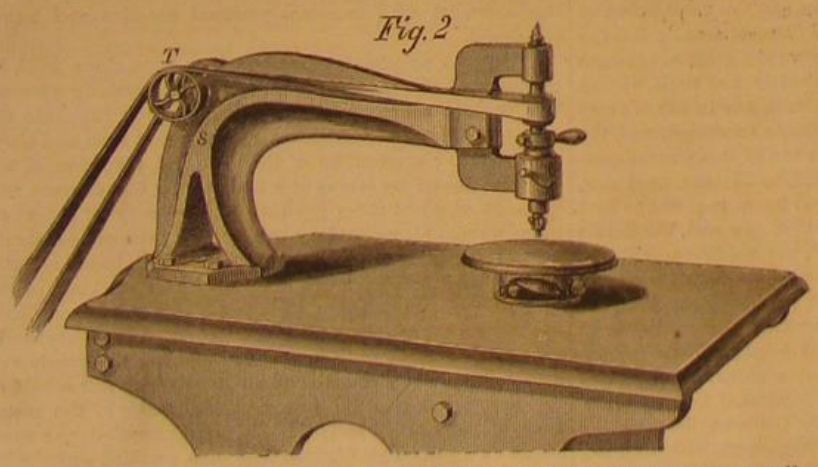


Fig. 3

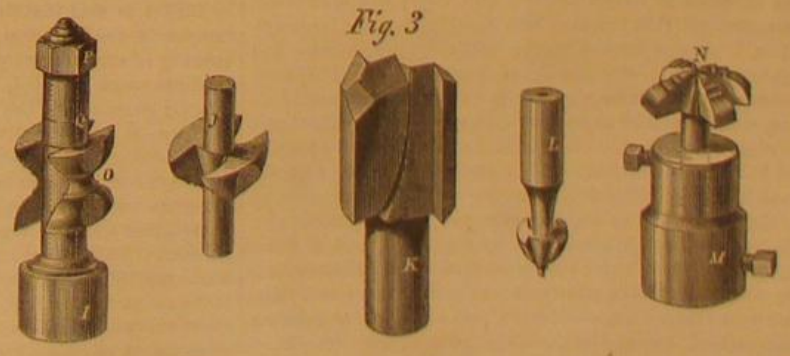


Fig. 4

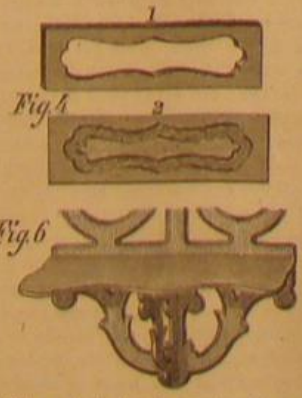


Fig. 5

The principles of construction adopted in this machine are practical, and the specimens of its work we have seen are of a superior quality

This machine is covered by several patents, obtained during the past two years, and applications for others are now pending through the Scientific American Patent Agency. Any information in regard to machines or rights may be obtained by addressing the patentee, M. T. Boult, Battle Creek, Mich., or the manufacturers, Messrs. Burnham & Hyde, of the same place.

Mount Seward in the Adirondacks.

The recent explorations of Verplanck Colvin, of Albany, in the Adirondack wilderness, have developed some valuable scientific facts. The principal result was the ascent of Mount Seward, which seems never to have been ascended and measured, the guides, together with the celebrated Indian, Mitchell Sabattis, affirming to that effect, and no record appearing of any visit or measurement. The mountain is difficult to reach, lying in a peculiarly rugged piece of the forest known to the Indians as "the dismal wilderness." He climbed the mountain from the Preston Ponds on Cold river, and after severe exertions, the ascending and descending of many lofty summits, succeeded in reaching the peak of the mountain. The ascent occupied a little over two days. Snow and ice of last year were found in small quantities upon the open summit; he is disposed to consider this as an exception rather than a rule. On the night of the 14th of October he camped near the summit, and from thence saw the aurora; the wind during the display was strong and variable, and shortly after a change in it, there would seem to be a corresponding motion of the aurora. The temperature was very low during that night. The next morning the highest point was reached with great labor by chopping through and finally walking on top of dwarf balsam trees. The barometrical observations established a hight of 4,370 feet above the level of the sea; much less than Prof. Emmons estimated (5,100), which was little more than a guess, as he never ascended the mountain. Mr. Colvin entered the wilderness at the east from the Hudson river, and on his return penetrated westward to Lewis county, returning to Albany by way of Utica, passing from south to north and then from east to west through the wilderness during this survey. His instrument was a mercurial cistern barometer of the best construction; the station for corrections was the Dudley Observatory. He spoke highly of his guide, Alvah Dunning, of Raquette Lake, commending his energy and skill. A formal report of this expedition is to be made to the State authorities, through the Regents of the University.

To Polish Marble, etc.

Marble of any kind, alabaster, any hard stone, or glass may be repolished by rubbing it with a linen cloth dressed with oxide of tin (sold under the name of putty powder). For this purpose a couple or more folds of linen should be fastened tight over a piece of wood, flat or otherwise, according to the form of the stone. To repolish a mantelpiece it should be first perfectly cleaned. This is best done by making a paste of lime, soda, and water, well wetting the marble, and applying the paste. Then let it remain for a day or so, keeping it moist during the interval. When this paste has been removed the polishing may begin. Chips in the marble should be rubbed out first with emery and water At every stage of polishing the linen and putty powder must be kept constantly wet. Glass, such as jewelers' show counter cases, which become scratched, may be polished in the same way.

IRON AND ITS MANUFACTURE.

[Abstract from an address delivered at the Fair of the American Institute, by A. W. Humphreys, President of the Sterling Iron and Railway Company.]

The method employed by all the early workers of iron was that still employed in India, Borneo, and Madagascar, consisting in heating, as heating through the aid of rude bellows, rich ores of iron, in contact with incandescent charcoal. The mass of iron thus produced is called a bloom, from the old Saxon word *bloma*. This method obtained until the discovery of cast iron, which in its development led up gradually to the smelting process, or indirect method of producing iron from its ores.

THE INVENTION OF THE BLAST-FURNACE.

To properly trace the history of the present iron manufacture we have only to go back about 500 years, to the development of the process of making pig-iron by the blast-furnace, at a date which cannot be fixed with precision, but about the beginning of the fifteenth century. It is probable that the gradually increased hight of the little furnaces or forges, formerly in use, with the greater intensity of blast, also gradually increased, finally led to the complete melting of the ore, and so, by the final addition of some earthy flux, cast-iron was obtained; but where and by whom the change was turned to any practical account, is unknown, though the first furnaces erected to make only pig-iron seem to have been in France, or what is again, unfortunately, the debatable land between France and Germany; and one of the earliest English makers of pig-iron imported a workman from France to teach him the art. But if France can claim the origin of the manufacture, England soon took and has since maintained the front rank in the quantity made, though to Sweden we still look for a superior quality of many descriptions of iron. The quantity of iron made in England was for a time seriously checked by want of fuel. Down to the beginning of the eighteenth century, charcoal had been the only fuel employed to any extent in the manufacture of iron, and the immense forests of Russia gave her, for a time after the manufacture was established there, a certain advantage, and she sent large quantities of iron to England, where the drain of timber for iron-making had been so great, that in 1581 stringent laws were passed to prevent the consumption of timber in any new iron-works within 22 miles of London, or 14 miles of the Thames, such legislation being necessary to prevent a famine of fuel, the whole kingdom being then dependent on wood; this and some additional legislation having failed of its object, it was finally forbidden to use any timber for charcoal for making iron.

Some fuel was necessary, and the Dudleys spent much time and money in their experiments in the use of pit-coal, finally succeeding in making iron by its use, but, through various obstacles, many of them thrown in the way by jealous charcoal iron makers, not being able to establish it as a regularly accepted article.

For nearly 80 years after the final abandonment by Dudley of his persevering trials and partial successes, nothing was accomplished toward the practical solution of the problem, until, finally, in 1735, Abraham Darby, of Colebrookdale, succeeded where so many others had failed, and the manufacture began a fresh period of prosperity, though still only partial, for the introduction of mineral coal necessitated further improvements which the state of the mechanical arts made still impracticable, and England continued partially dependent on Sweden and Russia. In 1750, Smeaton erected, at the Carron Works, the first large blowing-cylinders, and these, furnishing the larger quantity of air necessary with pit-coal, or rather the coke from the pit-coal—raw coal being yet unused—showed iron-masters in what direction lay the chief difficulty hitherto preventing the complete success which had been expected to follow Darby's discovery; while, at about the same time that Smeaton was constructing his large cylinders, Watt was improving the steam-engine; and he had so far perfected it, with the aid of Boulton, that in 1788 iron masters were beginning generally to employ his double engine, which supplied the power necessary to work the large blowing-cylinders, thus completing what Darby had begun; but it extended no further than the blast-furnace and the manufacture of pig-metal. Another step had been needed for the speedy and economical conversion of pigs into bars; this was supplied theoretically by a patent issued to Peter Onions, in 1783, in which the *rationale* of the puddling process was described and the principles involved fully covered. The next year Henry Cort, of Gosport, took out a patent covering the practical use of the puddling process, and the use of grooved rolls, and to Cort is generally ascribed the merit of both inventions; and he has been styled the Father of the Iron Trade; although, as a matter of fact, the mode of puddling described by neither Onions nor Cort is precisely followed at the present time. Cort spent a large sum in perfecting and introducing his inventions, and had what seemed the shrewdness to get a Government official interested in his patent, and to furnish a part of the capital necessary, and Onions sunk out of sight. Cort's Government friend was caught, however, in a defalcation, or "irregularity," having, in fact, stolen the money he advanced to Cort. The Government seized the patent; it was locked up in court, and Cort finally died a poor man, ruined by what has proved to be the means of wealth to England.

PROGRESS OF THE MANUFACTURE IN ENGLAND.

These improvements laid the foundation of England's supremacy as an iron-producer; they speedily came into general use, and the production of iron, aided by the fostering care of the Government and the unusually high price of foreign iron, rapidly increased. As the completion of these improvements, about 1790, was the commencement of the present era of iron-making in England, it may be worth while to consider, for a moment, her previous and succeeding position in this industry, from a commercial point of view. The quantity of iron made in the Kingdom nearly sufficed for the consumption of Great Britain until the passage of the stringent fuel laws above spoken of, and there were neither imports nor exports of any great quantity until the seventeenth century. Statistics of the whole product of the British Island previous to 1715, are not to be had; in that year there were estimated to be about three hundred furnaces in operation, and the price of pig-iron was about £6 per tun; from the dearness of fuel and the operation of the laws against the employment of charcoal at iron-works, the production gradually fell off, until in 1740 there were only 59 furnaces in operation, producing 17,350 tuns per annum of pig-iron, while the net imports of iron of all descriptions, mainly from Russia, Sweden, and the American colonies, were about 20,000 tuns. Then came Darby's success with pit-coal, and the make immediately began to increase, and continued to do so moderately, until, in 1788, the total production of Great Britain was 68,300 tuns, and her net imports about 15,000 tuns. Then came Smeaton and Watt, and Cort; the duty on bars was put at 56 shillings per tun, the value of bar-iron being about £18 per tun, and the manufacture fairly began the prosperity it has ever since retained, with occasionally a dull period of a year or more. In 1796 an additional duty of £1 per tun was laid upon bars, a rise of about 30 per cent took place in Russia, and the manufacture increased so fast that, to quote Tooke, "the produce of iron proceeded so rapidly, that, with the aid of further duties, amounting almost to a prohibition of importation, it not only kept pace with the increasing demand, but actually nearly superseded the use of foreign iron in this country, and furnished a surplus for exportation." In 1797, the production was 125000 tuns. So strong had been the stimulus, that, in 1801, there were building or in blast, 47 new furnaces, 125 being then the total number of the old ones. Let it be borne in mind that no new process had been discovered since 1790, nor had any special improvements been made, meantime, in furnace machinery; the increase was due entirely to the increased demand, to a rise in foreign iron caused mainly by this increased demand, and by the action of the Government in so arranging the duties that Great Britain might herself reap the full benefit of the changed circumstances, carefully sustaining the feeble steps of this branch of industry while thus in its infancy. In 1806, the total number of furnaces in Great Britain was 173, making 258,000 tuns per annum, an average of less than 1,500 tuns to each furnace. In 1825, there were 364 furnaces, of which 261 were in blast, making 581,000 tuns per annum. The duty, at this time, on bar-iron, was £6 10s. per tun, having been gradually raised to this figure since 1796, and Great Britain, from being an importer, had so changed her relative position in the iron world, that her net exports were 90,000 tuns.

THE USE OF HEATED AIR.

There was still no further change in modes of manufacture, but in 1828, Mr. J. B. Neilson, of Glasgow, took out his patent for the use of heated air, instead of the cold blast, which had alone, until then, been used to support internal combustion in the blast-furnace. Whatever merit we may gladly concede to the predecessors of Mr. Neilson for their improvements, it is certain that no single invention in the manufacture of pig-iron has been followed by so great benefits or occasioned so marked advance as the use of the hot blast; although it deserves to be called a discovery rather than an invention, for, in the words of Dr. Percy, "there is no reason to believe that the patentee had, at first, any adequate conception of the value of his invention, and the great influence it was destined to exert upon the smelting of iron." But the iron-masters were not slow to perceive the great advantages it offered, and promptly availed themselves of them, so that by 1835 it is said that the heated blast was in use at every furnace in the Kingdom, with a single exception, and the quantity of coal necessary to smelt a tun of iron was reduced in three years, from $8\frac{1}{2}$ tuns, coked, to $2\frac{1}{4}$ tuns, used raw, actually consumed in the furnace, and 8 cwt. required to heat the blast, or a total of 2 tuns 13 cwt. of raw coal, the Calder works having demonstrated, in 1831, the needlessness of coking when hot blast was employed, while later the expense of any extra fuel for heating the blast was dispensed with, the waste gases from the top of the furnace being used for that purpose. This latter improvement originated in France, where, in 1811, M. Aubulot took out a patent for their employment and utilization, reserving to himself, however, only their use as far as connected with his own business, the cementation of steel—giving to iron-masters, with singular generosity, not only all the benefits they could derive in other ways from his patent, but carefully instructing such as chose to apply to him, in the best way he knew of collecting the gas, although he foresaw at least a part of the enormous advantages which would finally result from his idea. But little was actually done with the waste gases, however, to assist in smelting, until, in 1845, Mr. Budd took out a patent in England for the utilization of the gases for heating the blast, and soon applied his principle, not only to the stoves, but to the generation of steam in the boilers, at his furnaces, and since that time it is almost the universal practice to employ only the heat from the combustion of these gases for those purposes, and at some furnaces their employment is carried still further, and ore is calcined by them in kilns especially adapted for that purpose; though whether there is as yet any real economy in this, at large furnaces, remains, to a certain extent, an open question. The people of the United States have especial reason to hold Mr. Neilson in grateful remembrance, for, without hot blast it would be almost absolutely impossible to smelt iron with anthracite coal, the experiment of doing so with cold blast having been thoroughly and carefully, but unsuccessfully tried in the United States, in France, and in Great Britain, the earliest recorded trials having been made as early as 1820, near Mauch Chunk, Pa., and the next in France in 1827; but it was only when aided by hot blast that Mr. Crane, in Wales, with ovens built by Mr. Neilson himself, finally achieved success with this king of fuels, in 1837, though Geissenheimer had in 1823 taken out a patent in the United States for the use of anthracite, but with no practical results. Again, at Mauch Chunk, in August, 1838, this time with hot blast, and, it is asserted, without a knowledge of Mr. Crane's success, an attempt was made to employ the Pennsylvania anthracites, and a blast of five weeks is claimed to have been perfectly successful, the furnace being owned by Bauman, Guiteau & High. They stopped, from want of ore, in January, 1839, and, after somewhat enlarging the furnace, again blew in at the end of the following July, and continued in blast till November of the same year, having produced about two tuns of iron per day, when working best, with a blast heated to about 400 degrees. The size of the furnace was 5½ feet bosh by 21½ feet high. The quantity of coal consumed per tun of iron made, I am unable to state.

The Pioneer furnace, at Pottsville, was the next furnace successfully employing anthracite coal, and the same site is still occupied by an anthracite furnace owned by Messrs. Atkins Bros., though the old stack was torn down in 1858, and a larger furnace built on the same foundations. It was blown in by Benjamin Perry, with some general assistance from David Thomas, in July, 1839, and completed his first blast in January, 1840.

The above statements regarding the first use of anthracite seem to me well authenticated by documents written by the parties interested, at, and immediately after, the dates mentioned above, and I believe may be relied on, though there has been some controversy upon whose brow should rest the *corona muralis* of success in this peaceful struggle, and I have taken corresponding pains to determine the conflicting claims

THE USE OF ANTHRACITE COAL.

In a general way, it is sufficient to say that from 1839 dates the employment of anthracite coal for smelting iron in the United States, and the production of this description of iron has, with various ebb and flow, finally reached the handsome quantity of 971,000 tuns made in 1869. The primal development of the use of anthracite we must concede to Mr. Crane, in Wales. The American iron-masters long ago left their Welsh competitors far behind in the production of this particular description of pig-iron, whether there be considered the quantity made, the size and general completeness of the furnaces, or the quality of metal produced, the generally poor character of the Welsh coal, and its excessive decrepitation upon the application of heat, having been powerful hinderances to the growth, at the place of its birth, of this particular branch of iron industry, Wales having made, in 1869, but 38,000 tuns of anthracite pig-iron. With hot blast and the use of anthracite begins the real history of the extensive manufacture of iron in America. But this sketch would be quite incomplete and unsatisfactory without an attempt to follow, as accurately as possible, the progress of the early iron-workers on this continent, though the record is quite imperfect, our forefathers having had quite enough to do to maintain their individual footing, without giving themselves much anxiety about general statistics; and whoever traces carefully the fluctuating fortunes of the predecessors of the present iron-masters of this country will find that the soldier patriots of Valley Forge were not the only men whose faithful picket-duty in the cause of American Independence was attended with immense personal sacrifice and heroic self-denial.

In order to appreciate what has been done since 1840, let us glance at the then condition of the iron-making process: The ore was charged, with its accompanying fuel, into the open tunnel-head of furnaces of about 12 feet bosh and about 45 feet high; combustion of the fuel and reduction of the ore was effected by means of a blast of say 500 degrees, at a pressure of about three pounds; a part only of the waste gases were at all utilized by being taken from some distance below the top of the stack, before they had become really "waste," frequently deranging the proper working of the furnace, while the portion thus taken was of but very little use, by reason of its insufficient mixture with atmospheric air and subsequent only partial combustion; the result was a consumption of a tun and a half to two tuns and a half of fuel per tun of iron produced, and the quality of the metal made was decidedly variable, and the production per week about 70 tuns. The pig-iron was then puddled entirely by hand, to make wrought iron, and the purified product rolled into merchant bars, not a rail having been rolled in the United States until 1843. Steel was only made by the old-fashioned processes, either slowly, and at great cost, or, if more quickly, of variable and inferior quality. The lines of demarcation between the only three forms of iron then recognized, cast-iron, wrought-iron, and steel, were strongly pronounced and definite.

It would be unfair not to mention the first use of the raw bituminous coal west of the Alleghenies, as the production of iron with this fuel will ultimately quite surpass in quantity that made with anthracite. David Himrod is said to have been the first to employ it, uncoked, in 1845, being driven by a strike of his workmen to either attempt this or blow out his furnace. He tried the raw coal, and with complete success, thereby opening the door to the manufacture in 1869 of 550,000 tuns of iron made with bituminous coal.

Since 1840, the blast has been gradually made hotter and hotter, and the means of economically and regularly giving the air a temperature of 1,000 or more degrees, have naturally attracted much attention, resulting in the patenting of

various stoves, of which Player's and Cowper's plans may be considered leading methods of accomplishing this end—Player's operating by burning the gas from the furnace in a separate combustion chamber, below the pipes, through which the cold air passes to be heated, and allowing only the heat to come in contact with these pipes, instead of permitting combustion to take place in the oven inclosing the pipes, as was the old plan, and the results have been very favorable, though it is fair to state that part of the gain from the use of Player's oven arises from the increased number, and somewhat changed shape of the pipes themselves.

Cowper's patent, said to be a revival of an old Scotch idea, is but little known, practically, in this country, though favorably used in England, and is founded on the Siemens' regenerative principle, a cellular mass of brick-work being first raised to a high heat, and this heat then imparted to the blast, which is made to pass through it, while a similar mass of brick-work is being heated, ready for use as soon as the first shall have become partially cooled. Whitwell's ovens, acting on the same principle, avoid some of the objections raised against Cowper's stove, the principal one being that it clogs readily with dust and is expensive to clean. This Whitwell obviates by making his brickwork into largish compartments instead of cellular. It is claimed that the blast can be heated to 1,800 degrees by this stove, and a regular working heat of 1,400 degrees be steadily maintained. To estimate properly the great importance of improved devices for heating the blast, it should be constantly remembered that for every tun of materials charged in at the tunnel-head at least three tuns weight of air is blown in at the bottom through the tweeres; and it requires but little further consideration to impress on any one the great difference that must be exerted upon the work of the furnace if this air is put into the furnace already heated, or is introduced cold, and the work of heating it thrown upon the fuel in the furnace, which should find abundant employment in smelting the ore only. There is also an unexplained advantage in the use of heated blast, it being a fact that, if the air supplied to a common laboratory blow-pipe be heated to say 500 degrees, many substances previously infusible by the common blow-pipe flame are readily melted. Why, is yet unknown.

The complete closing of the tops of furnaces is another great improvement with most ores; and, as a rule, whenever a flame is visible at the tunnel-head, we may be sure that a large waste is taking place. The best device yet arranged is what is known as the bell and hopper, or cup and cone, which consists of an inverted truncated hollow cone of cast-iron, the cup or hopper filling the throat closely at the top, but considerably smaller at the lower end than at the throat. In this is suspended a cast-iron cone, by a chain attached to its apex, and so arranged as to be raised or lowered at pleasure; its largest circumference being larger than the downward end of the cup, closes the top of the furnace completely, when raised against the cup, and, when lowered, leaves an opening of several inches all around it. Through this the furnace is charged, and as each charge passes through, it is immediately closed by raising the cone, and kept shut until time to admit another charge. The furnace gases, prevented by the tightly-closed cup from passing out of the furnace-top, and collected in the open space around its lower end, pass out to the hot blast rooms, boilers, and wasting-kilns, through proper flues. The principal object of the closed top is that all the gases may be secured for use; but it has other incidental advantages, the cone distributing the raw materials much more evenly than practicable with simply a large hole in which to dump them, while the ability to close or open the throat assists in the general control of furnace action. An excellent English authority says that 600,000 tuns of coal are saved in their Cleveland District alone, per annum, by the use of closed tops.

Passing at once from the top to the bottom of the furnace, we find an attempted improvement, not yet generally introduced, in Lurman's closed hearth. This plan builds up the hearth in a complete circle, leaving only a small hole at the bottom for the iron to run out, and, where the cinder notch usually is, a tweer, one and one-half inches in diameter, is inserted, through which the slag runs off as fast as formed. The advantages claimed, and, in some places where this hearth is introduced, fully realized, are a hotter hearth, there being no heat wasted to keep up the temperature in the useless channel between the hearth and the dam; while the tweers, instead of blowing into the cinder, as is frequently the case, are inserted at a level of about nine inches above the slag outlet, so that the materials to be smelted have the full and uninterrupted effect of the blast; less time is required for casting, while the hearth is kept so hot as to have no tendency to "grow up," and, there being no fire-hearth, there is no crust to break up, thus saving much time; and, as the hearth has no opening through which the materials can blow out, a much higher pressure of blast may be maintained.

Quite in the region of theory, as yet, is the plan of Herr Schintz, of Strasbourg, a metallurgist who has made the action of blast furnaces a special study, and who has suggested innovations which have a plausible appearance of success. It is of course known that of all the atmospheric air blown into the furnace, whether hot or cold, a large proportion consists of nitrogen, which assists not at all in the combustion of fuel, and is of very doubtful utility, in any way, in the furnace, while it is certainly harmful in diluting the useful gases, and occupies a deal of space that could be much better employed, to say nothing of the fuel necessary for heating the nitrogen, along with the hydrogen, in common air. Herr Schintz's theory has for its object the elimination of part of the great surplus of nitrogen by working the furnace partially with solid fuel, in the ordinary way, and partly with carbonic oxide, manufactured in separate generators and forced into the furnace through separate tweers with ordinary blast. It is applicable, as far as developed, only to hot-blast furnaces, and the details are too long to find a place in this paper, but the plan is worthy the intelligent consideration of iron-masters, being theoretically correctly founded.

THE FURNACES OF TO-DAY.

The size and shape of the furnace have gradually undergone great changes, the whole interior having been originally square in horizontal section, and the hearth was made square, or a parallelogram, long after the upper portion of the furnace became circular. When the interior was square, the exterior was naturally so, and was generally formed of stone masonry, heavy and massive, but the heavy masonry seems to have no special advantages beyond making a picturesque ruin when abandoned, and the later furnaces, in England and our own Western States, are of what is called the cupola style, the heavy masses of stone at the corners having given place to simple iron columns, supporting a large iron ring, on which is built the stack, the exterior of the fire-brick, which forms the hearth, being open all around, and the stack itself consisting of the fire-brick lining, with a course or two of red brick external to it, and surrounded by boiler plate securely riveted together, the whole looking not unlike a brewer's huge vat, standing on four legs. The vertical section of the interior varies with the fuel and ores to be employed, and somewhat, also, according to local fashion; the precise shape, in any locality, is best attained by careful observation of the furnace, when blown out. The constant tendency of the best English practice has been to enlarge the hearth, and with beneficial results, though on the continent of Europe, generally, the small hearths are still adhered to. The throat has also been much enlarged from the size common thirty years ago, and the proportionate hight of the furnace also increased, where the fuel is strong enough to bear it without danger of being crushed by the increased weight of the larger mass of ore, or the pieces of the crude materials so fine as to obstruct the blast, both which changes have unquestionably much increased the economy of fuel.

Now, then, after a lapse of thirty years—since 1840—a combination of the various changes and improvements gives furnaces of 27 feet bosh and 105 feet high; a blast heated at will to 1,400 degrees, blown, with a pressure of from five to seven pounds per square inch, into the upper portion of a roomy, circular hearth, tightly closed except the absolutely necessary apertures to permit the egress of scoriæ and metal, and after supporting combustion, which must produce a heat of at least 3,000 degrees, and mingling with and partially forming the gases evolved, reaches the tunnel-head at a temperature of about 500 degrees, and there, finding the throat entirely closed, is compelled to seek its exit through side flues, and do still further service—after being mixed with atmospheric air—in heating a fresh supply of air, or generating steam to force it, in its turn, through the same route; the result being a production at a single furnace of 700 tuns per week, or from one stack, in 1870, more than double the quantity all Great Britain made in 1740, and made by the use of less than a tun of fuel per tun of iron.

The total quantity of pig-iron made in the United States in 1869 had a greater value, in this crude state, at average prices, than all the gold and silver produced in our country, by some $5,000,000. Throughout Europe, the advance in iron metallurgy has been scarcely less marked than here and in England.

	Tuns.		Tuns.
In 1845, France produced.....	449,000	In 1845, Belgium produced....	150,000
In 1869, France produced.....	1,380,000	In 1869, Belgium produced.....	363,000
In 1845, Germany produced..	180,000	In 1845, Austria produced.....	175,000
In 1869, Germany produced..	1,220,000	In 1869, Austria produced.....	205,000

The total quantity of iron made in the world in 1869 varied but little from 11,700,000 tuns.

The Poetry of Mechanism.

Hon. S. S. Cox, of this city, recently gave a lecture upon the above topic at Steinway Hall, under the direction of the General Society of Mechanics and Tradesmen. He said that at first thought poetry might seem the antipodes of mechanics, but on further examination there would be found a perfect accord between the two, and that in all mechanism there was poetry in the highest sense of the term. The poet was lifted up by the vigor of his own invention, and was at once the greatest of inventors and yet the least of liars. But in all the poems which have ever been written there is no such poetry as sings in most of the woudrous pieces of mechanism with which the world is acquainted.

There was a true poetry in the natural mechanism of the universe, a rhythm and meter in all the great works of the Creator—in sun and stars, in rock and wood, in river and mountain; all had a poetry of their own, to which the sweetest written songs were tame. He would divide his subject into two parts: first, the elemental harmony—a mechanism not made by man; and secondly, the poetry of the mechanism of actual forms of forces of matter. He then dwelt at length upon the harmony of nature, each element of which, considered either separately or in its relations to the great whole, was full of poetic fervor; and then passing to the second branch of his subject, he took up the inventions of most of the master mechanical minds known to the world, showing their inception to have sprung from true poetic invention of the mind.

Yet with all his inventive power man could not originate; only God could furnish the power, and man could use it. If man could generate the power all machines would begin of themselves, and perpetual motion would be possible, but that could never be without violating a universal law, and all power must be drawn from the source of power, the God of nature. The lecturer then called the attention of his audience to some of the most wonderful of the inventions of the world—the distaff replaced by the spinning-wheel, and that in turn by the jenny, the introduction of steam as applied to machinery, the locomotive, the power loom, the printing press, the telegraph, and many others.

The poetry of iron, he said, was, above all, the poetry of the world; and if iron was taken away, the world would lapse into barbarism. And next to the iron itself were the men who worked it. In the olden times the first in importance among the captures of conquerors were the anvils of the opposing nation, and in all ages the smiths have played a conspicuous part.

The Americans, he said, were an inventive race, and their poetic fervor showed itself in this way: they would have made more verses if they had not taken out so many patents. He then spoke of the wondrous mechanism of the human which was the most wonderful of all machines, and in every part of it there was the true poetry of motion and harmony of design. Mr. Cox concluded his lecture with the assertion that the mechanism of the universe, by reason of its compensations, would endure forever.

"Fusee Satan."

M. Laurent, the distinguished civil engineer and chemist of the rue de Londres, Paris, has invented a rocket which will be a formidable engine of defense. He has christened it the fusee Satan. To the end of an ordinary rocket is attached a very slight receptacle of tin, having exactly the shape of a conical bullet. In this receptacle is arranged a chamber filled with a composition based, we believe, upon sulphuret of carbon, which composition, once lighted, gives out considerable heat. A fusee communicates from this chamber with the top of the rocket. The tin bullet is filled, just before being used, with petroleum oil. The lighted rocket rises in the air and traverses the space necessary to arrive over a certain spot. Arrived above its object, the rocket sets fire to the fusee, the composition in the chamber of the bullet takes light, bursts its envelope, and at the same time fires the petroleum, which falls like a sheet of flame and continues burning. This sheet of flame fills a space of sixteen to twenty-four square meters, according to the size of the rocket. No. 1 throws one liter of petroleum, No. 2 two liters, and No. 3 three liters. They can be thrown a distance of six kilometers, and aimed with great precision, being balanced by means of a long stick attached to each rocket, which maintains the elevation given to it at the time of discharge. Some interesting experiments were made recently with this weapon at St. Cloud. In less than ten minutes a considerable space of ground was covered with a sea of fire. A committee, composed of superior officers of artillery, presided over the experiments, and the general at their head was appalled by the terrible nature of this engine of destruction.

Just imagine this sea of fire falling upon the Prussian masses, burning everything, setting light to the cartridges in the soldiers' pouches and to the ammunition vans of the artillery. The committee, in its report, says the journal *La Presse*, has declared in its opinion no civilized nation could make use of these rockets except for reprisals; and it would be only in case of the Prussians firing upon us with petroleum bombs; such as they used at Strasbourg, that we should be entitled to retaliate with the new rocket. However this may be, the Committee of National Defense has given the inventor a large building on the Batignolle (formerly a girls' school), and has ordered the immediate manufacture, on a large scale, of Satan rockets. From day to day 200 workmen will be actively employed, and within a few days they will have a sufficient stock to enable them to repay the Prussians in their own coin, if, as at Strasbourg, they make use of unlawful weapons.

Mental Taxation a Cause of Dyspepsia.

Mental anxiety and pecuniary embarrassments, such as loss of property by fire, by failure in business, or by bad debts, and also domestic troubles, disappointed affections, and the loss, or the treachery, of friends, will frequently cause dyspepsia; too close, and too active intellectual labor is also a frequent cause. Editors, authors, and literary persons often engender dyspepsia in this way.

Much brain labor requires much blood at the brain, and an ever-working intellect uses up so much of both blood and nervous force that there is not enough remaining to do the work of digestion.

On the other hand, deranged digestion is sometimes produced by too little exercise of the brain. Persons are frequently met with who have been in active business life, and, having accumulated enough to satisfy their ambition, have retired from business. Now although the brains and bodies retire from active life, yet the poor stomachs very often have their tasks increased. If a man has been for a long time accustomed to eating heartily and working hard, either with body or brain, he had better not relax his working habits without at the same time having a corresponding relaxation in his habits of eating. "He who will not work neither shall he eat," is not only a Bible injunction, but a law of the human constitution, the disobedience of which is often attended with such derangements of digestion, and other bodily infirmities, as to render either property or life of but little value.—*Dr. Miller on Dyspepsia.*

SEVERAL of the eyeless fish of the Mammoth Cave of Kentucky have been presented to the Dublin Zoological Gardens. They were caught on the 18th of August, in Echo river, four miles and a half from the sole entrance to the cave. During their month's residence in light some trace of eye has been developed.

Improved Hand-Washing Device.

The annexed engraving represents a simple and useful device for the purpose of washing the hand and arm of those who have been unfortunate enough to lose one of these most important members. Of all inconveniences to which a one-armed man is subject, none is so great as that of the washing of his remaining hand, which, in fact, is considered an impossibility without the aid of some device. The convenient contrivance shown in our engraving has been long used by the inventor (a one-armed man), who recommends it to like unfortunates. It is simple in construction and not liable to get out of order, and may be applied to either washstand or basin as desired.

Fig. 1 represents a perspective view of the device with the sponge removed from the plate, F, and Fig. 2 is a front view of the same.

A sponge or other suitable material is fixed to the upper surface of the frame which slides in grooves on the upper surface of a bed-plate, the latter being attached to the side of a washstand or other fixture. The implement is affixed in an inclined position, so as to let the water expressed from the sponge to run off through a chamber in the bed-plate.

A designates the bed-plate. It consists of a curved plate, from one of whose sides depends an ear, C, which receives a clamping screw, D. The bottom of the bed-plate has two studs, B B, separated a little distance from each other, and standing far enough behind the pendent ear to permit the edge of a washstand, G, to come between them, as shown in Fig. 2.

The bed-plate, A, is curved in cross section, and its upper face is depressed throughout its whole length to receive the perforated sliding plate or frame, F. The sides are made tapering so as to form a dovetail connection with the bed-plate, A. The perforations of the plate, F, serve a two-fold use: first, to allow a sponge, E, to be fastened by strings or wire through said perforations; and, secondly, to permit water from the sponge to run through to the surface of the bed-plate, A, and discharge into the basin.

If it is desired to use the washing surface of the apparatus after the manner of a wash cloth, water and soap are applied to the sponge, E, then remove the frame or plate, F, containing the sponge, from the bed-plate, and hold it in the hand with the lower side of the plate next to the palm. In this position the sponge can be used to wash the different parts of the body.

The bottom of the bed-plate is solid and any water which comes from the sponge is conveyed off in the channel in the bed-plate.

Patented, through the Scientific American Patent Agency, July 4, 1865. For further particulars address the inventor, Gustave Dieterich, Box 773, New York City.

FIG. 1.

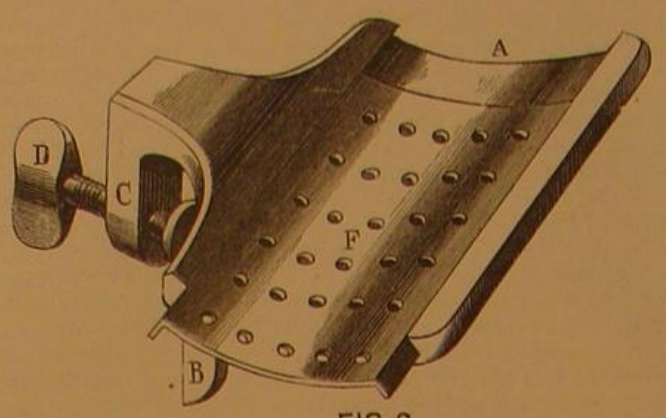
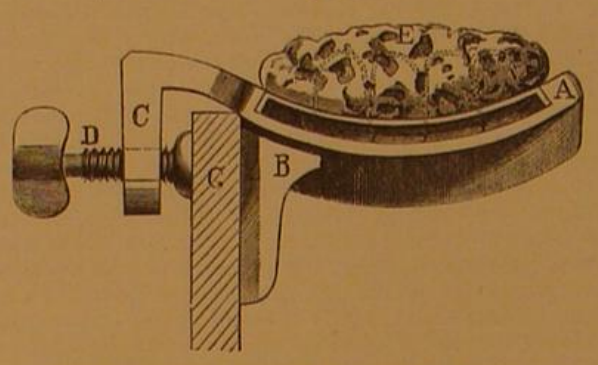


FIG. 2.



DIETERICH'S HAND-WASHING DEVICE.

Securing Pulleys, Gear Wheels, Etc., to Hollow or Solid Shafting.

When the common taper key, or the set screw, is employed to secure pulleys to shafting, only two points of bearing on the shaft are made. The use of either of these devices on a hollow shaft has a tendency to collapse or indent it, and renders a better device for this purpose a desideratum, which it is the object of the invention shown in the accompanying engraving to supply, and also to furnish a fastening by the use of which the pulley shall not be forced out of its concentric posititon whether the shaft be hollow or solid.

The device consists in slotting the hubs of the pulleys, and clamping the parts thus slotted by rings to the shaft. The details of the method will be readily understood in reference to the engravings; Fig. 1 being a perspective view of a pulley with one of the rings detached; Fig. 2 an axial section with both rings in place, and Fig. 3 a perspective view of the pulley in position on the shaft, and also showing the extension of the principle to pulley coupling.

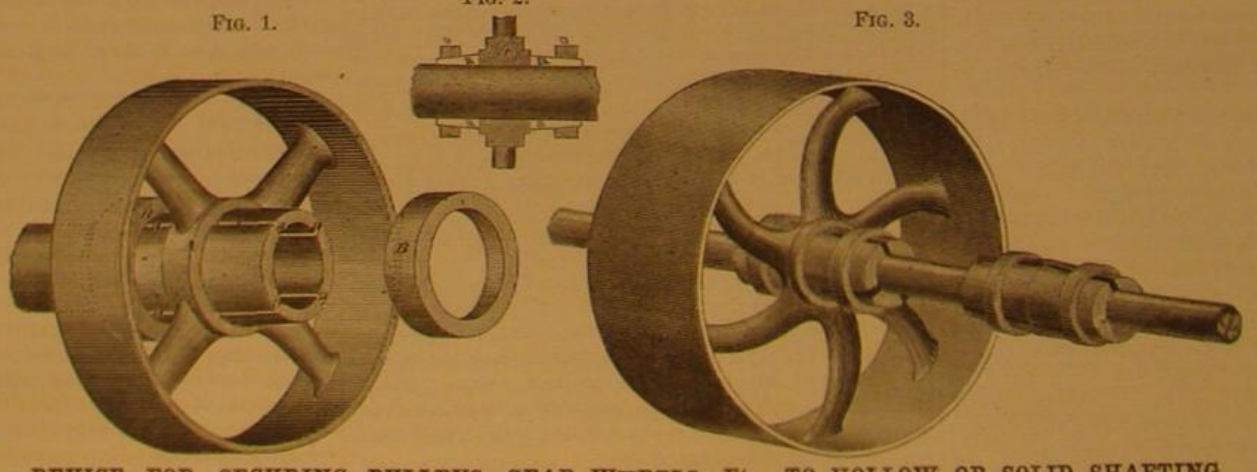
The hub, A, is made tapering at both ends, and the slots, *a*, are cast in the hubs. The rings, B, are formed on a mandrel to the proper taper—five eighths of an inch—and driven on to the hub, as shown, the hub being turned to fit the rings. The driving on of the rings causes the slotted parts of the hub to rigorously embrace the shaft, and thereby secure the pulley by a uniform pressure on all sides of the bearing.

For shop rights or royalty, or for any further information, address the manufacturers, Reinshagen & Buckman, Queen City Machine Works, No. 87 Eighth street, Cincinnati, Ohio.

FIG. 1.

FIG. 2.

FIG. 3.



DEVICE FOR SECURING PULLEYS, GEAR WHEELS Etc., TO HOLLOW OR SOLID SHAFTING.

Proposed Iron Bridge over the Housatonic River.

The New York and New Haven Railroad Company will soon commence the construction of a handsome iron truss bridge of great strength over the Housatonic river, about five miles east of Bridgeport. Its entire length will be 1,091 feet, consisting of two stationary spans of 190 feet each, three stationary spans of 168 feet 4 inches long each, and a draw or swing span 206 feet long. The piers will be built of stone, and of such a form as will be best calculated to resist large masses of floating ice, when it breaks up and floats down the river during the spring freshets. When the draw shall be opened, there will be a clear space on each side of eighty-five feet for the passage of vessels. The iron girders, one on each side, will be twenty-two feet high, and sufficiently wide apart for two tracks, with a space of six feet in the clear between them. The columns, girders, and beams are to be of cast iron. The wrought iron work is to be capable of withstanding a tension strain of not less than 60,000 pounds to the inch without breaking. The floor beams are to consist of two heavy Phœnix I-beams properly trussed.

It is agreed on the part of the contractor, that it shall not require more than two men to open or close the draw with ease inside of two minutes, and in case it shall be found on completion that more than two men shall be necessary to perform the work of opening or closing the draw in the time prescribed, a stationary steam engine is to be provided for the motive power to turn it, and the turn-table is to be so constructed that in case any part thereof liable to break or wear out by ordinary use of the draw, may be replaced without interrupting the use of the swing span.

The bridge, when entirely finished and declared ready for the passage of trains over it, is to be subjected to a load of 5,000 pounds per lineal foot, without deflecting in any part more than one inch on any of the spans, and when removed all parts of the bridge to resume their original position, and no greater deflection is to occur to any part of the bridge while a train is passing over it. The company reserves the right to select at random pieces of wrought iron from each of the sizes and forms used in the construction of the bridge, and subject the same to a test strain of 60,000 lbs. per sectional inch.

The bridge will form a straight line across the river and level grade. It will be constructed on the north side of the present railroad bridge, and as near as it can be without the work being interfered with.

The cost of the iron superstructure will be $140,000. Including the piers and approaches, the cost of the bridge is estimated at something over $300,000. The bridge, with the exception of the draw span, is to be completed by the end of October, 1871, and the swing span is to be finished within one month after the close of navigation next year.

We are glad to report the progress of these substantial railroad improvements.

Manufacture of Paper.

The offer of a reward by the Mulhausen Society of Industry for the best treatise on the manufacture of paper and choice of paper stock has secured a highly valuable contribution from Mr. O'Reilly, in which he remarks that it is gratifying to see that in the manufacture of paper, as well as in all other arts, there has been great progress during the last hundred years. Chemistry and mechanics have each contributed their part. The former has afforded us improved methods for washing, bleaching, blueing, and coloring the stock, which must yield a different product from what was made by the ancients The mechanical improvements have been many, and tend to facilitate and cheapen the manufacture of paper. The use of ultramarine, which at one time was almost as valuable as gold dust, is a contribution from chemistry that the most sanguine believer in the progress of science could not have foretold. To see the beautiful blue color that Raphael so highly prized now made so cheaply as to be available in every laundry and in extensive manufactures, is one of the triumphs of modern science.

The same science that has given us our color has also taught us that the cellulose of all plants is the same as that contained in rags; and, in fact, the fiber of some plants will give us a paper that cannot be made from rags.

Not all plants, however, are adapted to the making of paper. Much depends upon the bark, membrane, and fiber, and there is a difference in the purity of the cellulose in various plants. The chemical tests also show a modification in the fiber of plants. The cellulose of cotton yields a blue color immediately with tincture of iodine; that of flax does not turn blue until an acid has been added, and hemp requires both acid and considerable time before the blue color makes its appearance. These reactions point to the presence and absence of starch and glucose in different species of plants.

Chemically pure cellulose is perfectly white, more or less translucent elastic with a mean specific gravity of 1·5. It is insoluble in water, alcohol, ether, and volatile and fixed oils. It is unchangeable in dry air, but when moist it becomes yellow; in consequence of the formation of ulmic acid. In the sunlight moist cellulose suffers changes that have not been fully explained, and these alterations are modified and retarded by coloring or any organic matter. The action of acids upon cellulose is full of interest. Sulphuric acid changes it into a species of parchment, and if the action of the acid be permitted to go on for some time, the cellulose is transformed into starch, dextrine, and glucose. Very concentrated sulphuric acid chars paper and converts it into ulmic acid. Nitric acid has violent action upon cellulose, and changes it into explosive compounds, and longer contact converts it into oxalic acid. Hydrochloric acid dissolves cellulose in small quantities.

A mixture composed of 80 per cent hydrochloric acid and 20 per cent nitric acid has been shown, after a great number of experiments, to be the best adapted for the disintegration of woody fiber. In twenty-four hours it converts the cellulose of wood into a spongy, soft mass, that can be easily separated by the fingers. The color is not changed, and all of the incrusting and foreign matter of the wood is destroyed.

As the result of his experiments he concludes that woody fiber, treated as above, afterwards carefully washed, pressed in a mortar again washed and neutralized with a 10 per cent soda lye, bleached with a 10 per cent chloride of lime bath, would yield long, soft, strong, silky fiber for the manufacture of paper. But notwithstanding the success of the experiment in a small way, all attempts to apply it on a large scale have proved unsuccessful. The wood was mixed with the *aqua regia* in large stone reservoirs, and it was found to be impossible to prevent leakage; then arose the difficulty with the red fumes of nitrous acid that produced a most deleterious effect upon the workmen. After the wood is disintegrated it must be hastily washed or the acid would wholly destroy it, and there was difficulty in performing this operation, as the acid would attack iron rapidly and thus introduce chloride of iron into the stock, which would certainly ruin it for the manufacture of paper. There was also a great loss of soda growing out of the neutralization of the pulp after it had been disintegrated.

With regard to boilers, he prefers those with double bottoms to any other invention for preparing the stock, and he lays much stress upon the gradual increase and decrease of the temperature. He also gives an account of the successful employment of ammonia water in the treatment of certain kinds of fiber. In reference to the various ways of bleaching the pulp preference is given to the employment of the chlorine gas and of hypochlorites. If the hypochlorite of alumina were a salt that could be made in sufficient quantity and at a reasonable cost, it would be better than any other as a bleaching agent, but under the circumstances its use must now be confined to a superior quality of paper where the cost

is of less importance. Bleaching by chloride of lime appears to have been universally adopted, although of late years much has been said about the use of permanganic acid as in every way preferable.

PERPETUAL MOTION.

NUMBER I.

The search after "perpetual motion"—so called—through centuries of vain effort have brought only failure, still captivates those who believe in the possibility of such a machine, exacting time and money from its votaries. To the end that it may be seen how hopeless are all such efforts, and that inventive genius may be turned into more profitable channels, we have decided upon publishing the present series of articles.

It is not designed to make these papers a connected history of the numerous attempts which have been made at solving this problem. Our object will be principally to place before our readers some of the most plausible devices that have deceived people into waste of time and money, that others may shun these false paths; for it is noteworthy that not one of the devices which have been brought to our notice by modern inventors, in the course of our long and large practice as patent solicitors, has not had its prototype in some invention that preceded it. "There is nothing new under the sun," said Solomon the wise, and certainly so far as "perpetual motion" machines are concerned, Solomon was right.

Many people are not very clear in their ideas of what is meant by "perpetual motion," and the term itself is one of those unfortunate ones calculated to mislead those who do not use language critically.

The perpetual motion so long sought by inventors is not something that moves or will continue to move forever, or that will move till it wears out. A water wheel placed on a never-failing stream, is a perpetual motion, if this be the true meaning of the term. Neither is it a machine that once set in motion by an external force, will retain its motion forever, or until it is stopped by the action of another external force, though even such a machine has never been constructed by human hands. A wheel armature suspended from a magnet having just power enough to keep it from falling, and placed in vacuo, is probably the nearest approach to such a machine ever attained by mortals. The pendulum hung on knife-edges in vacuo will retain its motion nearly as long. Theoretically, if we can eliminate from any moving body all resistances, it would never cease moving and would become literally a perpetual motion, though not the thing sought. The motions of the tides, the rotation of the earth, and the motions of the heavenly bodies, will continue for ages, but of these there is not one of which an astronomer would dare to predict that it will never cease.

So far as we can see, there is no single motion in nature that can be called perpetual, though change is perpetual, and motion somewhere, either of molecules or masses, must, according to the conclusions of modern science, always exist. Such can be the only conclusion drawn from the doctrine of the "conservation of force," of which the great Faraday said that it is the highest physical law of which the human mind can form any conception.

The perpetual motion of which visionaries have dreamed, and for which enthusiasts have labored, is a machine that will, under ordinary circumstances, start itself and increase its motion till it reaches a maximum, overcoming the resistances of air and friction, and possessing a surplus of motion to spare for the impulsion of other machines not self-moving. That there may be no mistake, in terms, let us adopt the name of "self-mover" for this supposed desideratum. It is not a new term, but is the only one that does not mislead thought in the consideration of the subject. Of the term "perpetual motion" Prof. Nichol, in his "Physical Sciences," says:

"If this famous appellation had simply meant perpetuity or indestructibility of force, it would have stood for an important and undeniable truth. No force is lost in the Universe; we never discern the loss, but only the conversion of force, *e. g.*, when a machine is brought to a stand through friction, all that has occurred is—the force applied to move the machine, has—through the resistance we call friction—been converted into a mechanical equivalent of heat; and this heat, by communication and radiation, is in existence playing its equivalent mechanical part. But this is not the common or practical conception attached to the term perpetual motion. It has ever signified as follows:—a machine, whose characteristic is, that the initial or primary force shall be restored or replaced by the very movement it produces. Now, setting aside the fact, that, in every machine of earthly materials, part of the initial force must ever be converted into heat and dissipated through effect of friction, it is clear that, were such a machine consummated, the effect would be not motion, but equilibrium or rest. A machine is a mere medium of connection between power at one end, and effect at the other; and were these two equal, the machine would simply stand still. The negation of the possibility of perpetual motion may therefore be accepted as an axiom in mechanical science. Mr. Grove has recently shown, in a most ingenious essay read before the Royal Institution of London, that important uses may be made of this axiom as an aid in scientific research. He has illustrated, by many important instances, that, considered as a test, it might enable us to discern in any experiment, to what degree of approximation we have obtained, from any given natural force, the total quantity of power it is capable of affording; and that it might also serve, on the discovery of any new phenomenon, to show, up to what point that phenomenon might be put in relation with phenomena formerly known."

From what we have said it will be inferred that we believe a self-moving machine to be an impossibility; but while we entertain this view, we do not forget that many able minds have held an opposite opinion, and that it has been even claimed that in two instances such machines have been actually constructed. These instances will receive notice in their proper place hereafter. We do not, then, "sit in the seat of the scornful," in regard to those who have attempted to reach the goal which has by its delusive promises led many an unfortunate inventor on to his ruin. Nor will we dogmatically assert that our opinions are infallible. All we say is, that we believe those opinions founded on sound scientific principles, and that whoever tries to produce a self-mover, is wasting his time, money, and powers, to no purpose.

John Wilkins, the Bishop of Chester, who died in 1672, and who, during his life, wrote upon the subject, classes the means employed to reach the desired object, under these heads:

1. By Chymical Extractions.
2. By Magnetical Virtues.
3. By the Natural Affection of Gravity.

He says:

"The discovery of this hath been attempted by Chymistry. Paracelsus and his followers have bragged, that by their separations and extractions they can make a little world which shall have the same perpetual motions with this microcosm, with the representation of all meteors, thunder, snow, rain, the courses of the sea in its ebbs and flows, and the like. But these miraculous promises would require as great a faith to believe them, as a power to perform them; and tho' they often talk of such great matters,— * * * yet we can never see them confirmed by any real experiment; and then, besides, every particular author in that art hath such a distinct language of his own (all of them being so full of allegories and affected obscurities), that 'tis very hard for any one (unless he be throughly versed amongst them) to find out what they mean, much more to try it.

"One of these ways (as I find it set down) is this:—Mix five ounces of ☿ with an equal weight of ♄; grind them together with ten ounces of sublimate; dissolve them in a cellar upon some marble for the space of four days, till they become like oil olive; distil this with fire of chaff, or driving fire, and it will sublime into a dry substance; and so, by repeating of these dissolvings and distillings, there will be at length produced divers small atoms, which, being put into a glass well luted, and kept dry, will have a perpetual motion.

"I cannot say anything from experience against this; but methinks it does not seem very probable, because things that are forced up to such a vigorousness and activity as these ingredients seem to be by their frequent sublimings and distillings, are not likely to be of any duration. The more any thing is stretched beyond its usual nature, the less does it last; violence and perpetuity being no companions. And then, besides, suppose it true, yet such a motion could not well be applied to any use, which will needs take much from the delight of it."

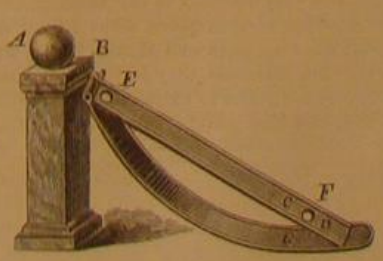
This example is enough, we think, to satisfy our readers of the absurd character of the attempts to obtain a self-mover by "chymical extractions," and though chemistry has advanced to the front rank of sciences since that time, any attempt to get a perpetual motion through its aid would be even more absurd to-day than in Wilkins' time, since it is, in a great measure, through the aid of this science that molecular physics has advanced to the knowledge of the "conservation of force."

The second class of means, viz: by "Magnetic virtues," is exemplified by a device of which we give herewith an engraving. Fig. 1.

Of this, and similar attempts, our author says:

"But amongst all these kinds of inventions, that is most likely, wherein a loadstone is so disposed that it shall draw unto it on a reclined plane a bullet of steel, which steel, as it ascends near to the loadstone, may be contrived to fall down through some hole in the plane, and so to return unto the place from whence at first it began to move; and, being there, the loadstone will again attract it upwards till coming to this hole, it will fall down again; and so the motion shall be perpetual, as may be more easily conceivable by this figure:

FIG. 1.



"Suppose the loadstone to be represented at A B, which, though it have not strength enough to attract the bullet C directly from the ground, yet may do it by the help of the plane, E F. Now, when the bullet is come to the top of this plane, its own gravity (which is supposed to exceed the strength of the loadstone) will make it fall into that hole at E; and the force it receives in this fall will carry it with such a violence unto the other end of this arch, that it will open the passage which is there made for it, and by its return will again shut it; so that the bullet (as at the first) is in the same place whence it was attracted, and, consequently, must move perpetually."

But however this invention may seem to be of such strong probability, yet there are sundry particulars which may prove it insufficient: for—

"This bullet of steel must first be touched, and have its several poles, or else there can be little or no attraction of it. Suppose C in the steel to be answerable unto A in the stone, and to B; in the attraction C D must always be directed answerable to A B, and so the motion will be more difficult; by reason there can be no rotation or turning round of the bullet, but it must slide up with the line, C D, answerable to the axis, A B.

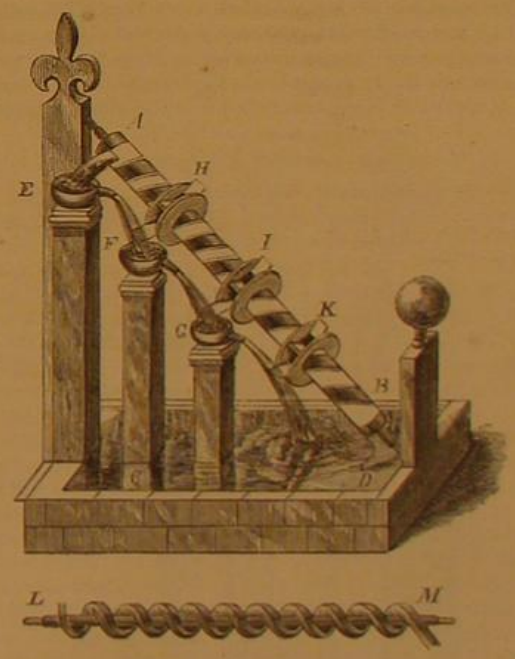
"In its fall from E to G, which is *motus elementaris*, and proceeds from its gravity, there must needs be a rotation of it; and so 'tis odds but it happens wrong in the rise, the poles in the bullet being not in the same direction to those in the magnet; and if in this reflux it should so fall out, that D should be directed towards B, there should be rather a flight than an attraction, since those two ends do repel, and not draw one another.

"If the loadstone A B have so much strength, that it can attract the bullet in F, when it is not turned round, but does only slide upon the plane, whereas its own gravity would rowl it downwards; then it is evident the sphere of its activity and strength would be so increased when it approaches much nearer, that it would not need the assistance of the plane, but would draw it immediately to itself without that help; and so the bullet would not fall down through the hole, but ascend to the stone, and, consequently, cease its motion: for, if the loadstone be of force enough to draw the bullet on the plane, at the distance F B, then must the strength of it be sufficient to attract it immediately unto itself when it is so much nearer as E B. And if the gravity of the bullet be supposed so much to exceed the strength of the magnet, that it cannot draw it directly when it is so near, then will it not be able to attract the bullet up the plane, when it is so much further off.

"So that none of all these magnetical experiments, which have been as yet discovered, are sufficient for the effecting of a perpetual motion, though these kind of qualities seem most conducible unto it; and perhaps, hereafter, it may be contrived from them."

From among many devices under the third class, we select the one shown in Fig. 2, whereby the desired motion is sought through the action of fluid weights:

FIG. 2.



"Where the figure L M, at the bottom, does represent a wooden cylinder with helical cavities cut in it, which at A B is supposed to be covered over with tin plates, and three water-wheels upon it, H I K; the lower cistern, which contains the water, being C D. Now, this cylinder being turned round, all the water which from the cistern ascends through it, will fall into the vessel at E, and from that vessel being conveyed upon the water-wheel H, shall consequently give a circular motion to the whole screw. Or, if this alone should be too weak for the turning of it, then the same water which falls from the wheel H, being received into the other vessel F, may from thence again descend on the wheel I, by which means the force of it will be doubled. And if this be yet unsufficient, then may the water which falls on the second wheel I, be received into the other vessel G, and from thence again descend on the third wheel at K; and so for as many other wheels as the instrument is capable of. So that, besides the greater distance of these three streams from the center or axis by which they are made so much heavier, and besides that the fall of this outward water is forcible and violent, whereas the ascent of that within is natural,—besides all this, there is thrice as much water to turn the screw as is carried up by it.

"But, on the other side, if all the water falling upon one wheel would be able to turn it round, then half of it would serve with two wheels, and the rest may be so disposed of in the fall as to serve unto some other useful delightful ends.

"When I first thought of this invention, I could scarce forbear, with Archimedes, to cry out *eureka, eureka*; it seeming so infallible a way for the effecting of a perpetual motion that nothing could be so much as probably objected against it; but, upon trial and experience, I find it altogether insufficient for any such purpose, and that for these two reasons:—

"1. The water that ascends will not make any considerable stream in the fall.

"2. This stream, tho' multiplied, will not be of force enough to turn about the screw.

"1. The water ascends gently, and by intermissions; but it falls continually, and with force; each of the three vessels being supposed full at the first, that so the weight of the water in them might add the greater strength and swiftness to the streams that descend from them. Now, this swiftness of motion will cause so great a difference betwixt them that one of these little streams may spend more water in the fall than a stream six times bigger in the ascent, tho' we should suppose both of them to be continuate; how much more, then, when as the ascending water is vented by fits and intermissions, every circumvolution voiding so much as is contained in one helix; and, in this particular, one that is not versed in these kind of experiments may be easily deceived.

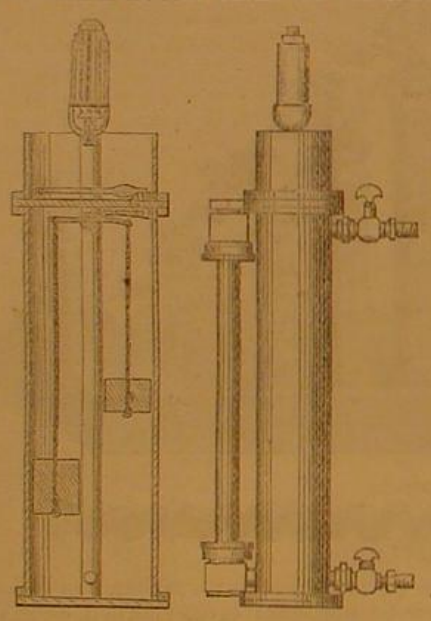
"But, secondly, tho' there were so great a disproportion, yet, notwithstanding, the force of these outward streams might well enough serve for the turning of the screw, if it were so that both its sides would equiponderate the water being in them (as Ubaldus hath affirmed). But now, upon farther examination, we shall find this assertion of his to be utterly against both reason and experience. And herein does consist the chief mistake of this contrivance; for the ascending side of the screw is made, by the water contained in it, so much heavier than the descending side, that these outward streams, thus applied, will not be of force enough to make them equiponderate, much less to move the whole."

HIGH AND LOW WATER ALARM FOR STEAM BOILERS.

This invention consists in the employment of weights, suspended in a cylinder, for the purpose of giving an alarm in the case of high or low water, or over-pressure of steam, and in the use of a hollow cap as a receptacle for the safety valve.

A double cylinder is connected by two cocks to the boiler; one half way above the water line, and the other the same distance below it. Two weights, which may be of stone, or any other suitable material, are suspended from the ends of a lever by cords or wire of unequal length. One of these weights should be greater by one third than the other, in weight. The object of this is that the large stone or weight, when immersed in water, shall weigh less by one third, or, more properly speaking, displace one third of its weight, so that the smaller weight will balance the larger.

The operation of this invention is as follows: The safety valve is first weighted to the pressure the boiler is to carry, say, sixty pounds. The water is then let in the machine until it submerges the large stone, when the small one will balance it. If the water in the boiler should fall to near the bottom



of the large stone, the difference in the weight, operating on a cam lever and a supplementary lever, will raise the safety valve, and admit the steam to the whistle. If water be again pumped into the boiler, and raised high enough to submerge both stones or weights, the gravity of the weights becomes relatively what it would be if both were out of the water, again raising the valve and giving the alarm, either of these causes being determined by inspecting the glass gage.

This invention was patented Feb. 11, 1868, by Joseph H. Springer, of Philadelphia, Pa.

Another Patent Agent in Trouble.

Commissioner Fisher, just previous to his retirement from the Patent Office, ordered the name of Otto Leissring, a patent agent doing business at Washington, to be stricken from the rolls of attorneys practicing before that Office. The "gross misconduct" of which Leissring is charged is that he fraudulently withheld moneys paid to him as final government fees upon allowed applications.

Lissring, in a letter to the Commissioner of Patents, dated October 27, 1870, acknowledges the error of his ways, and puts in the following somewhat novel defense:

"I herewith inclose affidavits to you of my not being able to appear before the office; and I must willingly acknowledge that I have erred in not paying my fees as I ought to have done.

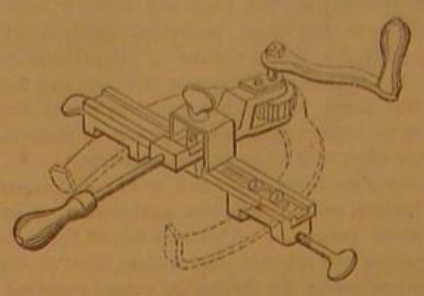
"The first time I took the fee that I ought to have paid in there was a telegraph from Green Bay, Wisconsin, stating my brother was dying and to come on immediately, and I started; which has been the principal cause of all my present trouble. My brother left over $60,000, and all of which will come to me, and I have had to go on there twice, which has cost me considerable; and I have expected to get $10,000, stated in the affidavit, long before this, but, on account of the war in Europe and sickness of my mother there, my papers were delayed, and they have only come to me within the past ten days, and I have sent them on to Wisconsin as stated in my affidavit, and I am expecting them back every day, and as soon as they return I will be in possession of $10,000, deposited in bank in this city for insurance on my brother's life.

"I will give you further information soon as I am able to appear before you."

DEVICE FOR SHARPENING HORSESHOE CALKS.

Our engraving shows a novel machine for sharpening horseshoe calks, while the shoe is secured to the horse's foot, thereby obviating the necessity for removing the shoe for that purpose. It consists in the employment of an adjustable clamp, adapted to be secured to the shoe, and armed with a rotary, circular, or cylindrical file. The device is the invention of John Johnson, of Barrington, New York, and was patented by him January 28, 1868. The rotary file is adjustable relative to its holding-clamp and the shoe in such a manner as to adapt it to operate upon the several calks without changing the position of the clamp.

In operation, the clamp-bar, with its swinging arm and



other appendages, is firmly clamped to the shoe. The operator then adjusts the swinging arm upon said bar, to bring it into the desired relation to the calk to be operated upon, when, seizing the handle, the desired pressure of the file against the calk may be given, while, at the same time, by vibrating the handle, the file is made to traverse back and forth over the calk, and the required rotation being given thereto through the crank, the calk is readily and rapidly filed away, until the desired degree of sharpness is secured.

Patents--No Examination.

The New York *Tribune*, in a recent editorial referring to patents and inventions, says our patent laws seem to need an amendment which will assimilate them, in an important respect, to the British. The Patent Office here, as there, should simply register claims to have made inventions or discoveries in their order, without undertaking to pronounce upon their novelty or value; and all questions thence arising should be taken directly to the courts, and there settled. This is the British rule on the subject, and it is much better than ours. Let the inventor make whatever claims he will, and let the courts determine their validity. Our laws give the Commissioner and his examiners entirely too much power—power which the best functionaries might abuse, through defect of information or error of judgment—which the worse certainly *do* and *will* use most unrighteously. Let them be cut down.

The prospectus of the Industrial Exhibition Company, now before the public, embodies a magnificent scheme. Four full blocks of ground for a site; a building eight stories high, and containing 2,844,000 square feet, or over six acres of floor room, to be filled with all manner of curious and instructive objects; eleven acres of glass-covered court, forming one vast hot house and garden; and an art gallery 3,760 feet or two thirds of a mile long and 150 feet wide; these are the prominent attractions promised, besides others of minor importance. The capital required is $2,000,000, and on this the estimates of the projectors show an expected net income of $6,291,000, or something over 300 per cent. Some of our most substantial citizens have taken hold of the speculation.

Spontaneous Combustion.—A correspondent from Bridgeport, Conn., states that recently in the establishment of the Winchester Arms Co. at that place, some rifling chips were taken from the draining pans and thrown in the scrap heap, when, in a very few moments, they burst into a fierce flame which required much water to extinguish. The rifling chips mentioned were fine steel shavings covered with oil.

An Invention Wanted.—An English cotemporary calls attention to the fact that the ordinary method of cleaning door steps, which requires the operator to kneel on the cold damp stones, gives rise to a disease familiar to hospital physicians, which it calls "*housemaid's knee*." It says some instrument for this purpose, which will not necessitate kneeling, is an invention much needed.

Gas Burners.—The streets of New York are lighted by 18 017 gas burners, owned by the different companies as follows: Manhattan, 7,084; New York, 3,241; Harlem, 4,000; Metropolitan, 3,692. Each burner consumes three feet of gas per hour, and burns 3,833 hours and 20 minutes per year. The price paid the companies is $53 per annum for each lamp. Each lamp-post cost the city $20, and each lamp $4·50 to construct. The number of feet of gas burned per annum by the city in lighting the streets is 134,360,483; the cost of material is $441,416·50; the annual cost of gas is $954,001. The Manhattan Co. has two hundred miles of main pipe; the New York, one hundred; the Metropolitan, ninety-five, and the Harlem, ninety-eight.

Correspondence.

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

Transferring Surface Lines in the Hoosac Tunnel.

Messrs. Editors:—In your issue of October 29 is an article on the Hoosac Tunnel and the difficulty involved in transferring the surface lines to the bottom of the shaft. If the transit is made with rings instead of plates, so as to permit an unobstructed view downwards, it certainly seems to me that the engineer, by the aid of a calcium or magnesium light, could fix as many points in the vertical plane as he desired, and with more accuracy than with plummets. Cross hairs are evidently most accurate.

It may not be practically possible to see down clearly a depth of 1,030 feet, but I have set points at night with a light at a greater distance than that on the surface. If it is practicable the engineer can constantly verify his work from the mouth of the shaft. C. E.

Keosauqua, Iowa.

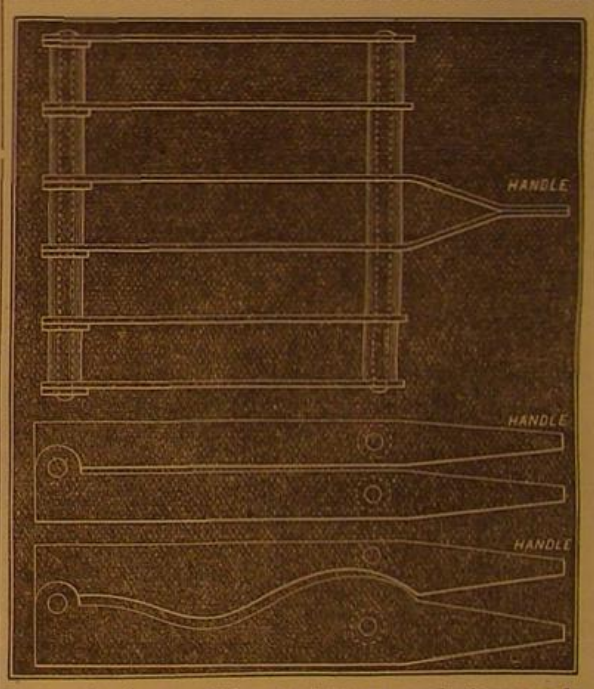
Don't Use Zinc and Lead Paints in Apple-Grinding Machines.

Messrs. Editors:—I have just received an apple-grinder from New York State, and when it arrived I found the inside was painted with a heavy coating of zinc white. Of course I procured some benzine and cleaned it; but, as many would use such a machine in just the condition received, I think some measures should be taken to prevent manufacturers from using such substances. Although zinc may not be as poisonous as lead, it is chemically foreign to the body, and injurious to the health. The same company of which I obtained the grinder advertises a feed-cutter in which the knives cut against strips of copper, which I think is a very objectionable feature. H. A. Sprague.

Charlotte, Maine.

Tempering Thin Steel Tools.

Messrs. Editors:—In answer to J. H. M., of N. Y., how to harden thin steel without springing, you will find inclosed a diagram of a machine made out of hoop iron, or better, old buck saws. A certain number of them put together, as shown, and riveted; the width and length must be made to answer the work which it is intended to hold



between its jaws. Either straight or curved pieces can be held nicely. The inside edges of the tongs or gridiron, or whatever name you may call it, should be filed sharp that the water or bath prepared will have full action on the surface of the articles hardened. I would recommend for hardening a bath as follows: Water at a temperature of from 30° to 40° F.; or better, a bath composed of sal ammoniac, spirits of niter, and white vitriol, each one ounce, alum two ounces, salt eight ounces, lard oil one pint, and water one gallon.

For mill picks, heat to a cherry red, cool quick, and draw no temper. For taps and dies, heat to a cherry red, and draw the temper till the shade is of a light blue color. For wood tools, draw till the shade is a copper color. For springs, heat to a black red, and draw till the shade is a dark blue color. For marble chisels the shade should be a light yellow.

Portland, Me. George Jones.

Severe, but Is It Just?

Messrs. Editors:—In the experience of a California miner, who emigrated to South Africa in search of diamonds, given in your issue of Nov. 12, occurs the following passage: "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," etc. Now, is not this a rather damaging accusation against the white blood? If "a little" will make a negro a thief, what must be the moral status of the full-blooded white man? This is severe, but I hardly think it just.

Cleveland, Ohio. J. W.

New Dress.—The next issue of the Scientific American will appear in new type, cast expressly for this paper by Farmer, Little & Co.

A monster gun of 35 tuns is being cast in Woolwich England. It will be rifled with nine grooves, and the ordinary cartridge will contain eighty pounds of powder.

SAMUEL F. B. MORSE.

BY JAMES PARTON.

During the voyage of the packet ship *Sully* from Havre to New York, in October, 1832, a conversation arose one day in the cabin upon electricity and magnetism. Dr. Charles S. Jackson, of Boston, described an experiment recently made in Paris with an electro-magnet, by means of which electricity had been transmitted through a great length of wire, arranged in circles around the walls of a large apartment. The transmission had been instantaneous, and it seemed as though the flight of electricity was too rapid to be measured. Among the group of passengers no one listened more attentively to Dr. Jackson's recital than a New York artist, named Samuel Finley Breece Morse, who was returning from a three years' residence in Europe, whither he had gone for improvement in his art.

Painter as he was he was nevertheless well versed in science, for which he had inherited an inclination. His father was that once famous geographer and doctor of divinity, of Charlestown, Massachusetts, whose large work upon geography was to be found, half a century ago, in almost every considerable collection of books in America. Besides assisting his father in his geographical studies, Samuel Morse had studied chemistry at Yale College under Professor Silliman, and natural philosophy under Professor Day. After graduating from Yale in 1810, he went with Washington Allston to London, where he received instruction in painting from Sir Benjamin West. Returning to the United States in 1815, he pursued his vocation with so much success that he was elected the first president of our National Academy, and held the office for sixteen years. In 1829 he went again to Europe for further improvement; and it was when returning from this visit that the conversation took place in the cabin of the *Sully*. During all the years of his artist life he had retained his early love for science, and usually kept himself well informed of its progress. Hence the eagerness with which he listened to Dr. Jackson's narrative.

"Why," said he, "when the doctor had finished, "if that is so, and the presence of electricity could be made visible in any desired part of the circuit, I see no reason why intelligence might not be transmitted instantaneously by electricity."

"How convenient it would be," added one of the passengers, "if we could send news in that manner."

"Why can't we?" asked Morse, fascinated by the idea.

From that hour the subject occupied his thoughts, and he began forthwith to exercise his Yankee ingenuity in devising the requisite apparatus. Voyages were long in those days, and he had nothing to do but meditate and contrive. Before the *Sully* dropped her anchor in New York harbor he had invented and put upon paper, in drawings and explanatory words, the chief features of the apparatus employed, to this hour, by far the greater number of the telegraphic lines throughout the world.

The system of dots and marks, the narrow ribbon of paper upon a revolving block, and a mode of burying the wires in the earth after inclosing them in tubes, all were thought of and recorded on board the packet ship. The invention, in fact, so far as the theory and the essential devices were concerned, except alone the idea of suspending the wires upon posts, was completed on board the vessel. A few days after landing, the plan, now universally adopted, of supporting the wires was thought of by the inventor, though he still preferred his original conception of the buried tubes.

The reader, of course, is aware that the mere idea of transmitting intelligence by electricity was not original with Samuel Morse. From the time when Dr. Franklin and his friends stretched a wire across the Schuylkill river, and killed a turkey for their dinner by a shock from an electrical machine on the other side of the stream, the notion had existed of using the marvelous fluid for transmitting intelligence; and long before the *Sully* was launched some attempts had been made in this direction which were not wholly unsuccessful. Science had done her part. It remained for the inventor to devise an apparatus which would utilize scientific truth, and Samuel Morse was the individual.

An artist arriving at home after a three year's residence in foreign countries is not apt to be furnished with a great abundance of cash capital; nor is he usually able to spend any more time in unproductive industry. Three years passed before Mr. Morse had set up his rude apparatus of half a mile of wire and a wooden clock, adapted to the purpose by his own hands, and sent a message from one end of his wire to the other, legible at least by himself. He used to exhibit his apparatus now and then to his friends, and he spent all the time he could spare from his profession in perfecting it. For some time it was placed in a large room of the New York University, where, in the fall of 1837, large numbers of persons witnessed its operation.

The invention attracted much notice at the time, as I can just remember. Every one said, How wonderful! How ingenious! and boasted of the progress man was making in science; but scarcely any one believed that the invention could be turned to profitable account, and no man could be found in New York willing to risk his capital in putting the invention to a practical test. By this time, however, Mr. Morse had become fully possessed by the inventor's mania, which shuts a man's eyes to all obstacles, and forces him to pursue his project to the uttermost.

Having no other resource he went to Washington in 1838, arranged his apparatus there, exhibited its performance to as many members as he could induce to attend, and petitioned Congress for a grant of public money with which to make an experimental line between Washington and Baltimore, a distance of forty miles. It is weary work getting a grant of money from Congress for such a purpose; and it *ought* to be, for Congress has no constitutional right to give away the people's money to test such an invention. A committee reported upon it favorably, but nothing further was done during the session.

He crossed the ocean to seek assistance in Europe. His efforts were fruitless. Neither in France nor in England could he obtain public or private encouragement. It seemed out of the sphere of government, and capitalists were strangely obtuse, not to the merits of the invention, but to the probability of its being profitable. They could not conceive that any considerable number of persons in a country would care to pay for the instantaneous transmission of news. Returning home disappointed, but not discouraged, he renewed his efforts, winter after winter, using all the influence of his personal presence at Washington, and all his powers of argument and persuasion.

March the third, 1843, the last day of the session, was come. He attended all day the House of Representatives, faintly hoping that something might be done for him before the final adjournment; but as the evening wore away the pressure and confusion increased, and at length hope died within him, and he left the capitol. He walked sadly home and went to bed.

Imagine the rapture with which he heard, on the following morning, that Congress, late in the night, amid the roar and stress preceding the adjournment, had voted him thirty thousand dollars for constructing his experimental line! Eleven years and a half had passed since he had made his invention on board the ship. Perhaps, on that morning, he thought it worth while to strive and suffer for so long a period to enjoy the thrill and ecstasy which he then experienced.

But his troubles were far from being over. Clinging still to his original notion of inclosing the wires in buried tubes, he wasted nearly a whole year, and spent $23,000 of his appropriation in discovering that the plan would not work. He resorted at length to the system of wires suspended upon poles; and on the 1st of May, 1844, messages were transmitted between the two cities, and the electric telegraph was an accomplished fact!

Many years elapsed before the invention was of much advantage to Mr. Morse. Rival inventors entered the field, and rival companies spoiled the business. It was not until the consolidation of most of the companies into two or three that the business of transmitting messages by telegraph was very profitable to any one. During the last few years the inventor has been enriched; but I presume there are at least fifty persons now living who, without having contributed an idea to the invention, have made more money by it than the inventor.

What an astounding development the business has attained in the United States! We have one company the capital stock of which is $41,000,000, and the receipts during the year 1869 $7,500,000, of which more than $2,500,000 were profit. This company has 121,595 miles of wire, 3,469 stations, 2,607 instruments for reading by sound, 1,334 recording instruments, and 22,000 magnetic battery cups. It transmitted last year 40,000,000 messages, and an amount of newspaper matter equal to about 30,000 columns of the New York *Ledger*. There is one telegraphic office in the city of New York in which 125 operators are employed, and you may see them at work if you step in at the corner of Broadway and Liberty street. It is not unusual for this office to receive and send 30,000 messages in one day. Not far from the *Ledger* office there is a small sign-board over one of the cable offices, which I should suppose Mr. Morse could never read without emotion. It is this:

"Telegraphic messages sent to all parts of Europe, Asia, and Africa."—*James Parton, New York Ledger.*

The Fifth Avenue Cathedral.

The great Roman Catholic Cathedral, covering the entire square between Fifth and Madison avenues, and Fiftieth and Fifty-first streets, is rearing its vast proportions above the ground level with increased rapidity. The entire area of ground occupied by the edifice proper is one and a half acres. The huge enterprise, commenced about five years ago, during the lifetime of the late Archbishop Hughes, is now progressing towards completion as rapidly as circumstances will admit, under the direction of Archbishop McCloskey. The time estimated as necessary to finish the work is about twenty years. At present considerably over one hundred men are employed in quarrying, stone-cutting, masonry, and general labor. The marble used is quarried at Pleasantville, on the Harlem Railroad, and is brought directly on the premises by a special branch track. It is of the very best quality for building purposes, being of fine, large crystals, of an even consistency and uniform color. Some of the blocks are very heavy, weighing from ten to fifteen tuns each.

The walls have now reached a hight of fifty-four feet to the triforum, and are ready to receive the cornices and parapet. Next season the columns for the clear story and the arches, will be reared; the entire front wall will also be completed. The transepts are now finished. The large Gothic windows, some twenty feet above the ground level, are all finished, and indicate the grandeur of the flood of light that they will admit through gorgeous stained glass. The mullions, traceries, etc., are all very delicately and beautifully wrought, but are not to be compared to the splendor of the greater upper windows in the clear story, yet to be erected.

A meager idea of the stupendous work can be gleaned from these items: The distance from the floor to the ceiling is to be 110 feet. The edifice is cruciform in shape; it is 185 feet wide at the transepts, and 330 feet in length. There will be two towers and two spires, each 330 feet high—the ground length of the building.

The side walls are between three and four feet thick; the tower walls between twelve and fourteen feet thick; the clear-story walls are to be three feet thick. About $800,000 have already been expended, and $2,500,000 will be required for its completion. The grand central entrance on Fifth avenue, lately completed, is a marvel of stately beauty and architectural finish. It is seventy feet in hight, thirty-three feet in width, with opening doors twenty-five by fifteen feet in dimensions. The marble work is most elaborately wrought. Rich carvings—the archiepiscopal coat of arms, the miter, keys, etc., form the key-stone piece; lilies of the valley, grapes of Eschol, grains of wheat, wreath of ivy, myrtle, olive branches, etc., ornament the sides. Incomplete as it is in every part, already the Cathedral is a thing of wondrous and fairy-like beauty. Its grand doorway is a marvel of art, its walls like carven snow in their purity, and with infinite grace are blended in their buttresses and pillars massive strength with ethereal lightness of effect. Inside the walls the picture is a strange one. Much of the ground is grass-grown, and piles of debris, masses of carved blocks of marble, mountains of brick and cement, cover the earth here and there. Work is going on but in a lazy, dreamy sort of way. There is no hurrying crowd of workmen; there are no unseemly noises of puffing engines, creaking derricks, and shouting laborers. A single lonely-looking horse sedately lounges along a path prepared for him, slowly hoisting up bricks and mortar to the men at work upon the interior of the walls. A yoke of patient oxen and still more patient driver languidly move big blocks of marble hither and thither on a low sledge. There is no haste; the men work as those who work for all time, and propose to take all time to do the work in. One has an almost irresistible inclination to lie down and go to sleep somewhere about the place. The loudest noise to awaken him, if he did, would be the chirping of the countless sparrows flitting all about, and his dreams would inevitably be of ghostly ruins in a land of eternal rest and silence. When complete, however, it will be the finest church edifice in America.

It is contemplated soon to commence operations on two new buildings, the archiepiscopal palace, on the corner of Madison avenue and Fiftieth street, and the pastoral residence on the corner of Madison avenue and Fifty-first street. These will be very large and of elegant design; the same marble, material, and architecture in correspondence with the Cathedral style will be used.

"The Most Murderous Machine."

The *Gaulois* of Paris lately published a paragraph stating that "The man who shall invent the most murderous machine, and the one easiest to use and handle, shall receive from the French nation a prize of 500,000 francs." This offer recalls to mind a passage in Lord Buchan's life of Napier, the inventor of logarithms, born in 1550, died 1617. In a note Lord Buchan quotes from St. Thomas Urquhart's Tracts (Edinburgh, 1774), who states that Napier had "an almost incomprehensible device, which, being in the mouths of the most of Scotland, and yet unknown to any that ever was in the world but himself, deserveth very well to be taken notice of in this place, and it is this—he had the skill, as is commonly reported, to frame an engine which, by virtue of some secret springs, inward resorts, with other implements and materials fit for the purpose, inclosed within the bowels thereof, had the power (if proportionable in bulk to the action required of it—for he could make it of all sizes) to clear a field of four miles circumference of all the living creatures exceeding a foot in hight that should be found thereon, how near soever they might be found to one another; by which means he made it appear that he was able, with the help of this machine alone, to kill 30,000 Turks without the hazard of one Christian!"

Of this, it is said (continues his lordship), that on a wager he gave proof upon a large plain in Scotland, to the destruction of a great many head of cattle and flocks of sheep, whereof some were distant from others half a mile on all sides, and some a whole mile." * * * (But) "when he was most earnestly desired by an old acquaintance and professed friend of his, even about the time of his contracting the disease whereof he died, that he would be pleased, for the honor of his family and his own everlasting memory to posterity, to reveal unto him the manner of the contrivance of so ingenious a mystery, subjoining thereto, for the better persuading him, that it were a thousand pities that so excellent an invention should be buried with him in the grave, and that after his decease nothing should be known thereof—his answer was, that for the ruin and overthrow of man there were too many devices already framed, which if he could make to be fewer he would with all his might endeavor to do; and that, therefore, seeing the malice and rancor rooted in the heart of mankind will not suffer them to diminish the number of them, by any new concert of his they should never be increased." "Divinely spoken, truly," adds his lordship, and divinely say we. Yet this was precisely the sort of machine, "the most murderous and the most easily handled," at present in request at Paris.

MAMMOTH PEARS FROM SOUTH CAROLINA.—Mr. S. C. Means, of Spartanburg, S. C., has sent us a number of very large and beautiful pears, the largest of which weighs 1¼ pounds. The fruit keeps, he states, till May. As it is not in condition to eat at present, we cannot speak for its flavor, but Mr. Means states that they are excellent in this respect. He has no name for his fruit, but they clearly resemble the pears which are being brought overland from California to this market.

Improved Earth Closet.

The attention which has been lately given to the earth closet system, is stimulating inventive talent to devise means for more conveniently applying it to general use. We herewith illustrate a new commode, which comprises many conveniences over others we have seen.

Fig. 1 is a perspective view of this commode; Fig. 2 a horizontal cross section made just below the seat, and comprising a plan view of the means whereby the earth is carried over and deposited upon the excrementitious matters; and Fig. 3 is a vertical section, designed to better show the operation of various parts of the device.

The earth is placed in a chamber, A, Figs. 1 and 3, the bottom of which consists of a metallic slide, B, Figs. 2 and 3. When the commode is not in use, all the parts occupy the position shown in Fig. 3, that portion of the metallic slide lying underneath the chamber being a continuous plate, fitting tightly against the bottom edges of the walls of the chamber.

The anterior portion of the slide, shown at C, Figs. 2 and 3, consists of recessed shallow chambers, D, Fig. 2, the bottoms of which are closed by pivoted slats, E, Figs. 2 and 3. These slats drop down into the position shown in Fig. 3, when the commode is not in use, and the lid of the seat is closed.

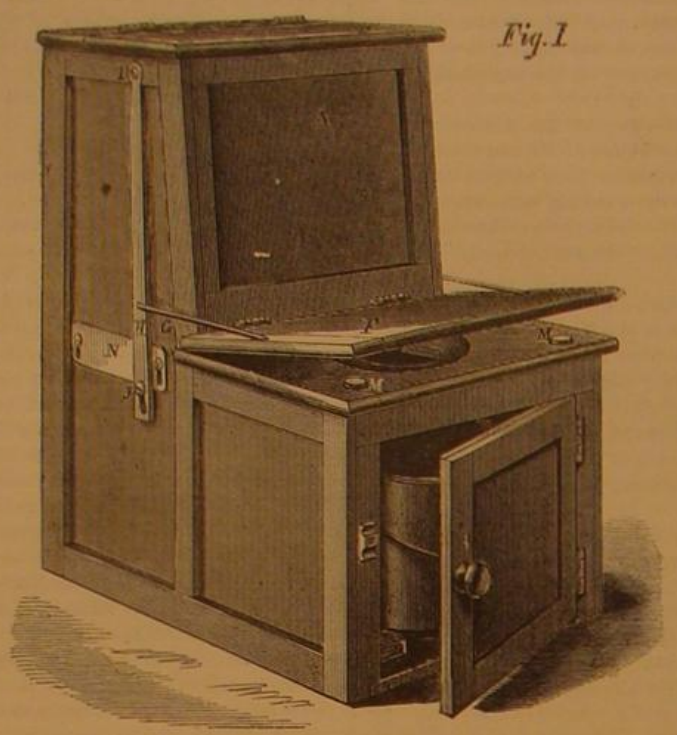


Fig. 1

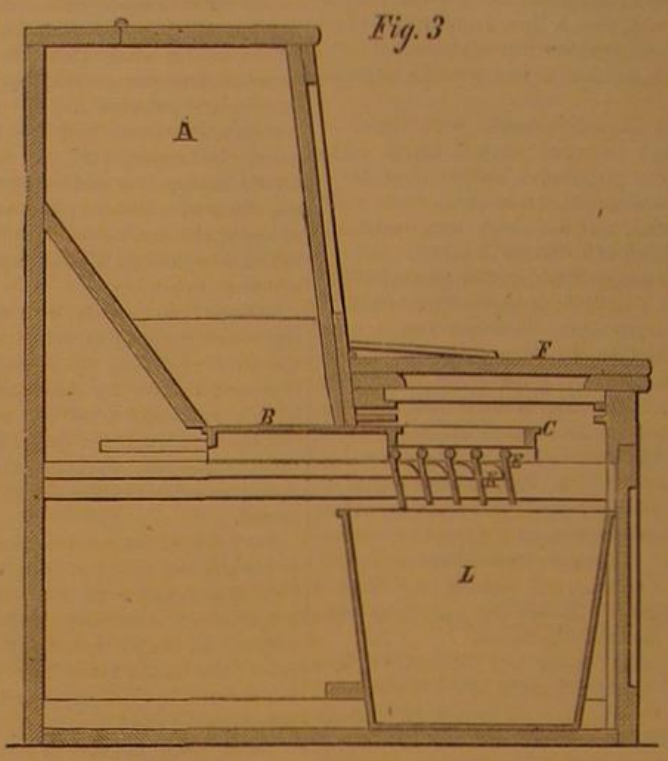


Fig. 3

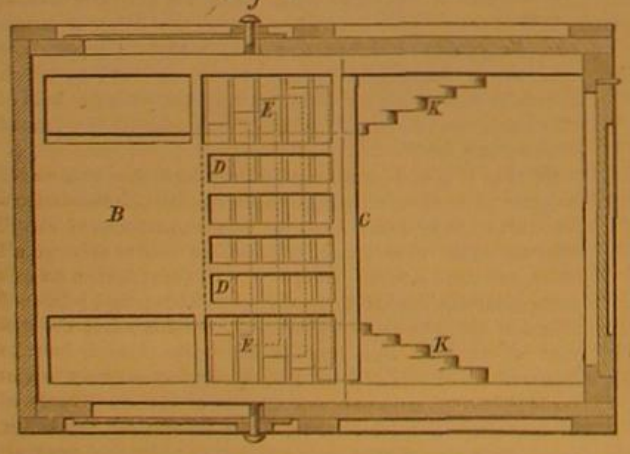
WAKEFIELD'S EARTH CLOSET.

When, however, the lid, F, Figs. 1 and 3, is raised, it operates through a link, G, Fig. 1, and a pivoted lever, H, pivoted at I, and engaging with a pin, J, projecting from metallic slide, B, Fig. 2, through a slot in the side of the commode, to draw back the slide, B, to a position in which the shallow chambers, D, are brought under the chamber, A, where they are charged with earth.

In this movement the pivoted slats, E, are closed by their engagement with the steps, K, Figs. 2 and 3, and when the movement is reversed by the closing of the lid, F, the flat part of the slide is again brought under the earth chamber, A, while the contents of the chambers, D, are brought forward, and by the dropping of the pivoted slats, discharged over the fecal matters deposited in the bucket, L, Figs. 1 and 3.

Knobs, M, Fig. 1, let into the seat, are attached to links, by which a slide is made to entirely close the opening in the seat, or another slide, containing a smaller opening for children's use, is made to replace the former one, according as one or the other of the knobs is raised. The first slide prevents

Fig. 2



the emission of fetid exhalations, and, also, prevents the escape of dust while the earth is deposited in the bucket.

An automatic vertical metallic slide, N, Fig. 1, also operates to close the slot in the side of the case, in which the pin, J, plays, and prevents the escape of exhalations from it.

A device, not shown, for placing earth, coal ashes, etc., in the chamber, A, enables this operation to be performed without the escape of dust into the apartment in which the commode is placed. Patented May 17, 1870, by Chas. A. Wakefield. Address, for rights, licenses, or agencies, Wakefield Earth Closet Co., 36 Dey st., New York.

BUTTERMILK.—Persons who have not been in the habit of drinking buttermilk consider it disagreeable, because it is slightly acid, in consequence of the presence of lactic acid. There is not much nourishment in buttermilk, but the presence of the lactic acid assists the digestion of any food taken with it. The Welsh peasants almost live upon oat-cake and buttermilk. Invalids suffering from indigestion will do well to drink buttermilk at meal times.

How Glass Paper Weights are Made.

Every one knows those paper weights of solid, colorless glass, in a hemispherical shape, in the center of which are bouquets, portraits, and even watches and barometers, etc., but few persons know how or by what means these things are incarcerated in the center of the glass. There is a great distinction to be made, not merely between the objects, but also between the materials of which they are composed. As those representing flowers and bouquets in glass—those from which the name is derived—are the most ancient and the best known, we will begin with them.

The first thing to be done is to sort and arrange a certain quantity of small glass tubes of different colors in the cavities of a thick molten disk, disposing them according to the object to be represented. This done, the tubes are inclosed between two layers of glass. To do this they begin by placing on one side of the disk which contains the tubes, a layer of crystal, to which the tubes soon become attached. When this is done the disk is removed and a second layer of crystal is placed on the opposite side. The object being placed in the center between these two layers of glass thus soldered together, it becomes necessary to give the ball its hemispherical form, which is done when the crystal is again heated, by means of a concave spatula of moistened wood. It then only remains to anneal and to polish it on the wheels.

That a glass ornament, being covered with a layer of hot glass, should receive no injury or change of color, may be easily understood from its extremely refractory nature; but it is not the same with objects in metal, such as watches, barometers, etc., which a far less degree of heat would oxidize or even entirely destroy. The mode of manufacture, therefore, of these latter objects is quite different from that of the first. It is easy to prove this. If we look at a paper weight, provided the interior be of glass, the upper and under part of the recipient will also be of glass. If we now examine a paper weight containing a watch or barometer, under the lower part of the ball will be found a piece of green cloth, the use of which is to keep in place the objects which, instead of only forming one body with the covering of glass which surrounds them, are only placed in a cavity made beforehand in the center of the half spherical ball. In a word, to take out the glass ornaments, it would be necessary to break the paper weight, whilst to take out the others it would suffice to take off the cloth. As for the paper weights in which are placed portraits, usually of a yellowish color, these profiles are made of refractory earth, and many thus bear well a heat which only softens glass. Manufactured successively at Venice under the name of millefiori, and then in Bohemia, these paper weights have been carried to perfection only by French artists. The sole difficulty in their manufacture is in avoiding internal air bubbles, which would the more deform the objects, as any defect would be much increased by the thickness of the glass.

Pin Making in Birmingham, England.

Birmingham, into which the pin-manufacture was introduced about a hundred years ago, is now the headquarters of the pin-manufacture. Then a single pin passed through fourteen pair of hands in the operations of straightening the wire, pointing, cutting into pin lengths, twisting wire for heads, cutting heads, annealing heads, stamping heads, cleaning pins, whitening, washing, drying and polishing, winnowing, paper-pricking, and finally papering up. Adam Smith, arguing on the advantages of the division of labor, can find no better illustration than that afforded in the making of a pin. "Not only the whole work is a peculiar trade, but it is divided into a number of branches, of which the greater part are likewise peculiar trades. One man draws out the wire, another straightens it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head; to make the head requires two or three distinct operations; to put it on is a peculiar business, to whiten it is another; it is even a trade by itself to put them into the papers: and the important business of making a pin is, in this manner, divided into about eighteen distinct operations, which in some manufactories are all performed by distinct hands, though in others the same man will sometimes perform two or three of them. I have seen a small manufactory of this kind, where ten men only were employed, and where some of them consequently performed two or three distinct operations. But though they were poor, and therefore but indifferently accommodated with the necessary machinery, they could, when they exerted themselves, make among them about twelve pounds of pins in a day. There are in a pound upwards of four thousand of a middling size.

Those ten persons, therefore, could make among them upwards of forty-eight thousand pins in a day."

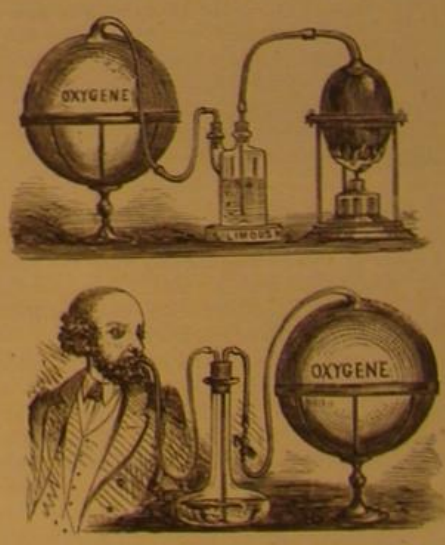
Adam Smith would now have to seek elsewhere for illustrations of the benefit of a division of labor, thanks to Wright, the American, who brought out, in 1824, a machine producing a perfect pin during the revolution of a single wheel. This machine, improved in many ways, is that employed at the largest pin-factory in Birmingham at the present day.

Pin papers are generally marked by means of a molded piece of wood, the molds corresponding to those portions representing the small folds through which the pins are passed and held.

The paperer, usually a girl, gathers two of the folds of the paper together, and places them—a small portion projecting—between the jaws of a vise, having grooves channeled in them, to serve as a guide for the placing of the pins. When filled, the paper is released, and held so that the light strikes upon it, when the eye at once detects every defective pin, and the ready hand removes it. One house consumes three tuns of brass wire per week in producing these ever-wasted utilities, the consumption of which in this country alone is calculated at fifteen millions per day.

APPARATUS FOR MAKING AND INHALING OXYGEN

The use of oxygen gas as a remedial agent and its administration by inhalation, have been attended with success in certain pulmonary diseases. Our engravings illustrate a very simple apparatus, designed to facilitate the use of this remedy. Fig. 1 shows the apparatus employed to generate the gas. The material (chlorate of potassa) is placed in a retort, fixed in a convenient stand, and the heat is obtained from a spirit lamp or a Bunsen gas burner. The gas is passed through a Wolfe's bottle containing water which washes it and cools it, and it then passes into a spherical receiver, also fixed in a convenient stand. In inhaling the gas it is drawn through flexible tubes from the spherical receiver, passing in its course through a washing bottle or flask, as shown in Fig. 2, before entering the lungs. The invention of this apparatus is due to M. Limousin.



PERPETUAL MOTION.—We commence this week the publication of a series of illustrated articles on self-motors, which will be continued from week to week for several months. It will form a very curious history, and no doubt will be a painful reminiscence to some.

Scientific American,

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SCIENTIFIC AMERICAN.

1871.

Special Club Premium.

A New Volume of this journal will commence on the first of January next. Any person sending us yearly clubs for ten or more copies will be entitled to receive, free of postage or express charge, one copy of the celebrated engraving, "MEN OF PROGRESS," for every ten names.

This large and splendid Steel Plate Engraving is one of the finest art works of the day, possessing a rare and peculiar value over ordinary pictures, by reason of the life-like accuracy of the personages it represents. The scene of the picture is laid in the great hall of the Patent Office, at Washington. The grouping is spirited and artistic. Among the persons represented are the following eminent inventors:

S. F. B. MORSE,.....Inventor of Electric Telegraph
CYRUS H. McCORMICK,.....Inventor of Reaper.
THOS. BLANCHARD,.....Inventor of Lathe for Irregular Forms.
WILLIAM T. G. MORTON,.....Inventor of Chloroform.
SAMUEL COLT,.....Inventor of Revolving Fire-Arms.
CHARLES GOODYEAR,.....Inventor of Rubber Fabrics.
FREDERICK E. SICKLES,.....Inventor of Steam Cut-Off.
HENRY BURDEN,.....Inventor of Horse-Shoe Machine.
JOHN ERICSSON,.....Inventor of the first Monitor.
JAMES BOGARDUS,.....Inventor of Iron Buildings.
JOSEPH SAXTON,.....Inventor of Watch Machinery.
PETER COOPER,.....Inventor of Iron-Rolling Machinery.
JOSEPH HENRY,.....Inventor of Electro-Magnetic Machine.
ISAIAH JENNINGS,.....Inventor of Friction Matches.
RICHARD M. HOE,.....Inventor of Fast Printing-Presses

These noble men, by their own efforts, raised themselves from the depths of poverty, and by their wonderful discoveries, conferred incalculable benefits upon the human race, entitling them to rank among its greatest benefactors. It is but fitting that the remembrance of their achievements, and the honored forms of their persons, as they lived and walked among us, should be perpetuated by the highest skill of art. The picture, which is three feet long and two feet high, forms an enduring and desirable object for the adornment of the parlor. It was engraved by the celebrated JOHN SARTAIN, from a large painting by SCHUSSELE, and all the portraits were taken from life. Every lover of Science and Progress should enjoy its possession. Single copies of the Engraving $9; Three copies, $25.

One copy of the Scientific American for one year, and a copy of the Engraving, will be sent to any address on receipt of $10.

MUNN & CO.,
37 Park Row, New York City.

ACCORDING to *Voss' Gazette*, the German soldiers now in France and fit for service number 690,000, while there are 160,000 horses. The daily requirements of these forces are 250,000 loaves of bread, 185 oxen, 400 cwt. of bacon, 540 cwt. of rice, 160,000 quarts of brandy, and 40 cwt. of coffee, 68,000 cwt. of hay, and large quantities of oats and straw.

HEATING OF BUILDINGS.

Although we have often been called upon to discuss the proper methods of heating and ventilating buildings, yet with the approach of each successive winter we receive numerous queries in regard to the comparative merits of various systems, and the best means of remedying the defects in each. These inquiries show that with this, as with other practical topics, "line upon line and precept upon precept" only can keep the people at large from falling into error. It is unnecessary, therefore, to offer any apology for returning at this season to a subject which, in its intimate relations to the health and comfort of all, stands scarcely—in this climate—second to that of food or clothing.

There are two, and only two, ways by which a room may be heated—namely, by radiation and convection. It is true conduction may play an intermediate part in the communication and distribution of heat to the radiating apparatus, and walls of rooms as well as the solid objects usually placed therein, but as this part is an unimportant one practically, we shall pass it without further remark.

Of the two general principles upon which all domestic heating apparatus is based, the better one, in its effects upon comfort and health, is radiation, provided the principle be applied so wisely that ill effects are not involved in its use. Of various kinds of apparatus for the application of this principle, the more common in use in this country are cast-iron wood and coal stoves, open fireplaces and grates, and steam and hot water heating apparatus. Without going into the question of relative economy in regard to these various devices, we shall consider them only in relation to their effect on health and comfort.

Against close cast-iron stoves there lie the serious objections that they do not afford proper ventilation; that when coal is used they are liable to emit deleterious gases; that in giving them fuel and removing ashes they introduce an irritating and disagreeable dust (an objection which also lies against open fireplaces and grates), and that it is difficult to maintain an equable temperature by their use. They nevertheless, from their small cost and the possibility of their use in small apartments and situations where more perfect apparatus cannot be employed, enjoy a wider favor than any other form of heating apparatus in use, and are doubtless destined to maintain their popularity, unless some inventive genius shall give to the world something which combines their advantages with the removal of their defects. We are certain such an invention could not fail to secure at once universal favor and adoption.

The chief improvements made in stoves of late years, and for which patents have been taken out, are changes in the designs and trifling alterations in the form of cast-iron stoves. If any one has thought of the possibility of cheaply rendering their joints and plates permanently impermeable to gases, it is certain that possibility remains undemonstrated by any practical invention. Methods of supplying fuel and removing ashes without the escape of dust are also very desirable, and, it would seem, not very difficult to devise and apply at small cost.

The improvement of ventilation in connection with the use of stoves is also a matter which should claim the attention of inventors. In this respect the open fireplace or grate has an immense advantage over the close stove. Nothing yet introduced for heating can retain that pure, fresh quality of air which is maintained in rooms heated by grates.

Next to the grate ranks the steam-heating apparatus for comfort and health. Properly adjusted, and with a small jet of steam escaping into the apartment to supply the needful moisture, it comes very nearly to the perfection of the open grate. But with this, as with all methods of heating where the heating apparatus is itself not a ventilator, the ventilation must be provided for by special means.

In hot-air furnaces there need be no special provision made for ventilation, as the proper circulation of air, when admitted, as it ought always to be, from the outer atmosphere to the heater, requires the constant exit from wall flues of the heated and vitiated air from the interior. There is, however, in air heated in this way an irritating and disagreeable quality which has made such an impression upon us wherever we have encountered it, as to lead us to believe that either there is some radical defect in the method, or that it is generally imperfectly applied. Our opinion is, that, as a rule, heaters of this kind are expected to furnish heated air for too large a cubic space, and are hence made to carry too highly heated plates. Plates thus heated are permeable to carbonic oxide, generated in the combustion of coal, a very poisonous gas. They also, by overheating the air, increase its capacity for water, which, though an attempt is made at compensation by placing water vessels in the flues through which the air must pass to reach the apartment, still fail to remove its disagreeable quality so as to render it equal in pleasantness to that heated by radiation from steam pipes or grates.

There are, nevertheless, conveniences in the application of these heaters which do not pertain to steam-heating apparatus, and from which they have secured great popularity. They need much less attention than steam heaters, and can be more economically applied to ordinary dwellings.

In cleaning such heaters and adjusting them for winter use, great care should be taken to make every joint air-tight, so that the gases of combustion may be kept from contaminating the air which passes over the flues. The fire-box should be carefully examined to detect cracks, and if found defective, replaced by a new one. Neglect in this respect will be sure to be followed by evil consequences. Admissions and exits for air should be protected from the effects of adverse winds by revolving vaned hoods. With these precautions, and with sufficient heating surface to render forcing of the fire unnecessary, such heaters will do good work, a will be found in general more economical than steam heaters

But whatever apparatus may be employed, none will prove fully effective without intelligent supervision. To leave the care of these devices wholly in charge of ignorant servants is about as safe a course as to place a box of arsenic alongside of the salt. Poisoning either quick or slow will pretty surely result in either case.

TO MAKE A CHEAP AND GOOD SMALL ICE HOUSE.

The essentials to a good ice house are three in number, viz: Its walls should be filled with good non-conducting and non-radiating material, its drainage should be perfect, and provision against air-leakage should be thorough.

The packing of ice in such a house is a simple matter need ing only the general direction to lay the ice with some loose fibrous or granular substance between the blocks, to prevent their freezing together, and in such a manner that the space be economized to the utmost.

The house may be built entirely above ground, or partially below it, on a side hill, if desired, or it may be built with a cellar, into which cold air is admitted from the ice stored in a room above. This will be found a great convenience to farmers in storing butter, milk, and fresh meats during the hot summer weather. The drawing off of cold air and replacing it by warm air, is, however, only to be done at an expense of ice; and if to preserve ice, as long, and with as little waste as possible, be the sole object, the cold air cellar or room had better be omitted.

The house may be built of logs, like the old style of log houses, with an inner wall of the same material, leaving a space of ten inches or more in width between the two walls, the chinks of both walls being filled with mortar. The space between walls may be filled with dry chaff, loosely packed, or sawdust, or cut straw answers the purpose very well. One of the most effective ice houses we ever saw, was made of logs, and stuffed with a mixture—about half and half—of cut straw and wheat chaff.

A frame building, with board covering, may be used, and, in many places, will be found more convenient than the logs. It will be equally effective if the joints are tightly battened, and the inner one papered throughout with old newspapers, two or three layers of which will stop all the air holes. Besides, paper is an excellent non-conductor.

Make the floor with an inclination sufficient to carry off all the drip, and make gutters all around it, near the walls, to conduct the water to the discharge pipe. A good cement bottom is best, as it can be made and kept air-tight. Make the drip pipe of inch lead pipe, and bend up the lower end, so as to form a trap which will hold water and prevent the influx of warm air. Such pipes may be bent without flattening them by first filling them with melted resin. When cold bend them, and, after bending, melt out the rosin. In this way can be obtained a neat, round bend, without sharp breaks or indentations.

Insert the drip pipe and make the joint air-tight by cement or common putty.

Make the entrance, if possible, at the top of the building, with a vestibule, and an outer and inner door. Make the inner door hollow, and stuff it, like the walls. Make it shut tight by packing the joints with lists or selvedges of cloth obtained at the tailor shops. The outer door should be made air tight, but need not be stuffed. Make the vestibule large enough to enter and shut the outside door before opening the inner one (and *vice versa*), when taking out the ice during hot weather. Having done these things you will have a perfect and efficient ice house.

The hight of the building should not be great, as it increases the labor of storing; the other dimensions are to be regulated according to the quantity of ice to be stored. In storing the ice, it should be laid out only to the inside edges of the gutters in the floor, and a thin layer of dry straw, chaff, or saw dust should placed between all the surfaces, vertical and horizontal. This enables the ice to be quarried out in neat blocks when required for use.

Any one following these directions will find that, at a very small expense, they can store and keep ice as well as the best. An old dairyman once said to us, that his ice house was as profitable to him as his cellar, and we believe it. He was the owner and constructor of the log ice house referred to above, which, if not as comely as some, was as good and effective as any man need desire.

BOILER EXPLOSIONS.

The numerous disasters arising from steam boiler explosions which so frequently startle and alarm the public, and their avoidance, are subjects of such great importance, that however trite, anything said or written upon them may be, it will attract more or less attention and excite some interest. Perhaps on no subject has a greater amount of nonsense and absurd theorizing been promulgated. We feel, therefore, in justice to the importance of the subject, that a little volume which has lately reached our table,* and which bears on every page the impress of practical knowledge, sound theory, and absence of hasty and ill-advised conclusions, merits more than the ordinary brief notice we usually accord new books and publications.

The enumeration of causes of explosions given by its author is, however, in our opinion, incomplete. It is as follows: Low water, over-pressure, defects in materials, etc., scale or sediment, repulsion of water, and overheating of water. If to this category had been added the force of unequal expan-

* EXPLOSIONS OF STEAM BOILERS: How they are Caused, and How Prevented. By J. R. Robinson, Steam Engineer. Boston: Little, Brown & Company

sion we should not have found fault with its incompleteness. Unequal expansion, while in our opinion it rarely or never alone causes explosions, acts to produce a condition in which much less steam will destroy boilers, than could be the case were the steam unaided by its disruptive energy.

As however this force can only be combated by proper construction, the category of causes given includes all that boiler users can provide against, and as the author proceeds after the discussion of these causes, to plain and explicit directions for their prevention, we regard the work as one which ought to be in the hands of every man who owns or uses a steam boiler.

In his preface the author remarks, that "while it is true that the condition of many boilers now in use is such that it is a matter of surprise that so few boiler explosions occur, having their origin in excessive pressure, overheating of the surfaces above the water, in defects of materials of construction, and in the presence of scale and sediment, it is also true that there have been so many explosions not attributable to either of these causes, as to point unmistakably to the existence and operation of a power not indicated by the pressure gage."

From page 31 to 35 inclusive, are given accounts of a large number of such explosions, wherein upon minute examination none of the above-named causes could be determined to have existed. Mr. Robinson then proceeds to account for such explosions by referring them to "overheating near the bottom of the boiler, causing the water to be thrown with such force as to break the top."

In support of this view, Mr. Robinson quotes the following passage from Rankine's "Manual of the Steam Engine and other Prime Movers."

There is much difference of opinion as to some points of detail in the manner in which this phenomenon is produced; but there can be no doubt that its primary causes are, first, the over-heating of a portion of the plates of the boiler (being in most cases that portion called the *crown of the furnace*, which is directly over the fire), so that a store of heat is accumulated; and, secondly, the sudden contact of such overheated plates with water, so that the heat stored up is suddenly expended in the production of a large quantity of steam at a high pressure. Some engineers hold, that no portion of the plates can thus become overheated, unless the level of the surface of the water sinks so low as to leave that portion of the plates above it, and uncovered; others maintain, with M. Boutigny, that when a metallic surface is heated above a certain elevated temperature, water is prevented from actually touching it, either by a direct repulsion or by a film or layer of very dense vapor; and that when this has once taken place, the plate, being left dry, may go on accumulating heat and rising in temperature for an indefinite time, until some agitation, or the introduction of cold water, shall produce contact between the water and the plate, and bring about an explosion.

He also quotes from Bourne and from Colburn, both of whom maintain that the peculiar condition in question may be a cause of explosion, and the latter of whom says that in case of the rising of water because of the condensation of steam above the water, and regarding the force of the blow given by the water, "it would not be necessary to assume the existence of any defect in the boiler; for when the water once struck violently, the soundest iron would probably be broken and the strongest workmanship destroyed."

The committee of the Franklin Institute demonstrated by experiments that the repulsive temperature of a clean, rough iron surface like that of a clean iron steam boiler is 385° F., and of iron "highly oxidated, but clean," 433° F. Their experiments also showed that for polished copper the temperature of perfect repulsion is 338°.

The temperatures of maximum vaporization is some 40° lower for iron, and 23° lower for copper. At the temperatures of perfect repulsion the water does not wet the metal.

By means of elaborate experiments, to which we shall refer in a future issue, Mr. Robinson claims to have demonstrated the following important facts.

The effect of pressure, accompanied by rapid circulation, so far overcomes the repulsion that "practically the point of perfect repulsion may be said to be raised by the pressure within the boiler; but this only holds true so long as there is perfect circulation of the water. When the circulation is not perfect, pressure has no effect upon the temperature of repulsion. A steam boiler, working under one hundred pounds pressure, the surfaces of which are of such a character that the temperature of perfect repulsion at atmospheric pressure is 385°, will be liable to just as perfect repulsion from any of its surfaces exposed to an intense heat, whenever that temperature is reached, unless the circulation of the water within the boiler is so good that it shall be continually brought into *forcible* contact with such surface."

Again, he finds that variations in the quality of water so slight that they neither affect its taste nor its color as seen through a glass, "affect the circulation in its relation to the point of perfect repulsion."

His experiments also show that whenever any part of the surface of a steam boiler much below the surface of the water is raised much above the temperature of maximum vaporization, the reduction of its temperature will be attended with such rapidity of vaporization as to endanger the boiler; and that, while in cases of perfect repulsion, there will always be recognizable signs of trouble within the boiler, indicated by the steam and water gages. In cases where the repulsion is not perfect, the danger may be incurred without any visible sign of its existence being manifested.

The way in which explosions occur from this cause is explained in the following quotation:

> Let us take the case of a boiler in which the surfaces around the fire are clean and smooth, and very nearly uniform, and in which the circulation of the water is ordinarily good, but which has now got some element in the water that favors repulsion, or causes the water to circulate sluggishly, working with so strong a fire that the surfaces exposed to the most intense heat shall be raised to a temperature very near that of maximum vaporization, but not above it, so long as the steam pressure is maintained. Now, let the demand for steam be increased, so that there shall be such a sudden reduction of pressure that the descending current shall give off steam, and the circulation will be so broken up that the temperature of the surfaces around the fire will be raised above that of maximum vaporization: this will cause a decrease in the steaming power of the boiler, so that, without a greater demand for steam, the reduction of pressure will be more rapid, with its consequent interference with the circulation of the water, and thus the temperature of these surfaces be rapidly raised to that of perfect repulsion. Now, let the demand for steam be so far reduced that the boiler shall make steam as fast, or a little faster than it is used, and let a fire-door be opened and a strong current of cold air be thrown upon the overheated surfaces, their temperatures will be so reduced that the water will return upon them and complete the reduction to the temperature of maximum evaporization, with the consequent violent evaporization of such an amount that the steam so generated shall throw the water above it with such force as to break the shell of the boiler, and so cause its explosion.
>
> Or, without the opening of the door, let the demand for steam be so reduced as to lead to a rapid rise in pressure, and the interference with the descending current ceases; the circulation of the water is soon so strong as to overcome the repulsive power; the overheated parts are reduced to the temperature of maximum vaporization, and the water is thrown by the steam generated under it with such force as to break the shell of the boiler, and so cause its explosion; without, in either case, any part of the boiler having been overheated so as to show it after the explosion, or so as to have reduced its tensile strength in the least.

Mr. Robinson is of opinion that most explosions of locomotive boilers on the road, or just after arriving at a station, occur in this manner.

We might protract this review to a much greater length than we have done, and go on to notice the methods of prevention prescribed by Mr. Robinson, but we forbear. Suffice it to say that the same practical sense which keeps the author from running off into speculative theories guides him in his directions for the construction, setting, and management of steam boilers. Many explosions have occurred which might have been prevented by the application of the information given in this part of the work.

A BRUTAL EXHIBITION.

Neither the presence and sanction of even such distinguished physicians and professors as Drs. Hammond, Flint, Doremus, Mott, and Barker, nor that of "distinguished clergymen," nor the fact that these physicians were nominally present in the interests of science, can, in the minds of sober men, soften the brutality of such a spectacle as was presented to the New York public at the Empire Skating Rink on the day preceding Thanksgiving Day, the occasion of Weston's attempt to walk 112 miles in 24 hours.

We are ready to believe that if clergymen were present as reported, they were so in ignorance of the real character of the exhibition and with the belief that the occasion was to be one of scientific interest. The name of Dr. Doremus, whose fame as a lecturer, and more particularly as an exhibitor of brilliant experiments, before Young Men's Christian Associations, etc., has become widely extended, was perhaps taken as a guarantee that the exhibition would be free from anything immoral in tendency, or disgusting to a refined taste. If this was the case, how must the reverend gentleman have felt to witness a poor jaded human being whipped like a dog around the ring, to prevent his falling asleep from sheer exhaustion.

The published report said the "blood spouted" in response to the "fearful lashing," and that a whip was "*smashed*" on the tired legs, that would no longer obey the exhausted nerve force of the failing pedestrian.

If such things are necessary to increase our knowledge of human physiology, why should they be made public? Would not an examination of Weston's urine by Dr. Flint have been just as valuable had the luckless aspirant for pedestrian honors exhausted himself in private? Perhaps, however, the elimination of urea is more rapid when made under the stimulus of the shouts of a crowd, and the knowledge that much money is staked on the result. Will Dr. Flint inform us on this point? and will Dr. Doremus please tell an anxious public whether, in view of his statement to the crowd that "no alcoholic stimulants had been employed," a glass of brandy or wine publicly administered would have been more or less demoralizing than the sight of a man whipped till the "blood spurted," as a substitute for liquid stimulants?

SPIRITUALISM AND SCIENCE.

Many of our readers will recall a trial that took place in New York in reference to spiritual photographs, and the power of these invisible agencies to impress their counterfeit presentments on glass and paper. The result was rather favorable than otherwise to the spirits, as the imposters were not punished.

The subject is one that scientific men dislike to approach, as it offers so little that is satisfactory or instructive. We are reminded of it, however, by the appearance of a small monograph entitled, "The Physics and Physiology of Spiritualism. By William A. Hammond, M.D.," which work, on account of the reputation of the author, and the original researches contained in it, is worthy of particular notice.

Dr. Hammond has devoted special attention to the study of the diseases of the mind and nervous system for many years, and is, therefore, in a position to speak with authority upon the subject. He, at the outset, calls attention to the difficulties that surround the study of mental phenomena, and says. "The physiology of the nervous system is, by no means, even tolerably well understood. Science has, for ages, been fettered by theological and metaphysical dogmas, which give the mind an existence independent of the nervous system, and which teach that it is an entity which sets all the functions of the body in action, and of which the brain is the seat. There can be no scientific inquiry relative to matters of faith, facts alone admit of investigation; and hence, so long as psychology was expounded by teachers who had never even seen a human brain, much less a spinal cord or sympathetic nerve, who knew absolutely nothing of nervous physiology, and who, therefore, taught from a stand point which had not a single fact to rest upon, it was not to be expected that the true science of mind could make much progress."

Dr. Hammond is admirably sustained in these views by Professor Huxley, who says in his lecture on "The Physical Basis of Life," while alluding to the fears expressed by metaphysicians on the progress of so-called materialism, "The physiology of the future will gradually extend the realm of matter and law until it is co-extensive with knowledge, with feeling, and with action. The consciousness of this great truth weighs like a nightmare, I believe, upon many of the best minds of these days. They watch what they conceive to be the progress of materialism, in such fear and powerless anger as a savage feels, when, during an eclipse, the great shadow creeps over the face of the sun. The advancing tide of matter threatens to drown their souls; the tightening grasp of law impedes their freedom; they are alarmed lest man's moral nature be debased by the increase of his wisdom."

It is evident that these leading scientific men entertain little respect for the application of metaphysical reasoning to the explanation of physical phenomena, but they do have respect for facts, and the laws to be deduced from them, and whenever a new phenomenon is presented to them, they immediately put it to the test of experiment, and do not for a moment think of appealing to supernatural influences for an explanation of what they have seen. Our ancient philosophers having no facts to found their edifice upon, built upon the frail gossamer of their own imaginations, and to them every phenomenon of nature was a spiritual manifestation. Thus have come down to us traditions of spirits, spiritual rappings, spiritual influences, spiritual presence, communication with departed spirits, and the like, which are accepted as true by ignorant people, and not believed in for a moment by men of science.

For the purpose of dispelling this ignorance, such works as Dr. Hammond's are of great value. Facts are stubborn things, and, as Faraday was accustomed to say, "We must believe in facts." Dr. Hammond adduces many instances, from his own observation, of so-called spiritual influences, and shows them to be the results of disease, just as fever or the cholera can be traced to a disordered system. He says: "Physicians know very well that actual organic disease may be produced by the habitual concentration of the attention on an organ. The fancies of the hypochondriac may thus, in time, become realities. Many of the facts of spiritualism are clearly explainable by referring them to this influence."

He cites the case of a young lady, under his professional care, upon whom the principle of suggestion can be made to act with striking effect. It is only necessary to tell her that certain images are before her, when she directly sees them exactly as they are described. Voices are heard and odors smelt, and she has a sweet or sour taste in her mouth, precisely as they are suggested to her. Another feature in the production of spiritualistic manifestations is sleight-of-hand. The author says, that he recently invited several medical friends to witness, in his library, some surprising spiritualistic exhibitions by a first-class "medium," who read communications from the dead, made on folded slips of paper, and performed other feats to the astonishment of all present, which were wholly deceptions and tricks of the trade.

Another patient had the power to induce the hypnotic state at will, by reading a book for a few minutes, then closing it and fixing the eyes steadily, but not upon any fixed object. During this state, she was not affected by holding aqua ammonia to the nostrils, or by touching the eye with the finger. She was able to perform the usual feats of mediums, and Dr. Hammond, with his acute observations, was soon able to give an explanation. Her sleep was incomplete, and she was in a condition similar to that of a dreaming person, for the images and hallucinations were either directly connected with thoughts she had previously had, or were immediately suggested to her through her sense of hearing. Some mental faculties were exercised, while others were at rest. The phenomena were not those of pure somnambulism, but three other conditions are present in greater or less degree; these are hysteria, catalepsy, and ecstasy.

At most of the spiritualistic meetings which the author has attended, there have been hysterical phenomena manifested by some of the men and women participating in the exercises. Some of these cases afterwards came under his professional care, and were cured by a persistant administration of iron and strychnine, medicines which appear to possess great exorcising power as against the spirits.

In catalepsy we have an affection which is well calculated to fulfill many of the requirements of spiritualism. The muscles have a tendency to preserve any degree of contraction which may be given them. Sensation is generally suspended, and pins thrust into the body are not felt, and yet the intellectual faculties are often exercised to a remarkable extent.

As to the movement of chairs and tables against the force of gravity, the author says: "There is no doubt that they are due to hallucination, legerdemain, or actual fraud. A visit to the performance of any pantomime will give an opportunity for seeing as striking manifestations in this direction as any of those attributed to the agency of spirits."

To suppose that the law of gravitation can be set aside for the accommodation of spirits, would not be believed by an engineer who constructs machinery for lifting heavy building

stones, and, although the scientific man may not be able to explain the tricks by which the law appears to be broken, yet he knows that there is fraud, and is not, for a moment, deceived.

This whole business of spiritualism has been the source of much mischief, and has brought insanity into many a family. Our readers ought to know, that no man of science, no sane man of intelligence, has any faith in it. Before the light of science the whole thing is shown to be an imposition. But, as Dr. Hammond says: "Spiritualism is a religion. As such it is held tenaciously by many well-meaning people. To reason with these would be a waste of words, just as much as would be the attempt to persuade a madman out of his delusion. Emotion, or interest, or accident might change them, but facts never."

There are some who halt between belief and unbelief, for the reason, mainly, that they have no clear conception of what knowledge is, and of how things are to be proved. Such persons would do well to read Dr. Hammond's book or consult him professionally, or ask the advice of scientific men anywhere, before plunging into the great folly of spiritualism.

SCIENTIFIC INTELLIGENCE.

USES OF GUN-COTTON.

When gun-cotton was discovered by Schoenbein, in 1846, great expectations were raised that it could be used for blasting and for military purposes, but owing to numerous accidents, it soon lost favor, and was scarcely used at all previous to 1862. In that year Baron von Lenk renewed the experiments with it, and finally succeeded in inventing a process by which it could be made available for artillery. He had it twisted into yarn, and applied it in that way. The English officers were not satisfied with the results of their experiments, and Professor Abel, of Woolwich, devised an improvement. He reduces the gun cotton into pulp exactly the same as paper stock, and by the same machinery. After conversion into pyroxyline, the stock can be worked up into endless paper, and in this way made available for cartridges. The pulp may be diluted in strength by the admixture of pure cotton. Common cotton waste may be employed. It can be compressed, and is thus far safer as it burns like tinder unless confined. It must be fired by detonation, and for this purpose a fuse had to be invented.

The compressed gun cotton is equal to five or six times its weight of gunpowder, is cheaper, lighter, can be stored wet, and dried when required. It is said to be good for torpedoes, but is not good in confined spaces.

TEST FOR CHLOROFORM.

A. W. Hofmann has discovered a remarkably sensitive test for the presence of chloroform. The liquid to be examined is mixed with aniline and a solution of caustic soda in alcohol; if chloroform be present, it will at once be recognized by the odor of isonitrile which is generated.

The hydrate of chloral, when treated with caustic soda and aniline in the same way, also at once reveals the liberation of chloroform. One part of chloroform in five to six thousand parts of alcohol can be recognized in this way, and it affords a method for distinguishing chloroform from chloraethyl.

INTERESTING EXPERIMENTS WITH SOLUBLE GLASS.

If to a solution of soluble soda glass, specific gravity 1·392, a solution of nitrate of soda in one part of water be added, we have at once a gelatinous precipitate of silicic acid; but if equal parts of the soluble glass and of a solution of nitrate of soda, in two parts of water, be employed, no precipitate will form in the cold; if the liquids be heated, silica is at once thrown down, and on cooling the vessel rapidly it goes again into solution.

Thus the alternate solution and re-precipitation of silica can be readily accomplished, as a neat lecture-room experiment.

IRON GUNPOWDER.

According to A. W. Hofmann, a mixture of one part sulphur, two parts iron filing (*ferrum limatum*), and three parts niter, will ignite by a glowing taper, and burn with brilliant light.

After it is cold the residue will probably give a red color, due to the ferrate of potash produced by the oxidation of the iron.

ORIGIN OF GRAPHITE.

Graphite, or, as it is sometimes called, plumbago, and black lead has been found in gneiss, mica slates, clay slates, limestones, and a variety of other rocks of different geological periods.

Its origin has long been a matter of conjecture, and scientific men have not been able to agree upon it. Professor Wagner ascribes it to the decomposition of cyanogen and of the cyanides. The black mass which sometimes separates from hydrocyanic acid, on being washed in nitric acid and dried, is found to consist of scales of graphite. Dr. Wagner infers from this that the artificial graphite that is formed on the cooling of many varieties of iron, has its origin in the same source, namely, cyanogen.

It is not the carbon which is held in solution in the melted iron, but the cyanogen compounds that give rise to the graphite.

In the manufacture of soda by Le Blanc's process there is always considerable graphite formed which is derived from the decomposed cyanogen compounds, and, in some of the large establishments of Bohemia, practical application is made of this incidental product in the manufacture of lead pencils.

This theory of the origin of black lead is worthy of attention, as it may lead to cheap methods for the artificial production of that valuable substance, and at the same time help to explain many difficult geological questions.

LETTERS FROM THE SOUTH.

RALEIGH, October 31, 1870.

Columbia, S. C.—Charlotte and Western North Carolina—N. C. R. R.—Gold and Silver Mines.—Chatham R. R. and the Deep River Section—Cotton Factories—Raleigh.

From Augusta to Charlotte, N. C., I traveled over the lately-consolidated line of the Charlotte, Columbia & Augusta R. R. The new part of this road, from Augusta to Columbia, is a smooth, well-laid track in modern style, but the remainder has old-fashioned and well-worn rails. Formerly the traveler had to go directly south to Branchville then north to Augusta, making an angle about equivalent to going to Hartford to get to Newburgh.

Columbia has been slowly rebuilding since the war. I am informed that 110 business stores have been built and 1,000 dwelling houses. The place, however, still retains some marks of the great fire. The famous capital building which was to have been the seat of future Confederate congresses has been partially fitted up, and is now occupied.

There is a large water power privilege near the city which was some time ago bought for a nominal sum by Senator Sprague, with the understanding that he was to complete the canal. He has just commenced work on it with 100 laborers. This commencement was delayed so long that many thought he bought it only to keep off others, and not for use. It is hoped now that he will properly improve it and erect factories. The country around on all sides is a large cotton producing section. There is near the city, on the Saluda river, a cotton factory of about 15,000 spindles, owned by Messrs. Childs & Johnston, and managed by Gen. Palmer, formerly of Illinois. It was burned by Gen. Sherman, but rebuilt and refitted by its present owners.

There are a number of other cotton factories in the State north of Columbia, numbering in all about 20,000 spindles. The railroad through Rabun Gap to Knoxville is expected to open new routes of travel and for transportation of produce. It will certainly open to the world a fine grazing country in Western North Carolina.

Charlotte is one of the oldest town in the United States, but within a few years past it has received a new life, and now promises to be one of the most flourishing inland cities of the South. On two sides it has a cotton growing region, on the rest as good wheat lands as can be found anywhere. While far up in the mountains is a grass and stock raising country equal to any in the world.

There are now three railroads centering there, a fourth is being built from Atlanta, and a fifth from the north. It can never, in its immediate limits, be a great manufacturing place, as it has not water power, and coal is far distant, yet it has enterprising inhabitants. The country around affords excellent water powers, and it may be the central distributing point for future factories on those sites.

The North Carolina Railroad commencing here was originally intended to be the great State line to build up her resources and redeem past errors. It has been of immense benefit, it is true, but was badly planned. It is 225 miles long, commences at Goldsboro and ends at Charlotte. An air line between the two points would not be over 150 miles. From Salisbury, on its line 40 miles north of Charlotte, starts out the Western North Carolina Railroad which is to cross the mountains at Swannanoa Gap on to Asheville, and thence eventually to Ducktown, Tenn., and Dalton, Ga. It is completed to the foot of the mountains, and the track will soon be laid to the eastern end of the tunnel. By a singular blunder of engineering the summit is made outside the tunnel on the west end, hence the contractor can work only from one side, and its completion is delayed.

The section of North Carolina which this road is opening to the world is noted for the fertility of the soil, its delightful climate, and beautiful and grand scenery, as also immense deposits of various minerals and metals. I was shown by Prof. C. P. Smith, of Franklin, Macon Co., formerly of the State Geological Survey, some beautiful rubies and amethysts he had found in his county, as well as very fine corundum. Iron and copper is in abundance, while the finest of marble, white, black, flesh color, and variegated exists in immense masses, and is easily quarried. But the great wealth of this country, heretofore almost an unknown region, is, in its climate and soil, and their adaptability to the grasses and dairy farming. Already several successful cheese factories have been established there. The North Carolina Railroad runs through one of the best sections of the South. Its eastern and southwestern ends, both are in cotton-growing sections, while the middle is a fine small grain country, affording many good manufacturing sites. Several cotton factories are on its line, and the company's shops in its center are noted for the excellence of the work done there and the superior character of the buildings. The country through which it runs is also a great mining region, chiefly gold. Near Charlotte there are a number of gold mines in quartz veins successfully and profitably worked by Northern men with the improved modes and machinery. I would not, however, advise any one to imitate their example, as it is the most precarious kind of work.

Near Lexington is the Silver Hill mine whence the ore comes from which the Bartlett Lead Co. make their pigments. I went down in their mine 645 feet and saw a vein of ore 12 feet wide. It is certainly one of the most astonishing veins in this country, and the deepest mine now worked this side the Mississippi.

The copper mines of this section have never paid well except in Wall street; some of them are good if properly worked. In Rowan is the famous Gold Hill mine from which millions of dollars of gold have been taken, and more left behind on top, in the debris and underground. This mine affords a fair illustration of the uncertainties of gold mining. A friend of mine once took out $25,000 worth of gold in two days. It so elated him that he spent twice as much in trying to find another such pocket.

South of Raleigh is the Deep River country, where the coal fields are located. It is reached by the Chatham Railroad from this place, and by steamboat and railroad from Wilmington. These coal mines have, unfortunately, like too many other mines in North Carolina, been worked more on speculation than for business. They were worked during the war on the latter plan, and one mine afforded fully 30,000 tuns of coal per year. By these very speculative movements mining in North Carolina has been put in bad repute, but a change is now likely to be made as the mines get into few hands.

The Silver Hill mine alluded to is an instance of what can be done on a business basis. Yet there the whole country immediately around the mine is filled with the sulphurous fumes from desulphurizing the ore for shipment. The company ship about 4,000 tuns of ore per year, they throw off into the air in North Carolina, and thus waste at least 2,000,000 lbs. of available sulphur, which for making sulphuric acid should be worth at least $30,000.

The owners of a copper mine in the Deep River country, called the Clegy Mine, east of the coal measures, adopt a different course. They ship about 3 tuns of ore per day. It is taken to Baltimore, there desulphurized, and the fumes utilized for making sulphuric acid, then the residuum is melted. This mine is an exception to the usual North Carolina copper mines. No gold has ever been found in its ore, and it was copper from the top, whereas those of Guilford and that region, on the surface are sulphurets of iron carrying gold, and change to sulphuret of copper. Those of Western North Carolina are the gray sulphuret and black oxide. This Clegy mine I could not but admire; every house was neatly painted or whitewashed, and the general air of cleanliness and order was quite refreshing. Under the ground the same system of affairs existed, the mine was opened right. Capt. John Ends is the efficient superintendent of this property; it is but fair to say, though, that the vein is almost vertical, and hence gives great advantage in opening regular workings.

In this same region there are immense deposits of iron ore, rivaling anything in Missouri or the Lake Superior country. They were worked by three furnaces during the war, but no work at all is done now, though two of the furnaces are standing. The cause of this may be the same that has crippled the credit and resources of North Carolina for a few years past, as this section became unfortunately mixed up in the speculations of the swindling bond ring. The superb water power at Lockville remains almost idle, and the still greater one on the Cape Fear below is worse than unimproved.

Agriculturally this region produced cotton and all the grains very well; some of the lands are very rich. South of Deep River, about 40 miles, is the town of Fayetteville, once the most flourishing town of the State, having one at time 8 cotton factories in her suburbs. Now there are only 2, one of about 4,500 spindles the other 2,500. They both pay large dividends, showing that others could be erected with profit. There are in the State now 25 cotton and woolen factories; previous to the war there were 34. They probably run about 80,000 spindles.

The country around Raleigh is a wheat, corn, and cotton growing region. The State capital, Deaf and Dumb, Blind, and Lunatic Asylums are located here, and a penitentiary is being built. There is one good foundery, an agricultural implement, and a sash and blind factory, and the shops of the R. & G. and Chatham Railroads. Great things are looked for in the completion of this last railroad, so as to bring coal to the city, and a cotton factory to run by steam is talked of. Dr. Hawkins, its president, and also president of the R. G. & Weldon Railroad, is one of the best railroad managers in the South or anywhere else, and is a man of enterprise and energy, disposed to encourage Northern settlers and desirous of building up this State. I well remember the old Raleigh & Gaston Railroad, with its flat strap rail, when we used to jump off the cars, steal apples from a neighboring orchard, and then catch the cars again by not even walking fast. There is now a vast change. It is not only a good road, but also a paying one.

Raleigh has no water power in its immediate limits, but a few miles off are good sites. On two of them are flourishing paper mills, and on another a flour and cotton-seed oil mill. There are at various points in the State agricultural implement factories, more than in any other Southern State.

I now return to New York, and for the present I bid the South adieu. I trust my letters have at least instructed some of your many readers as well as brought light on some of the many resources of the South. She only needs Northern capital and Northern energy to fulfill her destiny.

H. E. C.

CURE FOR IVY POISONING.—A correspondent writes that the extract of lobelia or a poultice made of the fresh leaves is a cure for ivy poisoning. It should be remembered, however, that the external application of this plant in excess may produce obstinate vomiting and even greater symptoms of poisoning. We should ourselves hesitate to use it except under the advice of an experienced physician.

THE thousand Chinamen who are working on the Alabama & Chattanooga Railroad, it is said, do not give satisfaction, and the experiment is not likely to be repeated in that section.

NEW BOOKS AND PUBLICATIONS.

ADRIFT WITH A VENGEANCE. Carlton, Publisher, Madison square, New York city.

Kinahan Cornwallis, the accomplished editor of the *Albion*, has given us in this volume a very graphic and entertaining story, which combines incidents of social life, travel, and adventure in a most thrilling and interesting manner. Its pages are crowded with incident and adventure and "hairbreadth 'scapes" in South Africa, Australia, and upon the treacherous deep, enough to furnish forth many such volumes. In the arrangement of his drama and the disposition of the characters, the writer has made excellent use of his own varied experience and knowledge of life. We can cordially commend this book as one well suited to enliven the smily circle on the dull winter evenings.

SCRIBNER'S MONTHLY, for December, contains a series of unique illustration of "The Street Venders of New York," "June Birds and their Flights," and the "The Hoosac Tunnel." It is an excellent number.

Business and Personal.

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

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4·00 a year. Advertisements 10c. a line.

House Planning.—Geo. J. Colby, Waterbury, Vt., offers information of value to all in planning a House. Send him your address!

Manufacturers of Blacking Boxes please send descriptive price list to R. H. Singleton, Nashville, Tenn.

Match splitting Machines wanted, by Paul Lechtenberg, Salt Lake City, Utah.

E. S. Hill, South Abington, Mass., can tell our correspondent how to blacken eyelets.

The Merriman Bolt Cutter—the best made. Send for Circulars. Brown & Barnes, Fair Haven, Conn.

Machinery for pulverizing sand and for crushing ores, is wanted by Pryor Lea, of Goliad, Texas.

$25,000 wanted by a M'f'g Co., in an extensive chemical wood treatment enterprize founded on important patents. Address S. & B., box 90, Postoffice, New York.

Peck's patent drop press. For circulars, address the sole manufacturers, Milo Peck & Co., New Haven, Ct.

Millstone Dressing Diamond Machine—Simple, effective, durable. For description of the above see Scientific American, Nov. 27th, 1869. Also, Glazier's Diamonds. John Dickinson, 64 Nassau st., N. Y.

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.

Small Steam Engines and fixtures, complete; hand lathes; foot and drop presses, cheap. Address J. Dane, Jr., Newark, N.J., who will contract with parties desiring machinery built at reasonable rates.

Rawhide Sash Cord has no equal for heavy windows or dumb-waiters. Makes the very best round belting. Darrow M'f'g Co., Bristol, Ct.

"507 Mechanical Movements."—This Book embraces all departments of mechanics. Each movement finely illustrated and fully described. To mechanics and inventors it is invaluable for references and study. Price $1. By mail $1·12. Address Theo. Tusch, 37 Park Row, N.Y.

Manufacturers and Patentees.—Agencies for the Pacific Coast wanted by Nathan Joseph & Co., 619 Washington st., San Francisco, who are already acting for several firms in the United States and Europe, to whom they can give references.

To Cure a Cough, Cold, or Sore Throat, use Brown's Bronchial Troches.

For Sale—The entire right of the best adjustable wrench. Price $5,000. J. F. Ronan, at Chickering's factory, Boston, Mass.

Machinery for two 500-tun propellers, 60-Horse Locomotive Boiler, nearly new, for sale by Wm. D. Andrews & Bro., 414 Water st., N.Y.

A very Valuable Patent for sale, the merits of which will be appreciated at sight. Apply to or address Jewell & Ehlen, 96 Liberty st., N.Y.

Improved Foot Lathes. Many a reader of this paper has one of them. Catalogues free. N. H. Baldwin, Laconia, N. H.

Foreman Machinist wanted. See advertisement.

Lighting Gas in Streets, Factories, etc., with Bartlett's Patent Torch saves great expense, all risks, etc. It is being adopted everywhere. Address J. W. Bartlett, 569 Broadway, New York.

Japanese Paper-ware Spittoons, Wash Basins, Bowls Pails, Milk Pans, Slop Jars, Chamber Pails, Trays. Perfectly water-proof. Will not break or rust. Send for circulars. Jennings Brothers, 352 Pearl st., N.Y.

Belting that is Belting.—Always send for the Best Philadelphia Oak-Tanned, to C. W. Arny, Manufacturer, 301 Cherry st., Phil'a.

For Fruit-Can Tools, Presses, Dies for all Metals, apply to Mays & Bliss, 118, 120, and 122 Plymouth st., Brooklyn, N. Y. Send for catalogue.

Parties in need of small Grey Iron Castings please address Enterprise Manufacturing Co., Philadelphia.

Excelsior Stump Puller & Rock Lifter. T.W.Fay, Camden, N.J.

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

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

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 96 Liberty 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. Price 25 cents per lb. 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.

The Largest Newspaper Mail

Which goes to any one firm in this country, is received by Geo. P. Rowell & Co., the New York Advertising Agents. Their place of business is at No. 40 Park Row.

QUERIES.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers, and hope to be able to make this column of inquiries and answers a popular and useful feature of the paper.]

1.—Can you inform me how fast steam passes through a pipe of a given size, say one inch in diameter, twenty feet long, and one hundred pounds pressure to the square inch in the boiler? How many cubic feet of steam will pass through such a pipe per minute?—P. C. C.

2.—I feel very grateful for the new space set apart in your very valuable and always interesting paper for persons seeking information to ask, and those who know to answer. I am a manufacturer in metals, and your paper has been worth to me, during the twelve years I have read it, more than six thousand dollars directly. I hope I may never be deprived of its perusal weekly. Can any of your numerous readers inform me of a cheap and neat way of coating black on small articles of brass in lots of fifty gross at a time.—W. A. M.

3.—I wish to gear from an upright water-wheel shaft to the horizontal crank shaft of my saw mill directly by bevel gears. The question is raised whether I can overcome the back lash caused by the action of the saw by a balance wheel, and make it run successfully. One millwright thinks I can, while two think I cannot. The upright shaft will run 150 and the saw shaft 300 times per minute.—J. B. W.

4.—All the other conditions being equal, which has the greatest ultimate range, without regard to accuracy, a rifled or smooth bore gun?—G. R.

5.—Where can I obtain india-rubber varnish? or get a recipe for making it? It must be transparent and durable.—L. H. B.

6.—I am a boat builder by profession, and use a good many galvanized nails, bolts, etc. In what way may I galvanize them myself? What kind of zinc must I use, and where can I obtain it? What are the details of the process?—J. M. S.

7.—Can some of your correspondents give the proportions of pulleys, distance between centers, and width of belt necessary for the best performance of a quarter twist belt? I propose to run one of these proportions—will it work well? Driving pulley, 30 inches; revolutions, 150; driven pulley, 24 inches; revolutions, 187; distance between centers, 14½ feet; width of belt, 10 inches.—J. F. K.

8.—Is the pressure on the cylinders of a locomotive greater when suddenly reversed under motion, and thereby caused to slip bodily forward on the rails, than when in starting the drivers are made to slip owing to inertia of load? and is any portion of the increase due to momentum, other things being equal, and the rapidity of friction the same?—H. W. C.

9.—I wish to know the U. S. standard weight of a tun of bituminous coal; also what a wagon body of the following dimensions will hold: 8 feet 7 inches long, 3 feet 3 inches wide, 12 inches deep. What are the standard dimensions of a coal box that will hold 2½ bushels? The reason I ask these questions is this; there are several persons that sell coal here, and I think their measures are wrong.—W. H. P.

10.—I have entirely lost the use of my lower limbs, but have full use of my hands. Now I want some kind of a vehicle that I can run on the street with. Will you please to send me the address of some one that keeps for sale or manufactures such a vehicle?—G. M. D.

11.—How can I make a fine black varnish for carriage harness? I have tried the recipe you gave in No. 18, but it makes the leather a dead, dull black, just the same as oil would do.—N. L. M.

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.

SILVERING CHEAP LOOKING-GLASSES.—"A. M." should place a sheet of glass, previously washed clean with water, on a table, and rub the whole surface with a rubber of cotton, wetted with distilled water, and afterwards with a solution of Rochelle salts in distilled water (1 of salt to 200 of water). Then take a solution, previously prepared by adding nitrate of silver to ammonia of commerce; the silver being gradually added until a brown precipitate commences to be produced; the solution is then filtered. For each square yard of glass I take as much of the above solution as contains 20 grammes (about 309 grains) of silver, and to this add as much of a solution of Rochelle salt as contains 14 grammes of salt, and the strength of the latter solution should be so adjusted to that of the silver solution that the total weight of the mixture above mentioned may be 60 grammes. In a minute or two after the mixture is made it becomes turbid, and it is then immediately to be poured over the surface of the glass, which has previously been placed on a perfectly horizontal table, but the plate is blocked up at one end, to give it an inclination about 1 in 40; the liquid is then poured in such a manner as to distribute it over the whole surface without allowing it to escape at the edges. When this is effected, the plate is placed in a horizontal position, at a temperature of about 68° F. The silver will begin to appear in about two minutes, and in about twenty or thirty minutes sufficient silver will be deposited. The mixture is then poured off the plate, and the silver it contains afterwards recovered. The surface is then washed four or five times, and the plate set up to dry. When dry, the plate is varnished, by pouring over it a varnish composed of gum damar, 20 parts; asphelate (bitumen of India), 5; gutta-percha, 5; and benzine, 75. This varnish hard on the glass, and the plate is then ready for use.—E. W., of Pa.

IRON CASTINGS.—"Young Molder's" difficulty may arise from various causes; the facing sand may be either too wet or too dry, or the mold too hard rammed, or the metal too slow poured into the mold. To prevent the first two, this must be left to his own judgment, as some qualities of sand can be wrought wetter than others; if too wet it will cause the iron to bubble and invariably scab; if too dry the blackening and sand will run before the metal, and in some cases will wash large pieces out of the face of the mold, particularly around the gate. Hard ramming will cause the mold to scab, the ramming depending on the weight of the casting; if heavy, must be rammed hard to prevent it from swelling, consequently the mold must be well vented and pricked in the face. Make up your pouring gate firm and clean, pour your metal quick and hot; never mind though skin is rough. By attending to the above it will assist you in making the castings solid.—J. T. H., of N. Y.

DRY PLATE PROCESS.—Would-be Photographer's query can easily be answered by referring to Anthony's *Photographic Bulletin* for March, page 30. This process is in use by Mr. T. C. Roche, the well-known veteran photographer, and his success with this formula was so marked that, to save much time and many questions, he was induced to publish it.

LACKERS.—I give the following recipes for "Indicator's" benefit: Deep gold lacker: 3 ounces seed lac, 1 ounce turmeric, ¼ ounce dragon's blood, 1 pint alcohol. Gold lacker: 1 pound ground turmeric 1½ ounces gamboge, 3½ pounds gum sandarach, ¾ pound powdered shellac, 2 gallons rectified spirits wine, 1 pint turpentine varnish. Digest for a week, frequently shaking the mixture, then decant and filter. Brass color: 1 ounce gamboge cut small, 3 ounces Cape aloes, 1 pound pale shellac, 2 gallons rectified spirit. I do not know of a pale colorless lacker —F. B., of Mass.

SCATTERING SHOT GUN.—J. J. T., of Texas, wishes a remedy for a scattering shot gun. Let him clean out his gun and scour the inside bright; then run on a little solder round the inside of the muzzle from one fourth to one half an inch down the barrel, and shoot the thickness of tin-foil. He will then have no further trouble. I think there is no difference in the sizes of shot about scattering, so long as they are not mixed. Mixed shot will scatter, because the large shot fly faster and farther than the small ones, besides being heavier and less liable to deviation from their course by currents of air.—A. C. D., of N. Y.

WHITE LIGHT.—Regarding J. O. K.'s query, many in this city have told me that they use the lime or calcium light for reading in the evening, saying that when the wear and tear of eyesight under the infliction of common gas is taken into consideration the lime light is the cheapest, and throws a clear white light. I find the kerosene lamp much preferable to gas, and use it for fine lathe work in the evening. Since I commenced it my eyesight does not trouble me in the least, and before that I had to suspend operations after dark.—E. B. B of N. Y.

SCALING BOILERS.—Some time ago I saw an inquiry in your paper in regard to methods of scaling boilers. I removed the scale from a ten horse-power boiler by boiling potatoes in it, as women remove scale from tea-kettles.

TO MAKE RUBBER BELTS STICK.—Put on a coat of boiled linseed oil, or hold on a piece of cold tallow while the belt is running, and then sprinkle on fine chalk. This will not hurt the rubber, because the belt does not absorb cold tallow.—C. E. G., of Ct.

H. M. P., of N. J.—Court plaster is made by applying several coats of a solution of isinglass with a little tincture of benzoin added, whilst warm, with a brush, to a piece of silk stretched on a frame, each coat being allowed to dry before the next is put on. It is supposed to be so called from having been used in former times by Court ladies for their patches.

F. E. H., of Mass.—The "fatting" of linseed oil for gold size is the result of the absorption of oxygen in the process of boiling, from the atmosphere, and also from the dryers added. The English method of preparing this size is to grind together red oxide of lead with the thickest drying oil that can be procured. To make it work freely it is mixed with oil of turpentine to the proper consistence. We cannot state the time necessary to bring the oil to the proper thickness, as it depends upon many variable circumstances.

M. F., of O.—Water free from mechanical impurities like that used in water-hammers, will not freeze quite as readily as that which contains nuclei for the commencement of crystallization. It will freeze, nevertheless, and might break the glass by its expansion. We have, however, had such an instrument in which the water has been frozen several times, without breaking.

J. B. R., of Mass.—The exposition of your query in a clear manner, would occupy more space than we can give to it. You should consult works on electro-magnetism, of which any good bookseller can furnish you with a list. We will say, however, that if a battery be made to supply a current to more than one magnet, the sustaining power of each will be less than the sustaining power of a single magnet, where the whole force of the battery is applied to it alone.

C. H. G., of N. Y., asks us to explain the following: In a saucer I dissolved one drachm nitrate of silver in one ounce of water, in another saucer I dissolved one ounce of hyposulphate of soda in one ounce water. I poured half of the hyposulphate of soda into the nitrate of silver, which turned to a thick, creamy paint. I then poured the remaining hyposulphate of soda into the paint, which again changed to a thin black fluid." *Answer.*—Some oxide of silver was at first precipitated, which was re-dissolved on addition of the hyposulphate.

J. N. W., of N. Y.—In a stream with sharp curves filled with water to the tops of its banks, there will be overflow at each sharp bend, and for some distance back of the bend, provided the velocity of the stream is sufficiently great. The effect of the bends is to obstruct the flow and set back the water, thus causing overflow.

J. S. M., of Tenn.—Meerschaum pipes and nearly every kind of tobacco pipes may be quickly and thoroughly cleaned, by connecting the stems by a small rubber connecter with a steam tap, and allowing the steam to blow through them The oily and gummy matters will all be softened and blown out.

D. T., of Md.—The use of glass bearings for the journals of car axles is not a new idea. It has been tried, and found not to answer a good purpose. Precisely the difficulties encountered, we cannot positively say, but that they failed is certain.

L. B. C., of Miss.—The following is recommended as a good method for making garden walks. Procure a sufficient quantity of stone broken rather fine; spread it out, basin fashion, and into the basin pour some heated tar; mix well. Then lay over your paths smoothly, sprinkle powdered quick lime over the top, and roll.

P. H., of Mo.—The moss-agate, or mochastone, is a transparent variety of agate, which is marked with an appearance like tufts of moss. This was formerly supposed to be a vegetable structure, but has now been shown to be a deposit of ferric oxide.

D. R. J., of Ala.—For large flow and low head, say ten feet or less, we believe the overshot water wheel will prove the most efficient. You can make a long wheel on a single shaft, or put in two, gearing into a single shaft.

O. H. L., of N. Y.—Wood gas has not found favor in this country.—Lime is usually employed to absorb the acetic acid from pyroligneous acid and as acetate of lime is a commercial article—see t article acetic acid in almost any encyclopædia.

R. J. S., of Ohio.—The best olive oil is, we believe, produced in the south of France. Much oil sold under this name, in this country, is adulterated with other fixed oils. Oil of poppies has been much used for this purpose.

D. L. G., of Va.—The conducting power of liquids, as a class, is very much less than that of solids. The conducting power of woods is in general from 2·5 to 4 times that of water.

S. J. W., of Iowa.—We have in our possession no such communication as the one to which you refer, and think it never came to hand.

G McD., of N. J.—A full account of the process of electroplating with iron was given on page 346, Vol. XXI., of the SCIENTIFIC AMERICAN.

R. S. S., of Australia—Brakes operating substantially like the one you propose, have been made. It is not probable that you could obtain a patent.

H. E. W., of N. Y.—Aniline dyes must be fixed by albumen—they are then tolerably permanent, depending upon the shade of color.

Inventions Patented in England by Americans.

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

PROVISIONAL PROTECTION FOR SIX MONTHS.

2,704.—SELF-LUBRICATING HUBS OR BOSSES FOR PULLEYS AND WHEELS.—D. McColley, Weston, Boston, Mass. October 13, 1870.

2,647.—REVOLVING AND OTHER HEELS FOR BOOTS AND SHOES.—J. Read Philadelphia, Pa. October 6, 1870.

2,663.—BEARINGS AND PACKINGS FOR SHAFTS, ETC.—E. D. Murfey, New York city. October 7, 1870.

2,675.—BREECH-LOADING FIRE-ARMS AND CARTRIDGES FOR THE SAME.—Hiram Berdan, New York city. October 10, 1870.

2,743.—SADDLE CLOTHS AND HORSE CLOTHING AND BLANKETS, AND IN PONCHOS OR OTHER COVERINGS.—Robert Spencer, New York city. Oct. 18, 1870.

2,762.—MANUFACTURE OF OIL AND OTHER PRODUCTS OF PETROLEUM.—C. Toppan, Wakefield, Mass. October 20, 1870.

2,764.—APPARATUS FOR WINDING THREAD ON TO BOBBINS.—Wm. Clark Newark, N. J. October 20, 1870.

Recent American and Foreign Patents.

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

PRESERVING EGGS.—John Kaye, Jr., Setzler's Store, Pa.—This invention relates to a new and useful improvement in the mode of preserving eggs whereby eggs may be kept perfectly sweet and fresh for months.

MANUFACTURE OF WROUGHT METAL WHEELS AND MACHINERY FOR THE SAME.—Barthelemy Brunon, Lyons, France.—This invention relates to a new method of manufacturing metal spoked wheels made of iron or such combination of iron that may be best suited for forging.

COMBINED ANCHOR AND BEAM SUPPORTER.—W. W. Goodrich, Rondout, N. Y.—This invention relates to a new and useful improvement in the mode of strengthening the walls of brick buildings, and consists in an anchor and beam or joist supporter combined.

FENCE POSTS.—A. M. Freeman, C. P. Ideli, and Bergen Vanderhoven, Metuchen, N. J.—This invention has for its object to furnish a cheap, convenient, strong, and durable fence post constructed in such a way as not to be liable to decay.

VEHICLE SPRING.—J. H. Gould, Burlingham, Ohio.—This invention relates to new and useful improvements in springs for carriages and all kinds of vehicles.

UMBRELLA LOCK.—Henry Clarke, Baltimore, Md.—This invention has for its object to furnish an improved device for attachment to umbrella handles, which shall be so constructed and arranged that the ribs of the umbrella may be conveniently locked when closed, so that no one except the owner or some one knowing the combination can unlock and open the umbrella.

COMBINATION LOCK.—S. K. Seelye, Hudson, Mich.—This invention relates to a new and useful improvement in locks, more especially designed to be used for fastening barn and stable doors, or doors of out-houses, and to be made of wood, but which may be made of metal, and used to good advantage on dwelling house and other similar doors.

COTTON GIN.—Leonard Watrous, Mystic River, Conn.—The object of this invention is to prevent the saws and ribs of the saw cotton gin from corroding from exposure to dampness and moisture.

WOODEN HOOP BOXES.—S. S. Barrie, Green Point, N. Y. This invention relates to a new and useful improvement in wooden hoop boxes for containing salt, fruit, spices, and similar articles or substances, and it consists in a metal tip for securing the champered ends of the hoops.

BOLT CUTTER AND SHEARS.—Isaac Dubois, Booneseborough, Iowa.—This invention consists in a combination with a pair of handles, pivoted together in the usual way, of a pair of bolt trimming cutters and a pair of shearing cutters, more particularly adapted for cutting flat strips of metal.

DITCHING MACHINE.—S. S. Wood, Brooklyn, N. Y.—This invention relates to improvements in ditching machines, and consists in a set of scoops or spades, mounted on endless belts, so arranged on rollers or drums, near the front of a frame or carriage of peculiar construction, working on two wheels, fore and aft, and partly sliding along the bottom of the ditch cut, that the said spades, being rotated by gearing connected with one of the wheels of the truck, will scoop up the earth in advance of the frame thrown in front of them by one of the sides, which cuts off a strip of earth the bank of a furrow made by a common plow, and throws it in advance of the spades, which carry it upwards and backwards, and deliver it, previous to passing over the upper roller, to an endless belt, which moves up an oblique trough, inclined also to one side, and provided with a discharging brush working obliquely across the top, to throw the earth sufficiently away that none will fall in the ditch.

METALLIC SLEEPERS FOR RAILWAYS.—Cyrus Fisher, Canton, Mass.—This invention consists in the arrangement of a hollow metallic tie; boxes cast inside the same near each end, wooden blocks placed on rubber cushions in the boxes with their fibers running vertically for the purpose of sustaining the rails on slightly elastic and not easily broken supports, and covering plates.

WINDMILL.—Alexander R. Randal, Avola, Mo.—This invention relates to a wind-wheel in which the sails are hinged upon the spokes, and connected with springs in such a manner that they may be set so as to bear a wind pressure of any desired number of pounds, and swing back whenever the pressure exceeds this number, so as to practically contract the surface on which the wind acts, and, at the same time, enlarge the spaces between between the sails through which the wind passes, thus getting rid of the surplus pressure of the same; the sails returning to the position in which they were set whenever said surplus pressure ceases.

SAFETY GUARD FOR PISTOLS.—Randall D. Hay, Crooked Creek, N. C.—This invention relates to an improved mechanism for preventing premature or accidental discharge of pistols, and consists in the arrangement of a guard which is automatically interposed between the nipple and hammer, and is retractible in no other way than by means of the trigger. The guard being always on the nipple so as to prevent communication of the spark to the charge whenever the hammer accidentally falls.

WASHING MACHINE.—John H. Dustan, Spartansburgh, Pa.—This invention consists in a corrugated and slotted squeezer worked with a reciprocating motion towards and away from the corrugated end of the suds-box and combined, by a pitman, with an elbow lever, operating through an orifice in the box cover, and with the rock-shaft on the top of the box to which the elbow lever is attached, said rock-shaft being provided with a spring that draws back the squeezer after it has been moved forward by hand; the suds-box being combined with a chamber which receives the water forced by the wringer out of the clothes, and conducts such water either back into the suds-box or away from the machine.

SAFETY GUARD FOR FIRE-ARMS.—Randall D. Hay, Crooked Creek, N. C.—This invention has for its object to prevent the premature discharge of fire-arms, and the accidents continually resulting from this cause. The invention consists in a guard that automatically interposes itself between the hammer and nipple of an ordinary muzzle-loader, or between the firing-pin and the metallic cartridge in needle breech-loaders, or between any two parts in a fire-arm, whatsoever they may be, which, by striking together, produce an explosion of the charge.

ANIMAL TRAP.—Thomas E. Marable, Petersburgh, Va.—The invention in this case consists in so arranging a series of horizontal radial arms, in connection with a vertical standard, rotated by a weighted cord, that they shall sweep a horizontal platform, which is furnished with a trap door held up by a spring. A pin, projecting from the door, acts as a stop for one of the arms, and when the animal steps on the door, it is depressed, the stop-pin withdrawn, and the radial arms sweep the animal into a suitable receptacle.

WINE AND LIQUOR FILTER.—Julius Strauss, New York city.—This invention relates to improvements in filtering and clarifying wine, whiskey, and other liquors and filter therefor, and consists of a cylindrical vessel preferably made in the parts, one considerably shorter than the other, and having a perforated bottom with one or more nozzles projecting downwards from it into which the holes discharge, said part connecting with the other serves mainly for a stand, so as to be readily disconnected, and the nozzles having filtering bags or sacks attached, for reception of the wine which, having pounded charcoal previously mixed with it, is poured into the upper vessel and allowed to percolate through the sacks.

WATER WHEEL.—Kenyon Cox and T. Cox, New York city.—This invention consists in the combination with radial buckets or pistons rigidly attached to the hub of the drawing shaft of a drum or ring made in sections of rings, preferably as many as there are pistons or buckets, and filled in grooves or guides at the ends of the case eccentric to the piston hub, which sections lap each other at the ends, and each has a hole at or about the center, through which a bucket extends; the whole revolving with the buckets and shifting on each other at the lapping ends as required by the constant changes of the buckets to the rim due to the eccentric arrangement of the one to the other, and closing the space at one side of the wheel against the passage of the water.

UNDERGROUND DRAIN.—Samuel H. Warner, Darbyville, Ohio.—This invention relates to improvements in underground drains, and consists in making the drains of plank in sections with a longitudinal, vertical dividing wall forming two spaces, one of which is open at the bottom, and receives the water which rises to the upper edge of the dividing wall, which is nearly as high as the wall side of the top of the drain, and passes on into the other space, in which it is conducted away.

VEHICLE WHEEL.—Thomas Jordan Smith, Connersville, Miss.—This invention relates to improvements in the construction of vehicle wheels, and consists in making a cast metal rim with socketed lugs on the inside for the ends of the spokes; also in making the hubs of two disks with recesses which form sockets for the other ends of the spokes when the two disks are bolted together; and also in providing detachable bearing blocks for the axle in recesses in the center of the hubs, the said bearings having a V or other formed groove receiving a corresponding collar on the axle which prevents end movement of the axle in the wheel. The said improvements are also applicable to spinning and other wheels.

BACK FOR PORCELAIN DOOR ROSES.—John J. Henderson, New York city.—This invention relates to a new cast metal back for porcelain door roses, and has for its object to so construct the same that both the thimble holding the rose, as well as the spindle of the lock, will find a reliable support in said back.

SKATE FASTENER.—Fred. C. Poole and Harry Howe, Boston, Mass.—This invention relates to a new heel fastening for skates of all kinds, and has for its object to make such fastening applicable to all kinds of boots and shoes, and adjustable in suitable degree.

HORSE HAY RAKE.—Oliver T. Nanny, Amity, N. Y.—This invention has for its object to furnish an improved horse hay rake, which shall be simple in construction, effective and reliable in operation, and easily operated.

OPERATING HIDE MILLS.—John G. Curtis, Emporium, Pa.—This invention relates to a new and useful improvements in mode of operating mills for softening or "milling" hides in the process of tanning leather, and it consists in combining a steam engine with the mill, so that the mill may be operated independently of any other machinery.

SCALE PROPELLER FOR STEAM BOILERS.—B. W. Reynolds, Evansville Ind.—This invention relates to a new and useful improvement in an apparatus for preventing the formation of scale on the bottom of steam boilers, and consists in producing a circulation of the water in the lower portion of the boiler, by means of an oscillating shaft, with movable or vibrating rings connected therewith.

NUT CRACKER.—Paul Geredo, Dusseldorf, Prussia.—This invention consists of a lever, having at the end of its shorter arm (which forms the movable jaw) a bowl or socket of proper form to receive or hold a nut, and having its fulcrum in a slot in a vertical standard, so that nuts placed in said movable jaw may be crushed against an upper stationary one, and fall through the slot or orifice into a box or other suitable receptacle.

BEE-HIVES.—George T. Wheeler, Mexico, N. Y.—This invention relates to a new and useful improvement in bee-hives, and consists in the mode of supporting and securing comb frames, and in the construction and arrangement of the honey boxes.

ADJUSTABLE FRAME FOR WINDOW SCREENS, ETC.—Henry R. Dexter, Putnam, Conn.—This invention has for its object to furnish an improved frame for screens for windows, doors, and other openings, which shall be simple in construction, inexpensive in manufacture, easily secured in place, and at the same time so constructed that it may be easily adjusted to various sized windows, thus enabling the purchaser to readily adjust them in place, without its being necessary to employ a mechanic to fit them to their places.

AUTOMATIC HARVESTER RAKE.—H. A. Stringer and Alexander F. Ward, Chatham, Canada.—This invention has for its object to furnish an improved automatic raking attachment for reapers, which shall be simple in construction, effective in operation, and at the same time compact and not liable to get out of order.

APPLE-PARING MACHINE.—Wm. Robb, 2d., South Stoddard, N. H.—This invention relates to improvements in apple paring machines, and it consists in an improved arrangement of that class of machines in which motion is imparted to the apple-holding fork by moving the frame carrying it, and part of the driving gear around a central pivot, and along the rim of a fixed segmental toothed rim, for discharging the apple by sliding the fork back after the apple has been pared, and the toothed pinion worked by the toothed rack has passed beyond it, behind a stripper, which arres the the rotary motion of the apple and detaches it from the fork.

SPINNING, DOUBLING, AND TWISTING MACHINERY.—Thomas N. Dale, Jr., and George Kraink, Paterson, N. J.—This invention relates to improvements in machinery for spinning, doubling, and twisting silk fibers for the manufacture of organzines or warps, trams, or weft, for the manufacture of silk goods, also for spinning and twisting sewing silk and twist, the said improved machinery being designed to accomplish in one machine the several operations of spinning, doubling and twisting now commonly performed in three separate machines, each of which occupies about the same area of space as the improved machines, which we devised, to perform all the said operations simultaneously.

HORSE CLIPPING MACHINE.—John C. Wilson, New York city.—This invention has for its object to furnish an improved horse-clipping machine, which shall be simple in construction, convenient in use, effective in operation, and so constructed that, should any of the teeth be accidentally broken, the plate to which they belong may be readily detached and replaced with a new one, at trifling expense.

HYDRAULIC STOP VALVE.—Charles S. Bailey, Mobile, Ala.—This invention has for its object to furnish an improvement in the construction of hydraulic stop valves, especially of hydraulic presses, which will prevent the water oil, or other liquid being used, from flowing back from one press, cylinder, or pipe, when the pressure is being applied to another, operated by the same pump or pumps.

MACHINE FOR CUTTING WINDOW-SHADE SLATS.—Francis A. Bixler, Nashville, Tenn.—The object of this invention is to so improve machines of this class that they will hold the stick more firmly in the proper position during their operation, while, at the same time, they will cut out the slat with the least possible expenditure of power.

HAND CORN PLANTER.—Peter McCollum, Fayette, Mo.—This invention has for its object to furnish an improved hand corn planter, which shall be so constructed as to scatter the kernels in the hill so that the plants need not be all pulled up in thinning out the hills.

ROTARY STIRRER AND COOLER.—Edward F. Hing, St. Louis, Mo.—The object of this invention is to provide, for public use, a machine by which lard, oils, or other substances of similar character, may be cooled rapidly and uniformly.

PLOW AND COTTON CULTIVATOR.—John R. Thomas, Mifflin, Pa.—This is a simple and convenient implement, so constructed that it can be adjusted to serve for all the various purposes required in plowing and preparing the ground, cultivating corn, cotton, etc., and marking off the land for planting.

SAWING MACHINE.—James R. Lambert, Sr., and James R. Lambert, Jr. Rockville, Ind.—This invention relates to a new sawing machine, which is so constructed that the saw will be properly guided, and not allowed to "whip."

CHILDREN'S DIAPER.—Mrs. Alice M. Hughes, Hudson City, N. J.—This invention relates to a new children's diaper, which is so made that it will conveniently fit children of larger or smaller size, and fully answer the object for which it is intended.

SALT FURNACE.—Calvin A. Shepard, Pomeroy, Ohio.—This invention consists in the application of a boiler, constructed of copper or wrought iron to the heating and evaporating of the water that is drawn from salt wells.

Official List of Patents.

Issued by the United States Patent Office

FOR THE WEEK ENDING NOV. 22, 1870.

Reported Officially for the Scientific American.

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109,367.—ELECTRO-NASAL DOUCHE.—S. E. Adams, Springfield, Ohio.

109,368.—SEAT FOR VEHICLES.—Daniel R. Allen, Cumberland, Me.

109,369.—GLASS LAMP.—J. S. Atterbury and T. B. Atterbury, Pittsburgh, Pa.

109,370.—MANUFACTURE OF LAMPS.—J. S. Atterbury and T. B. Atterbury, Pittsburgh, Pa.

109,371.—HYDRAULIC STOP VALVE.—C. S. Bailey, Mobile, Ala. Antedated Nov. 19, 1870.

109,372.—LIQUID METER.—Phineas Ball and Benaiah Fitts Worcester, Mass.

109,373.—WOODEN-HOOP BOX.—S. S. Barrie, Green Point, N. Y.

109,374.—SASH HOLDER.—G. F. Beardsley, Oxford, assignor to himself and A. S. Parker, Greene, N. Y.

109,375.—BROOM HOLDER.—W. H. Bixler (assignor to C. G. Beitel), Easton, Pa.

109,376.—BRICK MACHINE.—J. R. Armstrong, Elkhart, Ind., administrator of the estate of T. E. Bonner, deceased.

109,377.—SLIDING SEAT FOR CARRIAGES.—R. F. Briggs, Amesbury, Mass.

109,378.—TRACE BUCKLE.—Leroy Brooks, Mount Pleasant, Iowa.

109,379.—SOFTENING SHEEP AND OTHER SKINS.—J. M. Brown, Lynn, Mass.

109,380.—MANUFACTURE OF WROUGHT METAL WHEELS.—Barthelemy Brunon, Lyons, France.

109,381.—BUTTER WORKER.—Joshua N. Brush, Eyota, Minn.

109,382.—CLOTHES HOLDER FOR CLOTHESLINES.—M. V. Bulla, South Bend, Ind. Antedated Nov. 12, 1870.

109,383.—TINNERS' FIRE POT.—F. M. Campbell and L. W. Brown, Cleveland, Ohio. Antedated Nov. 9, 1870.

109,384.—SHEET-METAL COVER FOR SEWING MACHINES.—R. H. Chinn and J. F. Reigart, Washington, D. C.

109,385.—MACHINE FOR WASHING AND WRINGING CLOTHES.—Andrew Clark, Plymouth, Ohio.

109,386.—UMBRELLA LOCK.—Henry Clarke, Baltimore, Md.

109,387.—WASHING MACHINE.—D. C. Cooley, Wilkesbarre, Pa. Antedated Nov. 9, 1870.

109,388.—STEAM WHISTLE.—W. S. Cooper (assignor to Cooper, Jones & Cadbury), Philadelphia, Pa.

109,389.—POTATO DIGGER.—John W. Corwin, Lebanon, Ohio.

109,390.—WATER WHEEL.—Kenyon Cox and Theodore Cox, New York city.

109,391.—LATHING MACHINE.—George N. Creamer, Trenton N. J.

109,392.—BED PLATE FOR SAW MILLS.—A. J. Croft, Williamsport, Pa.

109,393.—OPERATING HIDE MILL.—J. G. Curtis, Emporium Pa.

109,394.—CAR SEAL.—John Dewe, Toronto, Canada.

109,395.—WINDOW SCREEN FRAME.—H. R. Dexter, Putnam, Conn.

109,396.—HEATING STOVE.—Andrew Dickey, Albany, N. Y., assignor to John S. Perry (trustee and executor), Andrew Dickey, and N. B. Perry.

109,397.—PRESS FOR THE MANUFACTURE OF ARTIFICIAL STONE.—Lewis Dodge, Chicago, Ill.

109,398.—LAWN MOWER.—Whitfield H. Drake, Musconetcong, N. J.

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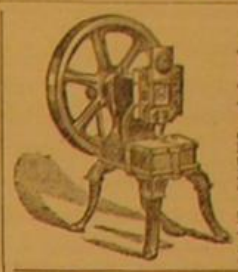

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SCIENTIFIC AMERICAN

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

Vol. XXIII.—No. 24. [NEW SERIES.] NEW YORK, DECEMBER 10, 1870. $3 per Annum. [IN ADVANCE.]

Improved Horse-Power Drilling Machine.

The sinking of wells by drilling, or what is commonly known among engineers as the "Artesian" system, is in many sections the only method of obtaining a permanent supply of pure water. In any locality it offers one important advantage over that of open wells, namely, the exclusion of surface water, which, unless great care and extra cost are expended in their construction, is apt to drain and leach into open wells, and contaminate their waters.

In sinking Artesian wells, or in boring for oil, when anything more than a few feet of earth, or rock, are required to be penetrated, the increasing weight of the drill attachments necessitates the use of greater power than manual labor can supply. In most localities, and for ordinary boring, the power of horses is more conveniently obtained than any other, and the object of the invention of which we give engravings herewith, is to furnish an improved system of applying such power to the purpose specified.

For this device the following advantages are claimed, viz: that it can do a given amount of work with less power than other appliances of the same class hitherto used; that it can be set up anywhere, on uneven ground, or in other circumstances of difficulty, and the horse power may be placed at any reasonable distance from the derrick, say, 200 feet; that it will give any length of stroke, from three inches to three feet; and that it is so easy of transportation, and can be set up with such facility that itmay be transported five miles and all its parts adjusted to work the same day.

MERRILL'S IMPROVED HORSE-POWER DRILLING MACHINE.

Fig. 1 is a perspective view of the apparatus, and Fig. 2 is a detail, showing in larger size, and more fully, the parts of the horse-power.

The horse is attached to the sweep, A, Fig. 2. This sweep imparts motion to the gear, B, and through it to the pinion, C, and the revolving lever, D. The revolving lever, D, is provided with friction rollers at its extremities, and actuates the lever, E, which, through the connecting rod, F, and chain, actuates the lever, G, Fig. 1. From this lever, G, a chain connects with a rope passing over a pulley at the top of the derrick to the drill, as shown.

Whenever the revolving lever, D, Fig. 2, disengages with the lever, E, the end opposite the lever, E, engages with the friction plate, H, Fig. 2, which affords sufficient resistance to prevent a sudden jerk upon the horse. This plate is provided with strong rubber springs, which, pressing it against the friction rollers on the revolving lever, give the required resistance.

In raising the drill out of the bore, a windlass and rope are employed, as shown in Fig. 1, the end of the rope being fastened at I, when not needed. As further assistance in raising the drill, when it becomes stuck in the bore, a workman places his feet on the lever, G, and seizing with his hands the bars, J, is enabled to exert a powerful leverage upon the drill, through the rope connecting it with the lever.

We are informed that this machine has already received an extensive application in boring wells, in various sections of the country, and that it is satisfactory in all respects.

Patented, May 4, 1869, through the Scientific American Patent Agency, by C. L. Merrill, whom address for machines or rights, at Watertown, N. Y.

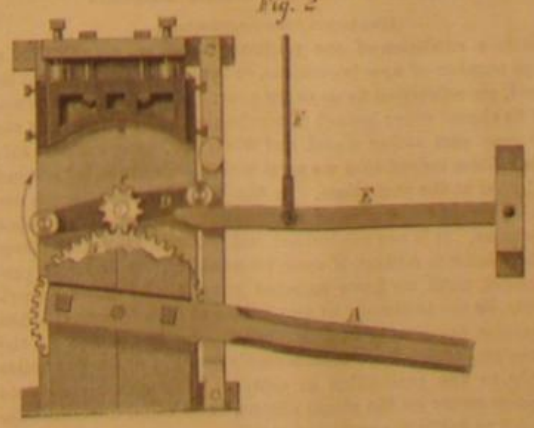
PITTSBURGH has thirty-two iron, nine steel, and two copper mills. The daily consumption of the iron mills is 1,200 tuns, and their annual production $23,000,000. There are forty-eight foundries, employing two thousand men in all, and, adding $5,000,000 per year to the wealth of our country.

CURRENCY OF JAPAN.

[Condensed from the Mechanics' Magazine.]

In Jeddo there were, up to a comparatively recent period, three separate establishments devoted to the production of coin. One of these was appropriated to each of the three metals employed. The gold mint, however, was destroyed by fire a few years since, and it has not been and will not be rebuilt. When in existence, no foreigner was allowed to inspect it, and therefore nothing authoritative can be said of its internal organization. The building, or series of buildings, rather, devoted to the coinage of silver money, is situated in a narrow street in the mercantile quarter of the capital. On entering the silver mint, the eye of the European would be first attracted by the extraordinary positions assumed by the work-people. Groups of men were seen in all directions, squatting on the ground and engaged in weighing, hammering, cutting, sorting, and packing the metal. A few officers, controlling the operations and giving instructions, moved about among the squatters. Let us take as an example of the processes carried on in respect of all the denominations of silver coin, the production of the itzebus of that metal. For the sake of simplification of description, we may speak of the past as if it were the present time.

Fig. 2



A massive block of silver of the requisite degree of fineness, as determined by assay, is placed in an iron ladle and reduced to a molten state by aid of a charcoal fire and a pair of blacksmith's bellows. The metal is poured into molds, that shape it into thin, rectangular bars, which are removed as soon as solidified and plunged into cold water. From the bath they are removed and handed one by one to a seated workman, who trims off their ragged edge by means of a pair of shears fixed to the ground. Another workman receives and improves their surfaces by hammering them. A third coiner, prepared with a pair of scales, weighs the bars and divides them into parcels, and a fourth shears them to the requisite length. The next operation is that of shearing the bars into short lengths, equal to that of the coin itself. Each bar yields eight coins. Another series of weighing now commences, and this demands the exercise of considerable skill and care, as it is also a test of the judgment with which the cutter has performed his task. The planchets which are below legal weight have to be returned to the melting ladle. Those which are correct in this respect are passed forward, and those which are too heavy are reduced by aid of shears. All the accepted planchets have next to be annealed and blanched.

These processes are effected by heating the embryo coins to redness over a charcoal fire, plunging them into cold water, and then immersing them in a bath of boiling acid. From this latter the planchets emerge with whitened or frosted surfaces of fine silver, the acid having attacked and dissolved the alloy. They are next planished on both sides by means of a flat-faced hammer. The edges are touched slightly in a similar manner, and thus the blank slips are made ready for stamping.

This operation is simple in the extreme. A workman places a single planchet, with thumb and finger, on a die firmly fixed, and resting on a solid bed. With his right hand he places another die on the top of the silver piece. A sledge hammer, wielded by an assistant, is the coining press.

The hammer, dexterously handled, falls in rapid succession upon the upper die, until the impressions—not very elaborate, but indicating the value of the coin—are completely transferred to both sides of the piece. When about a hundred have been thus dealt with, they are advanced another stage. A frame, so contrived as to receive that number on edge, stands near at hand, and boys place the itzebus within it. Small, star-like indentations are made by force of hammer on the edges of the coins, and this is the finishing touch in the manipulatory processes. Another weighing, however, takes place before the new coins are pronounced fit for circulation. It may so happen that the acid has bitten off too much metal from a small percentage of them, and the final test weighing decides this point. Those which are below a certain weight are returned to the ladle; the others, certified by the addition of an imperial stamp, are true and current money of the realm. In quantities of one hundred, the latter are packed carefully in stout paper, upon which a seal is imprinted, to guarantee to the public the number and quality of the coins within.

The order observable in the silver mint of Jeddo is remarkable. The men, as a rule, work as silently as if they were machines, although there are some hundreds of them engaged. When they enter upon their duties in the morning, they divest themselves of their garments—which are also rather primitive—and don clothes which are the property of the government. At the close of each day's work a gong is sounded, and its effect is magical. Some three hundred men and boys spring to their feet instantaneously. Divesting themselves of their working suits, with a rapidity equal to that which distinguishes clowns and pantaloons under process of transformation at a London theater, they scamper across the mint yard, and perhaps leap over a few hurdles in

their course. Their object is to pass as quickly as possible through a very disagreeable ordeal. They have all to be searched before leaving the establishment. The task is rendered less difficult than usual from the fact that when it is performed they are not encumbered with clothing of any kind. The examination, however, is rather more minute than would be pleasant to Europeans. Their back hair is carefully combed out, they wash their hands and hold them up to the view of the inspectors, take a draft of water, and are made to bawl loudly. Lastly, they are allowed to resume their morning costume and return to their respective homes.

ELECTRICITY NOT A DUAL FORCE.

BY RICHARD HIGGS, B.A.

Calorimetry teaches us that heat propagates itself through certain bodies with greater facility than through others. Some bodies likewise transmit electrical force better than others; those offering a ready passage are termed, in electrical science, *conductors*, and those offering a high resistance, *insulators*. Conductors and insulators are the same in kind, but differ in degree. Experiment proves that the best heat conductors are the best conductors of electricity. The following table will show the relative conductivities of various metals:

	Electricity. Mathiessen.	Heat. Wiedemann.
Silver	100	100
Copper	77·4	73·6
Gold	55·2	53·2
Sodium	37·4	..
Aluminum	33·8	..
Zinc	27·4	28·1
Potassium	20·8	..
Iron	14·4	11·9
Tin	11·4	15·0
Platinum	10·5	8·4
Lead	7·7	8·5
German silver	7·7	6·3
Antimony	4·3	..
Mercury	1·6	..
Bismuth	1·2	..

It will be seen that they generally agree as to order, but differ as to numerical relation. This difference may be accounted for by variations in the purity of the metals tested. The similarity in conductivity shows that electrical force and heat force are nearly allied. There then remains two theories by which we may explain the transmission of electrical force. Heat is supposed by most physicists to be the result of the vibration or motion of the atomic particles composing bodies, and this vibration produces the sensation of heat to our nerves. So far it is easy to follow the theory, but it is further stated that the vibrations which cause heat, take place not only among the atoms of which bodies are composed, but also in an ether supposed to surround each atom. This is difficult to understand, for if we consider gases or air to be made up of atoms, it is next to impossible to suppose that there is some intermolecular medium not made up of atoms, and which is yet not vacuous space, even though we may name it, mysteriously, ether.

The other theory is that so ably raised in reply to Faraday's objection that, if space be vacuous it must be an insulator, and there can be no transmission of electricity from particle to particle, and that therefore space must conduct. It has been answered that "if space be an insulator, and if a conducting atom charged with electricity can move through space into contact with another conducting atom, then there can be a transmission of electricity from atom to atom." In proof of this theory experiment has shown that, in liquids and solids subjected to electrical currents, there is molecular motion.

We have next to consider the kind of motion imparted to each atom, and here we must be content with theory alone. It can be inductively reasoned that the motion is circular, for as we conceive an atom to be circular in form, we must suppose it to follow the general law that when motion has been imparted to a spherical body, it revolves on its own axis in a direction answering to the line of force; a cannon-ball revolves in its passage through the air, and the earth itself in its passage through space. Regarding a conducting wire as a line of atoms, we know that if motion is imparted to one end of the line, it will be transmitted to each succeeding atom till the distant end is reached.

Let the reader take a dozen marbles, and place them in a line in the groove formed between the pages of an open book; let the nearest marble be struck, and the motion will be transmitted to the whole line, the last marble rolling some distance away. Let a spring that will always give the same force be arranged, and let the number of marbles be varied. It will be seen that the end marble moves farther away as the number is decreased; affording a good illustration that the force increases inversely as the length of the conducting line. Let now a sheet of paper, or a book, be placed perpendicularly for the end marble to strike against, and the marbles arranged in any number of lines—say three. If the three lines are impelled forward by the same motive power—a pencil held so as to strike the three lines at one time—the three end marbles will be impelled forward to the paper or book. Suppose that it were possible to register this action on the paper as three indentations, each of the same value, made in one second of time, it is plain we should have to impel one line three times—or once with three times the force—to produce the same value of indentation, and three times as fast to obtain three indentations in one second. The first result answers to electrical quantity, and the latter to electrical tension. We also see that with the greatest quantity the greatest amount of work is done, the resistance to be overcome being the same. Quantity, then, varies with the area affected; tension, with the number of times force is transmitted in a given time.

Having obtained some idea of the action of an atom when subjected to force, we have next to consider the direction of our force. If we consider electricity as a force, we must consider the normal atomic state to be that of comparative rest. Regarding an atom as a point in a line of force, the force tending towards that atom will be positive or negative to the force tending from the atom; positive and negative being used in the mathematical sense as referring to opposite directions. Electricians have termed that the positive current which flows from the copper pole to the zinc pole, or, inside the battery, from the zinc plate to the copper plate.

If the reader will make the following simple experiment, he will see that the positive current is the only visible current in a closed galvanic circuit. Take a battery and connect a piece of wire one end to each pole; sever the wire at any point, and apply the two ends to the tongue. On the side touched by the wire attached to the copper pole a sharp pricking sensation will be felt, and on that side only. Insert a galvanometer between the severed ends, and mark the direction of the index. Join up the severed wires, and insert the galvanometer in any other part of the circuit, the index will still point in the same direction, proving that there is but one current—that from the positive, or copper, pole. It would seem, then, that when electrical force is developed by chemical decomposition, the normal state of rest is destroyed, and force is imparted to the particles of the collecting plate and thence to line.

There is ground, then, for the supposition that the current flows from the seat of action in one direction only. In further proof, Faraday's experiment with a silver-copper couple may here be quoted. Let two plates, one of silver, the other of copper, be placed in a vessel containing sulphuret of potassium. The needle at first deflects in a direction which shows that the copper is the positive element of the pair; it then gradually returns to its first position, and again deflects in the opposite direction, showing that the silver is now the positive element. After some time it returns, and again deflects in the opposite direction, and goes on thus changing. If the plates be examined during these changes, it is observed that sulphuret of silver is formed when the silver plate is positive, and sulphuret of copper when the copper plate is positive.

Nowhere is there any indication of more than one current. What reason, then, is there to suppose electricity a dual force?—in a closed galvanic circuit we have seen that there is but one force exerted in one direction. The only phenomenon that can be supposed to give rise to the idea that two forces are set free occurs when earth is made to complete the circuit. The battery then appears to draw up a current from earth to zinc—note that the direction is still the same—as well as send a current from copper to earth. Before we suppose another force to account for this flow, let us see if it could not be produced by the already existing force. Imagine that the wire is a tube of water and that, at the point indicated by the battery, a force is applied which imparts motion to part of the water on the tube. We know that the rest of the water will flow in the same direction.

To return to our conducting wire: electrical force has been, and is being generated, the atoms in one part of the circuit are impelled forward to the limit of their space, and in their rear, so to speak, a kind of vacuum has been formed, having a tendency to increase, which the atoms in the other portion of the conductor endeavor to fill up, and, in the endeavor, are set in motion.

If this theory be true, it has the advantage in its favor that it does away with the complication of currents so difficult to the tyro in electrical science. Above all should we remember the aphorism, *Natura simplex est.*

Perhaps the greatest phenomenon of electricity is that it both produces, and is produced by, magnetism. Let us then define electricity to be, a force capable of generating, and being generated by, magnetism.

In a short time, the writer hopes to submit to his readers the application of this definition and of Ampere's beautiful, because practicable, theory to the phenomenon of static electrical force, and induction.—*Electric Telegraph and Railway Review.*

PARKER'S AIR-JET STEAM ENGINE.

[Condensed from Engineering.]

It is a condition of the position which we occupy that a large number of new inventions, or inventions supposed to be novel, are submitted to us every year. These inventions apply to almost every branch of mechanical science, and are for the most part either novel and worthless, or good and old. It is seldom indeed that we meet with an invention both novel and good at the same time. In the majority of instances we are expected to pronounce a favorable opinion by sanguine inventors. It is our misfortune, not our fault, that this favorable opinion is seldom, if ever, pronounced. It is never pronounced until we have satisfied ourselves by direct experiments, or the testimony of impartial and able judges, that the invention deserves to be well spoken of. Not a few of the inventions which have been recently brought under our notice apply to the production of power. They either constitute improvements on the steam engine, or in other machines intended to fulfill the same purpose.

The most noteworthy of these inventions consist mainly in combining air with steam, and using the combined fluid to actuate a piston or pistons. We seize this opportunity to state for the information of inventors that we pursue an invariable course when we are asked to witness trials of such novel apparatus. We are willing to inspect the machine at any time, but we decline to write a word about it for publication, unless we are afforded an opportunity of testing the invention fully and fairly. Very frequently such a test is refused altogether; in other cases it is submitted to, only under limitations which we decline to accept; most rarely we are told that the engine is at our disposal to do what we like with it. This last is precisely what Mr. Parker, the present owner of the patents taken out some years ago by his brother, has done, and it is fair to add that Mr. Parker is the only individual who has as yet given us the opportunity of determining by direct experiment, whether there is or is not any practical saving in fuel to be gained by mixing air with steam. We have never yet even seen a Warsop aero-steam engine at work. We were invited to examine a Galloway air engine, which we declined to do unless we were afforded permission to test it, of which offer no notice whatever was taken. The Marchant aero-steam engine is not yet ready for the test to which Mr. Marchant states he is quite willing we should submit his invention. It is the fault of other inventors if Mr. Parker's engine appears to receive an amount of attention in our columns denied to kindred machines.

We have already fully described the nature of Mr. Parker's invention in our impression of May 6, 1870. It will suffice now to recall to the recollection of our readers that the steam flowing from the boiler to the engine passes on its way through certain jets by the agency of which air is drawn in, as water is by an injector, which mixes with the steam, expands, and aids in the production of power within the cylinder. We have, in the impression just referred to, given particulars of one experiment which we carried out with all possible care. We desire now to call attention to another trial made with a much better engine in a somewhat different way—a way intended to secure the greatest possible accuracy.

To this end the steam, and the mixture of steam and air, were used under precisely the same conditions. Steam was raised in a vertical cylindrical boiler with twenty-four square feet of heating surface. The fuel used was coke. There was no blast or jet in the chimney, or other means of urging the combustion of the fuel. The arrangement of the steam and steam-air pipes was such that nothing more was required than the turning of a couple of cocks to put either system of pipes in use to the exclusion of the other. The engines are horizontal, 3½-in. cylinders, by 6-in. stroke. The fly wheel was fitted with a brake, and loaded with 21 pounds.

order to eliminate all the chances of error which may accrue when the economical efficacy of an engine is estimated by the consumption of fuel, we determined that the test should be intended to determine the amount of work which could be got out of a given weight of water when steam was used in the ordinary way, and the amount of work which could be got out of a given weight of water when a mixture of steam and air passed through the engine. The water was all measured gallon by gallon into a bucket, from which the pumps drew, so that no error other than one of infinitesimal amount could be made as to the quantity used. The load on the brake remained the same in both experiments. The number of revolutions was taken by a counter; each experiment lasted precisely one hour. The following is the result:

STEAM.

Started.	Stopped.	Consumption of water in gallons.	Total number of revolutions.	Revolutions per gallon.	Revolutions per minute.	Boiler pressure.
h. m.	h. m.					lbs. lbs.
11·57	12·57	15	9975	638·23	159·583	55 to 60

STEAM AND AIR.

Started.	Stopped.	Consumption of water in gallons.	Total number of revolutions.	Revolutions per gallon.	Revolutions per minute.	Boiler pressure.
h. m.	h. m.					lbs. lbs.
1·11	2·11	13	11742	903·23	185·7	50 to 58

From these figures it will be seen that steam alone only did, in round numbers, 70 per cent of the work done by steam and air mixed. In other words, the use of the combined fluids effected a saving of about 41½ per cent. Neither the actual power developed nor the consumption of fuel was noted; as on former occasions the steam pipe, 1½-in. in diameter, which receives the mixture of steam and air from the nozzles, and conveys it to the cylinders, passed through a small coke fire for about 20 inches of its length.

We are informed that this little superheating apparatus is found to promote economy very much. That it promotes it to some extent is certain, but it must be to a very moderate degree. We have heard it asserted that to this fire, and to this alone, the whole economy of the Parker system is due. To argue this point on one ground alone, it is evident that those who make the absurd assertion tell us directly that 20-in. of 1½-in. steam pipe, or, in other words, say ninety square inches of heating surface or thereabout, is so efficient that it can increase by 40 per cent the economical efficiency of a steam engine supplied by a boiler producing 24 feet of heating surface. It is unnecessary, we think, to waste time in refuting such an error.

RUSSIAN COTTON FACTORIES.—Russia has 667 cotton factories, employing 180,000 operatives. Before the war in this country cotton manufacture had scarcely commenced in Russia. During that period, however, the Russians began to manufacture Bokhara, Persian, Indian, and other cotton, and it is said that their factories are now the most magnificent in the world, exceeding in style and completeness even the English establishments. The products amount to $50,000,000 annually.

THE BEECH AND ITS PRODUCTS.

BY W. A. WETHERBEE, M. D.

The common beech, or *Fagus sylvatica* of the ancient Romans, is described by botanists as a beautiful tree, from 40 to 100 feet in hight, with a thin, smooth, whitish bark, and common to various parts of America and Europe. The wood, from its hardness and uniform texture, is highly valued for making plane stocks, and various other mechanical implements, shoe-pegs, etc., and when dry it is much used for fuel, especially in Paris, where it is called "*bois d' andelle.*" Its shavings, previously soaked in vinegar, are employed in the manufacture of the so-called white wine vinegar by the quick process. One pint of alcohol of 80 per cent is mixed with five or six parts of water, to which is added a minute proportion of yeast, honey, or extract of malt, and this mixture, heated to 80 degrees, is made to pass slowly through a perforated cask containing the shavings, after passing themixture three or four times through the loose shavings, it is completely converted into acetic acid. The beech-wood shavings are found preferable for this purpose, because they contain no essential oil which would arrest the acetous fermentation, and no marked or disagreeable flavor which would be imparted to the vinegar.

Beech wood, when dried and subjected to the destructive distillation, yields water, wood naphtha, tar, and pyroligneous acid, and is one of the woods preferred for this purpose.

Next in importance to the wood of the beech, yet scarcely inferior, is the fruit, or nut, called in many parts of England "beech mast," where it is extensively used, as it also is in this country, and especially in some of the Middle and Southwestern States as food for swine, which, before the mast has ripened, are turned in herds into the beech forest, where they remain till the time for slaughtering. The fruit consists of a capsule or *bur*, as it is sometimes called, containing, when perfect, two sharp-cornered, triangular nuts, of a pale, reddish brown color, and having within each a white kernel of a rich, pleasant taste, and abounding in a clear, yellow, inodorous oil, which may be obtained by hot or cold expression, in the same manner as that of the castor oil bean, cotton seed, etc. The usual yield is about 16 per cent. The nuts, which, at the early frosts of Autumn, fall to the ground by the opening of the capsule, and are usually gathered by children, are deprived of their shells before expressing the oil, and the residue, or oil-cake, is excellent as food for cattle, swine or poultry. This use of beech-nuts, however, is seldom made in this country or England, the principal harvesters being swine and turkeys; but in France, and some other parts of Europe, this branch of industry becomes a source of considerable profit to the inhabitants.

The oil, when obtained by the cold process, is at first slightly acrid to the taste, but this property is wholly dissipated by keeping a short time, or by boiling with water.

At 60 degrees Fahrenheit, it has a specific gravity of 0·9225, and at 29 degrees, it becomes solid. One thousand parts of alcohol of 90 per cent will dissolve four parts of the oil, but it is completely insoluble in water. Its composition is carbon, 79·77; hydrogen, 10·57; and oxygen, 9·12, with a trace of extradine matter, etc., in each one hundred parts. Like other expressed oils, it produces *acrolein*, or the hydrated oxide of acryl, by destructive distillation at a high temperature. By treatment with nitric acid, it also, like other nut oils, yields *elaidin*, or *elaidic acid*, in combination with *oxide of glyceryle*, and in about 103 minutes is, by this process, converted into a bluish green solid. The soap made from this oil is of a dirty gray color, becoming yellow by exposure to the air, and having a slightly characteristic odor of the oil. It is somewhat greasy and pasty, and for these reasons is less valuable to the soap-maker than many other kinds of vegetable oils, though in France it is extensively used for this purpose. Three pounds of the oil will make five and a quarter pounds of soap, as taken from the frame, which, in two or three months, by drying, will lose a considerable portion of its weight.

Beech-nut oil, however, is most valuable for culinary and lighting purposes, for the former of which it is considered very wholesome and palatable, and to a great extent takes the place of butter and lard among the French and German inhabitants of certain districts, and when used for the latter, it burns well, gives a good light, which is free from smoke.

When properly refined it is good for lubricating delicate machinery, such as clocks, etc., and for the preparation of hair-oils, pomatums, liniments, ointments, and for many other purposes it is not inferior to most of the vegetable fatty oils.

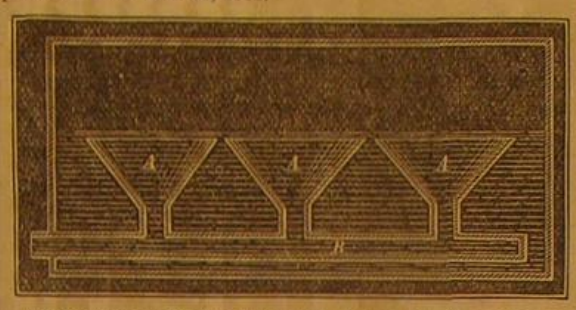
As the flesh of swine and poultry fed upon beech-nuts is apt to be soft and oily, it is, therefore, somewhat strange that the oil is not expressed to a greater extent in this country, and the residue sold, as it readily could be, for feed. Probably, if our Western pork and poultry were fed upon this cake and afterwards fattened upon corn and water or ground feed, they would bring a higher price, while at the present day they bring less than those which are fattened in New York, Pennsylvania, or New Jersey. This branch of industry affords a good opportunity for some party of capital and enterprise to add to his finances and to the list of the useful arts which are carried on in this country.

The bark of the beech, although not abundant in quantity or weight as compared with other portions of the tree, is sometimes used in tanning leather, and yields by analysis about two per cent of tannin. Although occasionally employed for this purpose, we believe that other articles are most generally substituted.

Several species of the beech are known, but they are mostly allied to each other so intimately as not to require a separate description. One remarkable variety, the original of which was found in a forest of Germany, nearly one hundred years ago, puts forth leaves which at first are of a cherry-red color, but when they attain their full size become a very dark purple. Though this variety has become quite common as an ornamental shade-tree in the parks and pleasure-grounds of Europe, we are not aware that any specimens have ever been planted in America except in the Central Park of New York, which, as we are informed, contains two or three. A sub-variety of the above bears leaves of a copper-color, and is also found in many of the parks of Europe.—*The Arts.*

BOILER CLEANER.

Our correspondent at Washington calls our attention to the fact that the boiler cleaning device described by T. C., on page 339, was patented Nov. 6, 1867, by Seward & Smith, and R. Needham, all of England, from whence T. C. probably obtained his ideas on this subject—the apparatus having been patented there Dec. 26, 1861.



Annexed is a sketch of another device for the same purpose from a rejected application filed by G. Ortleib, in 1852. It consists of a series of funnel-shaped vessels, *a a*, connected at their bottoms to a horizontal tube, *b*, having at its outer end a blow-off cock. The tops of these vessels reach to near the top of the water, and the scum settles in them and is blown out in the same way as in the apparatus described by T. C.

The Value of American Hemp in Medicine.

Dr. H. C. Wood, Jr., has written an essay, which he read before the Amer. Phil. Society, in which he records some experiments with an article of hemp grown in Kentucky. He took an alcoholic extract made from the dried leaves, swallowing at a dose nearly all the product of an ounce and a half of the leaves, with the effect of profound hemp intoxication. It proved to be toxic in its power, although he recovered himself in a day or two. He had all the exuberant hilarity usually experienced from the hemp, followed by a feeling of fear of impending death; this took so deep a hold on him that it was impossible to shake it off.

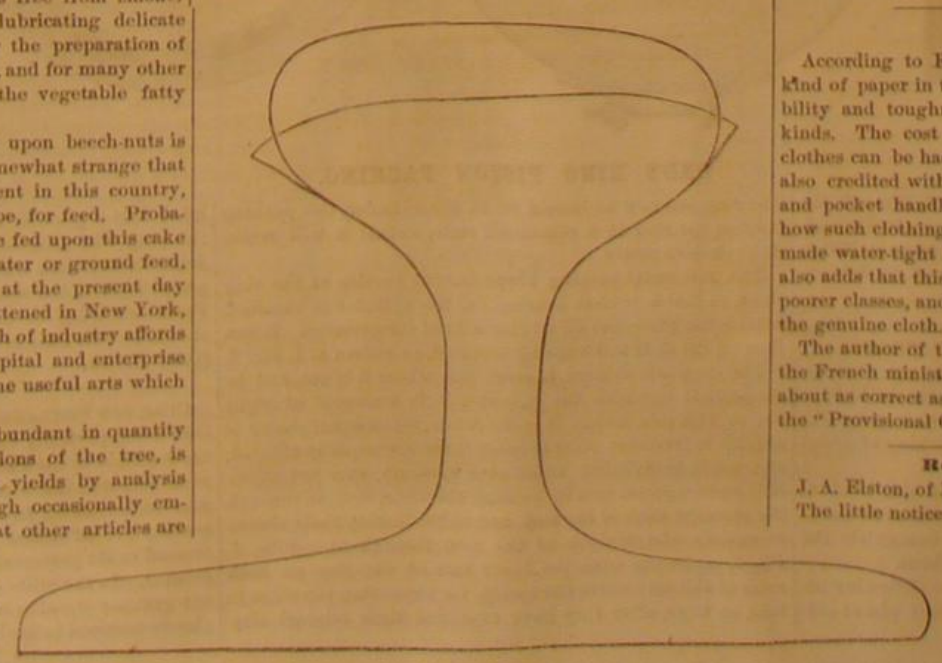
Other trials he has made with it convince him that it has more power than that brought from India, on one occasion four times the dose of the latter failing to produce the effect of the Kentucky specimen.

He has his extract made from a tincture, removing certain inert matters by an alkali; he intimates the hope that in the present revision of the U. S. Pharmacopœia the *ex cannibis purifactum* may be replaced by a preparation to be called *Resena cannibis*, and to be made by precipitating the concentrated tincture by water rendered strongly alkaline by soda or potash.

The native plant, if used, will always be more reliable than the imported, from the certainty of freshness, while the cost of it is hardly anything.

WEAR OF RAILS--LONDON UNDERGROUND RAILWAY.

A friend of ours while in London a few weeks since, was very courteously treated by the Chief Engineers and Assistants of the Underground Railway; he was shown, among other things, a new piece of rail, such as is used on the line, and a piece taken up from near one of the stations after being in three months. The great wear in so short a time, as shown in the accompanying sketch, is due to the fact that trains are run every two or three minutes; the stations being on an average about half a mile apart, it is necessary to run without slackening speed until very near the stopping places, when the brakes being applied, the wheels cease to revolve, and the whole train slides along bodily, while sparks fly off the rail as they do from a wheel when a tool is being ground; by this means the train is brought to a sudden stop with trifling loss of time. If this were not done the company could never accommodate the vast number of passengers who patronize the line.



American Colleges.

The typical American college ranks but little, if any, higher than the typical German gymnasium in the amount and quality of its mental training. There has been a great deal of boasting about our system of public education, as if it excelled every other in the world; while in fact we are far behind the Germans in point of popular intelligence. We are far from wishing to disparage any true American merit; but it is foolish, not to say dangerous, to give undue importance to events and results merely because they have been brought about by us as a people.

It is better to look at our own institutions and at those of other lands with the naked eye of criticism than to gaze at the one through the magnifying lenses of self-glorification, and then, reversing the glass, to belittle the other. The existence of our democracy very much depends on the thorough and universal spread of intelligence among our masses. We entertain no fears that the standard of popular education is to be made lower. On the contrary we expect to see it continually rising.

Every factor in our system has a part to perform in this work; and it seems to us that the governing bodies of our colleges and universities have it in their power to accelerate this movement. Let the standard of admission and scholarship be raised in our colleges, and at once the preparatory schools come up to a higher plane. The whole commonwealth is made sensible of an advance. Let the men who form the vanguard of our army of instructors move forward, let the word go through the rank and file, "Onward!" and our American universities will one day compare favorably with those of Europe.

Figures have lately been presented to the public showing that in New England the attendance at colleges for the past few years has been less in proportion to the population than in former times. This surely is not flattering. One cause of this was the late rebellion. Another cause is the popular notion that self-made men are never college graduates. This fallacy is to be combated and exploded. The people must be taught that the college is the place where a young man may best fit himself for the duties of American citizenship. Again, we as a nation are too much in a hurry. Our young men plunge into business or take up some profession before they are half prepared to make their career a success. It will require a long, long time, and much labor, to check this over hasty tendency, and to create a public opinion in favor of a long and close course of study. But we think it can be done.

Our history will one day have taught us its lessons, and on that day it will be felt that our ablest, our truest, our strongest men are those who have plodded patiently through their studies, who sifted the details and made clean work wherever they went. May it be our privilege to give some impetus to the cause. May we all do what we can to influence our fellows to give their earlier years to earnest work in the fields of art, science, and literature.—*Cornell Era.*

India Rubber Inexhaustible.

The belt of land around the globe, five hundred miles north and five hundred miles south of the equator, abounds in trees producing the gum of india-rubber. They can be tapped, it is stated, for twenty successive seasons, without injury; and the trees stand so close that one man can gather the sap of eighty in a day, each tree yielding, on an average, three tablespoonfuls daily. Forty-three thousand of these trees have been counted in a tract of country thirty miles long by eight wide. There are in America and Europe more than one hundred and fifty manufactories of india-rubber articles, employing some five hundred operatives each, and consuming more than 10,000,000 pounds of the gum per year, and the business is considered to be still in its infancy. But to whatever extent it may increase, there will still be plenty of rubber to supply the demand.

Paper Clothing.

According to French journals, we have discovered a new kind of paper in this country, characterized by unusual flexibility and toughness, admirably adapted for clothing of all kinds. The cost of the material is so cheap that a suit of clothes can be had for one dollar. Besides clothing, we are also credited with the preparation of napkins, table-cloths, and pocket handkerchiefs. The veracious Frenchman asks how such clothing will bear the rain, and presumes that it is made water-tight in some way, and thus weather proof. He also adds that this kind of paper clothing is intended for the poorer classes, and that it is impossible to distinguish it from the genuine cloth.

The author of this information must have taken lessons of the French ministry before publishing it to the world. It is about as correct as the news now served out to the people by the "Provisional Government."

Result of a Paragraph.

J. A. Elston, of Elston Station, Mo., writes as follows: The little notice in the SCIENTIFIC AMERICAN of my sawing machine, for which you obtained letters patent for me, has elicited inquiries from Canada to Texas, and from Florida to California, so that I am unable to answer half of them.

Improvement in Burglar-Proof Safes.

That the construction of safes has not been brought to its highest degree of perfection is evidenced by the fact, that every now and then the public is startled and alarmed by the news that some one or other of these devices upon whose impregnability entire confidence had been reposed, has been opened, and a rich harvest gathered by expert burglars.

The problem to be solved is, how to construct a safe so that within the limited time during which burglers can operate, it may resist any and all means of attack. The inventor of the safe which forms the subject of the present article, and of which the accompanying engraving is a good representation, claims that he has solved this problem.

The advantages claimed are: Reduction of the number of external plates; avoidance of homogeneity in the materials used, by which drilling is rendered difficult; the nicety of fit in the joints, and the avoidance of any bolt-holes through the external plates; the attainment of a cylindrical form by which the strength of the structure is greatly increased; provision against the oxyhydrogen blow-pipe, by constructing the body, back, and door of alternate plates of iron, and ribbed steel and iron welded together and hardened by a new process; the interstices of the ribbed steel, and each plate being thoroughly embedded into and filled up with a preparation to resist both heat and the drill.

The outside plate of the body of the safe consists of one immense hoop or plate, which is bent into shape on a former, the power used being that of an hydraulic apparatus, exerting a force of 220 tuns. This hoop when bent is, as intimated above, of the form of a cylindroid, the usual rectangular corners being truncated, or more properly rounded at top and bottom. The same may be said of all the interior plates.

Inside the exterior hoop or plate are four others. The one next the external shell is of iron and ribbed steel welded together. The backing of tough iron to which the steel is welded, prevents the breaking of the plate by sledges or other means.

The next, or third hoop, is of iron, and fits within the second, and the fourth plate is a compound one of iron welded to ribbed steel like the second one described. The fifth plate is of iron, which forms the lining of the safe.

The plates are bound together as follows: The central iron plate has countersunk holes drilled in it to receive a corresponding number of bolts. The compound iron and steel plate receives a like number of perforations through which the bolts pass into the central plate, and penetrate the outer plate to within half an inch of its outer surface. The bolts are steel pointed, and therefore a tool striking one of them would be stopped or diverted. Thus the three outer shells are bound into one solid body. The two inner plates are likewise held together by the same number of bolts countersunk into the outer face of the central band.

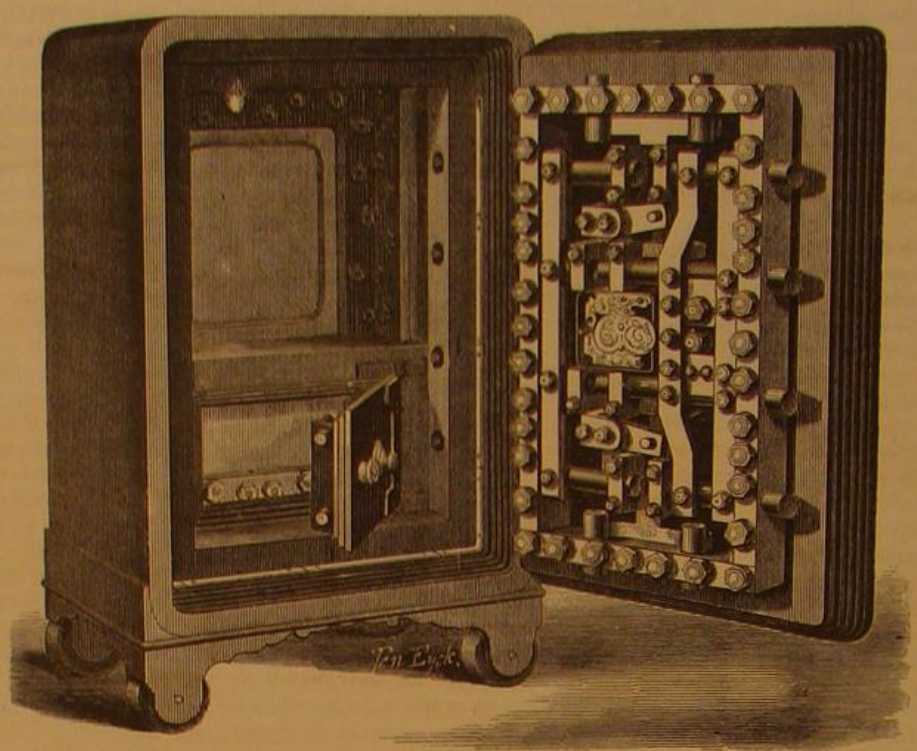
The use of the blow-pipe is also defeated by such a mass of metal conducting away and dispersing the heat.

The back and the door are composed of similar plates and bolted together in the same manner. The back is attached to the side walls by angle irons extending entirely around the safe.

The method of jointing by ledges or steps, is a precaution against the use of the wedge.

The guides of the locking bolts are attached to the plates of the door by bolts. The jams into which these bolts slide are designed to be the strongest part of the safe. They extend entirely around the inner front of the safe, and are attached to the body from the inside.

A double metallic spring, with rubber face, is fitted into a recess in the door. The door, in closing, shuts down upon this packing, and makes an air-tight joint. Various patents on this safe, bearing date from November 30, 1869, to March 15, 1870, have been obtained, through the Scientific American Patent Agency, by William McFarland, of Brooklyn, N. Y. For further information address Tilton & McFarland Safe Manufacturing Co., 95 and 97 Liberty street, New York.



THE DREADNOUGHT BURGLAR-PROOF SAFE.

Improvement in Ring Packing for Pistons.

Of all methods of packing the pistons of steam engines, steam pumps, etc., ring packing stands justly in highest favor. When properly adjusted this packing secures perfect tightness, with less friction than any other packing of equal efficiency.

We this week illustrate an improvement in this kind of packing, having for its object to provide a convenient packing for the split parts of the rings, and also to regulate the elasticity of the rings, making it equal throughout.

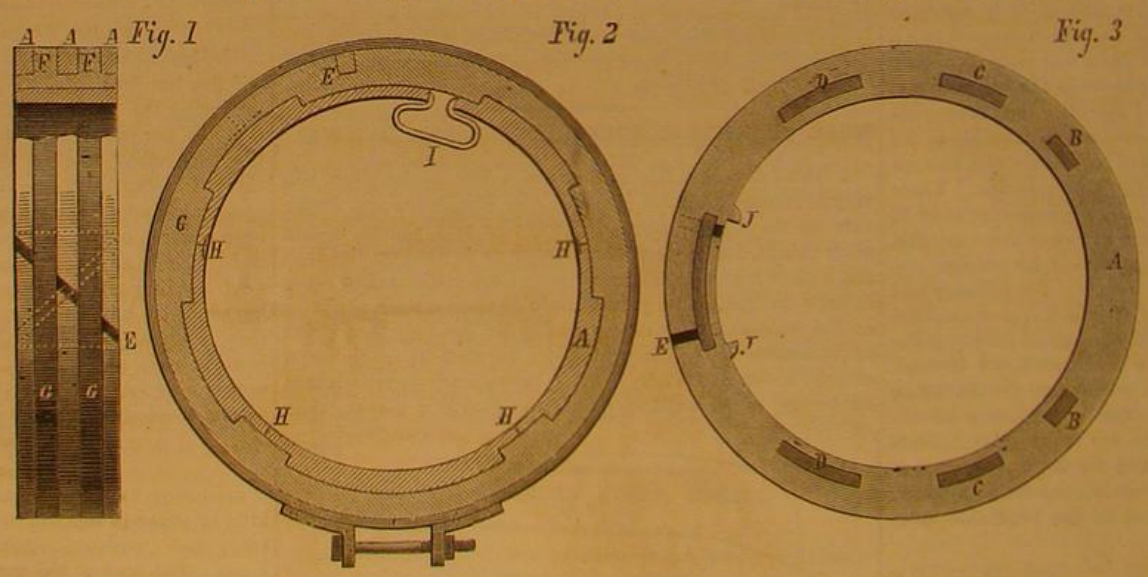
It is claimed that this method possesses the following advantages: First, the ring is complete in a single piece; second, it is self-adjusting; third, a wider range of expansion is secured; and, fourth, it cannot be put in wrong when perfectly made.

We are informed that a number of these rings have been put into practical use, giving entire satisfaction, and that it took the first premium at the late Northern Ohio State Fair. The rings are adapted to cylinders of all dimensions.

The invention consists in so constructing and grooving the ring that it will readily receive a packing of Babbitt or other soft metal, which retains the ring in a compressed state, allowing it to exert its elasticity to produce a tight fit; secondly, in weakening the rings by slots at the sides, so as to thereby equalize the elasticity; and, thirdly, in providing a spring on the inner side of the ring, in case its elasticity should become impaired through wear or otherwise. A in the engravings represents the piston ring. It is made of suitable width and thickness, cast of suitable material, with transverse slots, B, C, D, extending through it from face to face. The ring is cast larger than the cylinder for which it is intended, and is then grooved on the edge, as shown at Fig. 1, the grooves reaching the transverse slots, shown in Fig. 3.

The ring is now cut obliquely near the slot, at E, a piece being taken out as large as will allow compression to the required size. It is then compressed by a bolt and strap, as shown in Fig. 2.

The soft metal packing, G, is cast into the slots, B, C, D, and allowed to branch into the grooves, F, filling them entirely, and holding the compressed ring in a contracted state.



ORD'S RING PISTON PACKING.

The ring can now be turned to fit the cylinder, the packing holding the ring in a contracted state, so that it will retain its expansive power.

The soft metal packing keeps the cut portion of the ring tight, so that a perfect bearing on the cylinder is obtained until it has given out all its elasticity of compression. It can then be cut at H and a spring inserted, as shown at I, Fig. 2.

The ring, it is evident, is weakened where it is cut, and in diametrical line with the cut, and it is strongest at right angles with said line. It is, therefore, when equal power is applied to its entire outer or inner surface, unequally affected, and would be flattened under each pressure, were not provision made against this by putting the slots, B, C, D, through the stronger sides of the ring, and so graduating their size as to equalize the strength of the ring throughout. Ribs, J, Fig. 3, projecting from the inner face of the ring on both sides of the cut receive the spring, for expanding the rings to take up wear, after they have expended their original elasticity. Patented, through the Scientific American Patent Agency, November 15, 1870, by William Ord, whom address for further information, at Brooklyn, Ohio.

Sun Spots.

The first symptom of a spot appearing is a tiny speck upon the photosphere, as the luminous exterior of the sun is called This goes on enlarging, sometimes quickly through a few hours, sometimes slowly through many days: and as it grows it developes a double character—a black center and a gray penumbral fringe increasing together. There is no order or constancy in the matter of size, but in the matter of form there is noticed a general tendency to rough circularity while a spot is growing; and this shape is preserved, with small variations, until it begins to dissipate. Neither is there any regularity in the period of existence of spots; some will come and go in a day, others will remain in their full grown state for many months. When the time of breaking-up arrives, the boundary becomes irregular, and sometimes a sort of whirlpool action manifests itself, if it has not appeared before; the luminous matter of the photosphere intrudes itself in tongue-like masses into the chasm, and even bridges over it, parts of the penumbral fringe break away, the nucleus divides, and a general wrecking ensues, the *disjecta membra* scattering themselves far and wide, and dissipating as they disperse. The forces concerned in these dislocations must be stupendous indeed; masses of matter, probably thousands of cubic miles in bulk, are hurled over hundreds of miles in a few minutes, sometimes in a few seconds of time. The commotions that tear the solar surface are to the most tremendous earthquakes to which our globe has been subjected as are these last to the turning of the husbandman's sods.

And now to the question: What is a solar spot? Would that we could give it a satisfactory answer! The philosophers are groping for one now, as they were a century ago; but there is this consolation, that they are a century nearer to a solution, and there is hope that they will reach it long before such an interval again expires. An immense stride has been taken through the agency of the new science of spectrum analysis. The prism has shown that light does come from a solar spot, and that it is light of very peculiar character; not of that heterogeneous kind which we receive from the general body of the sun, but of the homogeneous nature which belongs to glowing gases. And in particular has it revealed that the prevailing element [hydrogen] is most conspicuous in the seeming black hole. More than this, by a highly-refined measure of light-motion, which cannot be popularly elucidated in such space as we have at command, it has been shown that there are down-rushings and up-rushings of the gaseous currents within the area of a spot, the very speeds of which have been approximately ascertained. So that toward a reply to our question we have the inference that a solar spot is a crateral opening in the light-giving shell of the sun, through which an interchange of gaseous currents is taking place between the interior of the globe and the atmosphere by which it is surrounded, which atmosphere there is good reason to believe is largely composed of flaming hydrogen gas.

The Scientific American

We are are in regular receipt of this popular and valuable scientific journal, and we know of no publishing house to which we feel more indebted for theoretical and practical scientific information than the enterprising firm of MUNN & Co., of New York

The SCIENTIFIC AMERICAN stands without a rival on the American continent, and can justly claim the undisputed rank that its foremost career deserves. It is full of useful and scientific information collated into a popular and elaborate form; it sets every one thinking who undertakes to read any of its able articles, and forms an excellent encyclopædia of the material and scientific progression of the world. We never wish to miss a number. Parties desiring to have their names placed on the books should lose no time in forwarding their orders.—*Peterborough (Ont.) Review.*

CURE FOR SOMNAMBULISM.—Two instances of somnambulism being perfectly cured by means of bromide of potassium are recorded in the Paris *Les Mondes*. A woman twenty-four years old, who had attacks two or three times a week for ten years, after taking two grammes of bromide of potassium in seventy-five of water daily, the dose being gradually increased to six grammes, was entirely cured at the end of two months. In the other case a girl of eight years, after taking one gramme morning and evening for a short time, was completely restored to health.

Self-Oiling Seamless Wagon Skein Box.

The improvement which we herewith place before our readers, consists in providing a way whereby the axles of wagons can be oiled without the trouble and delay of removing the nut and wheel, and also in securing more perfect and uniform lubrication, which, under all ordinary circumstances, prevents the axles from becoming dry, so as to increase friction and wear.

Fig. 1 is a longitudinal section of the axle skein box and nut.

The oil is put in at A, and running down a longitudinal groove, B, made in the upper part of the skein, immediately finds its way to all parts of the bearing surface. As the oil settles to the bottom of the box it runs along and falls into an annular recess, C, formed in the box.

Fig. 2 is a cross section through the recess, C. By reference to this figure it will be seen that the recess, C, contains within it lateral ribs, D. These ribs, during the revolution of the wheel, carry up the oil which runs into the recess, C, and delivers it again to the groove, B, whence it again flows over the entire bearing surface, and so on continually.

The flange nut, E, Fig. 1, prevents the escape of the oil from the outer end of the box, and the inner end of the box fits closely against a shoulder formed on the skein so as to confine the oil and prevent its escape.

When the groove, B, becomes clogged, it can readily be cleaned by the use of a wire. Tallow or lard may be used instead of oil, by melting it so that it will flow into the groove, B, through the aperture, A.

Patented, through the Scientific American Patent Agency, Nov. 8, 1870, by Thomas Smart, Jr., of Brockville, Ontario, Canada. For information as to rights, address Elswood Smart, care Pittsburgh Cast Steel Spring Co., Pittsburgh, Pa.

Fig. 1

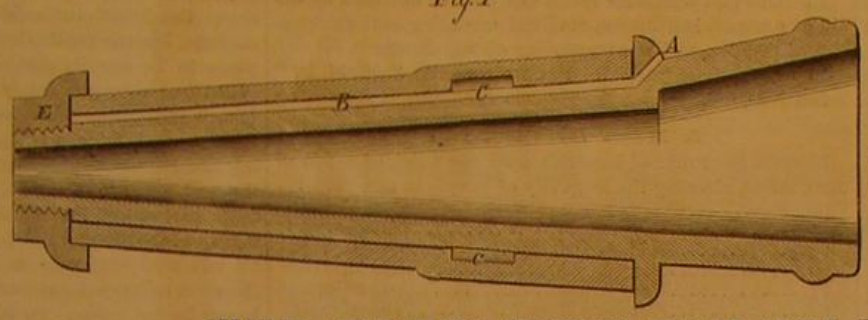
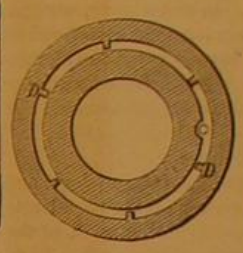


Fig. 2



SMART'S SELF-OILING SEAMLESS WAGON SKEIN BOX.

PERPETUAL MOTION.

NUMBER II.

In the library of the British Museum is an edition of "A very necessarie & profitable booke concerning Nauigation, compiled in Latin by Joannes Taisnierus, a public professor in Rome, Ferraria, and other universities in Italie of the Mathematicalles, named a Treatise of Continuall Motions; translated into English by Richard Eden." It is a black letter quarto tract, printed by Richard Jugge, without date, consisting of eighty-two pages. The first part is "Of the vertue of the Loadstone," and the second part is "Of continual motion by the said stone Magnes." It was reprinted 1579. In his introductory remarks, he observes, in allusion to continual motion, that it is—

"The thing which to this day in manner from the beginning of the world, great philosophers with perpetual studie and great labour, have endeavoured to bring to effect, and desired end, hath nevertheless hitherto remayned eyther unknown or hydde, not without great damage & hynderance of most expert mathematicians. * * * * * * *

"From the begynnyng of the worlde, in manner all naturall philosophers and mathematitians, with great expences and labour, have attempted to fynde out a continual motion or moovyng; yet unto this day have few or none atteyned to the true ende of their desyre. They have attempted to doo this with divers instrumentes & wheeles, & with quicksylver, not knowyng the vertue of this stone. Neyther can continual motion be founde by anye other meanes, than by the stone Magnes, in this maner. Make a holowe case of sylver, after the fashion of a concave glasse, outwardly laboured with curious art of gravyng, not onely for ornament, but also for lyghtnesse; the lyghter that it is, so much the more easyer shal it be mooved, neyther must it be so pearced through, that such as are ignorant of the hyd secrete, may easyly perceyve it. * * * * * * * * * *

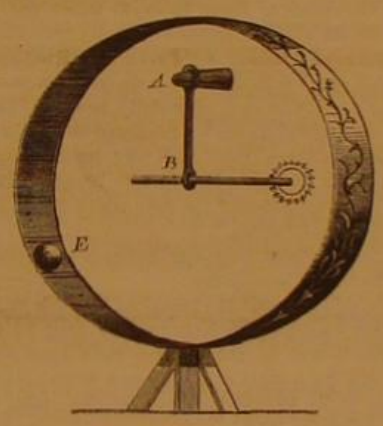
"It must have on the inner syde certayne little nayles & denticles or smal teeth of iron of one equal weyght, to be fastened on the border or margent, so that the one be no further distant from the other, then is the thycknesse of a beane or chick pease. The sayd wheele also must be in all partes of equall weyght, then fasten the exiltree in the myddest, upon the whiche the wheele may turne, the exiltree remayning utterly immoveable. To the whiche exiltree agayne shal be joyned a pynne of sylver, fastened to the same, & placed betweene the two cases in the hyghest parte, whereon place the stone Magnes. Beyng thus prepared let it be fyrste brought to a rounde fourme, then (as is sayd) let the poles be founde: then the poles untouched, the two contrarye sydes lying betweene the poles, must be fyled & pullyshed, & the stone brought in manner to the fourme of an egge, & somewhat narrower in those two sydes, lest the lower parte thereof shoulde occupie the inferior place, that it may touche the walles of the case lyke a little wheele. This done, place the stone upon the pynne, as a stone is fastened in a ryng, with such art, that the north pole may a litle inclyne toward the denticles, to the ende that the vertue thereof woorke not directly his impression, but with a certayne inclination geve his influence upon the denticles of iron. Every denticle therefore shall come to the north pole, & when by force of the wheele it shal somewhat passe that pole, it shal come to the south part, whiche shall dryve it back agayne; whom then agayne the pole artike shall drawe as appeareth. And that the wheele may the sooner doo his office within the cases, inclose therein a litle calculus (that is) a litle rounde stone or pellet of copper or sylver, of suche quantitie, that it may commodiously be receyved within any of the denticles: then when the wheeles shal be raysed up, the pellet or rounde weyght shal fal on the contrary parte. And whereas the motion of the wheele downwarde to the lowest part, is perpetuall, & the fal of the pellet, opposite or contrary, ever receyved within any two of the denticles, the motion shall be perpetuall, because the weyght of the wheele & pellet ever enclyneth to the centre of the earth & lowest place. Therefore when it shal permit the denticles to rest about the stone, then shal it well serve to the purpose. The myddle places within the denticles ought so artificially to be made belowe, that they may aptly receive the fallyng pellet or plommet, as the fygure above declareth. And briefly to have wrytten thus much of continual motion may suffice.

"Description of the Engraving, Fig. 3.—A, the stone; B, the sylver pinne; E, calculus, a little rounde stone or small weyght."

Notwithstanding our author of the 15th century seems so satisfied with his invention, we find that two centuries later the world was still without the desired self-mover, for Jacob Leupold, in a work published at Leipsic in 1724, says:

"It still remains to find out this wonderful and undiscovered thing, which to the present time remains impossible both mathematically and mechanically, so far as we yet know. Great weight only increases friction, but there was a wheel

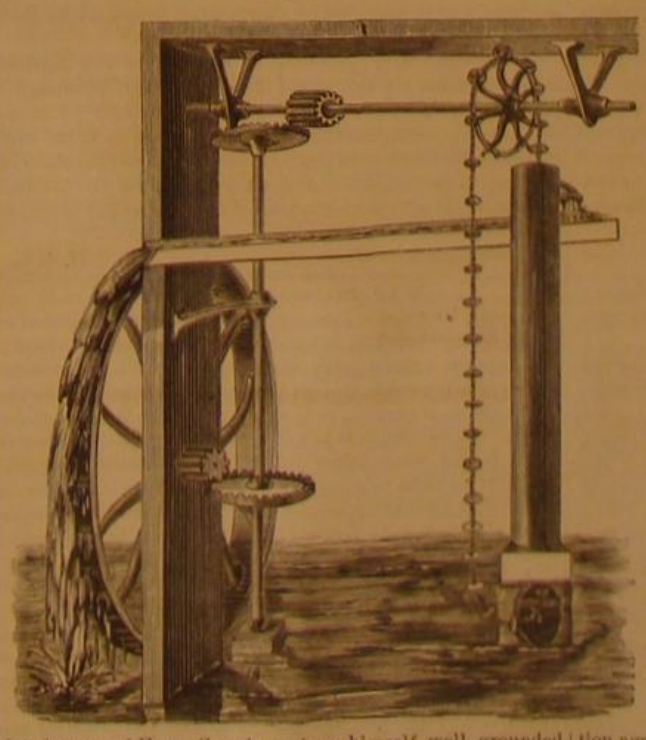
FIG. 3



or machine that did not weigh above forty pounds, and was nine feet diameter, which promised better results, yet failed like others, and so dissipated all hope of succeeding.

"Notwithstanding we hold that perpetual motion is not an impossibility, as has been shown to all the world by Councillor Orffyreus, and attested by the princely word of the

FIG. 4.



Landgrave of Hesse Cassel, a prince himself well grounded in the science of mechanics, and who so minutely scrutinized and observed this wonderful motion, which was with him on trial during two months; all of which time he kept the machine in a sealed chamber.

"To all the seekers after perpetual motion the following remarks will be found most valuable:

"1. That they must endeavour to construct one of the simplest of machines; for the more material and workmanship, the less chance of durability. And if not found in such simple arrangement, it will be hid for ever.

"2. That it must be tried by experiment and not only on paper, for the friction and action can only be estimated by trial.

"3. That unless grounded in the fundamental principles of mechanics, no one should attempt the project, as he will only lose time and money. The thousands who fail of success yet learn something of mechanics, and that one pound cannot move more than one pound, but always arrives at an equilibrium."

In a work entitled A History of the Manual Arts, we find the following:

"Archimedes, of Syracuse, the greatest mathematician and the rarest engineer that was in his time, invented a sphear and an artificial heaven, wherein he did represent the rotations and revolutions of the planets," and of which Claudian gives a poetic description —"that this machin did move of itself; it was an automaton, a self-moving device;" and further, "that these motions were driven and acted by certain spirits pent within;" also of another device of "a silver heaven sent by the Emperour Ferdinand for a present to Soliman the Grand Signior," with twelve men, and a book "that shewed the use of it, and how to order and keep it in perpetual motion." An account is next given of Cornelius van Drebble, a Dutchman, of Alcmar, engineer to King James, in England:

"He presented the king with a rare instrument of perpetual motion, without the means of steel, springs, or weights; it was made in the form of a globe, in the hollow whereof were wheels of brass moving about, with two pointers on each side thereof, to proportion and show forth the times of dayes, moneths, and years, like a perpetual almanack."

The accompanying engraving, Fig. 4, is taken from a work by Robert Fludd, published in 1618.

It is a water wheel which is expected through a system of gearing to operate a chain pump, which pump should raise the water necessary to propel the wheel, and so on forever. It is probably unnecessary to inform our readers that this fallacious principle has been tried in various ways, and that there are occasionally yet to be found those so unskilled in mechanical science, and incapable of seeing the radical error of the device, as to waste their substance in a repetition of this time honored blunder. We have now in mind an instance in point, in which a man spent the accumulation of an industrious life in endeavoring through various makeshifts to get such a wheel to move, and who has brought poverty upon his declining years, through his absurd experiments. It was earnestly sought by his friends to convince him that nothing in falling could perform more work than that required to raise it to the point from which it is allowed to descend, but all such efforts proved vain, and our perpetual motion seeker would not desist till he had sunk his bottom dollar. "*Perseverantia vincit omnia*," was his reply to every argument and appeal, a motto which perhaps is true when applied to possibilities, and the failure of which in all the attempts to secure a self-mover only strengthens the belief in the impossibility of the thing sought.

We not unfrequently have letters of inquiry if such a plan is not feasible, and if the discovery is not patentable, even at this late day.

Operations of the Postoffice.

The report of Postmaster-General Creswell is a very instructive document and worthy of careful perusal. The ordinary revenues of the Department for the fiscal year ended June 30, 1870, were $19,772,220 65, and the expenditures of all kinds, $23,998,837 63. For the year ended June 30, 1869, the ordinary revenues were $18,344,510 72, and the expenditures, $23,698,131 50. The increase of revenue for the year 1870, over the year 1869, was $1,427,709 93, or 7·78 per cent, and the increase of expenditures, $300,706 13, or 1·32 per cent, showing a net increase in revenue of $1,127,003 80.

MAIL DEPREDATIONS.

During the past year, 3,071 cases of loss by mail depredations, of which 1,574 were of registered letters, were reported to the Department, involving losses in bonds, drafts, and money to the amount of $1,393,768 21, a considerable portion of which has been recovered. The number of arrests for violations of the postal laws was 143, and the number of convictions of those who were brought to trial 54, the remainder being released on bail, acquitted, or held for trial. The Department is constantly availing itself of all the means within its reach to give perfect security to the mails, and to bring to justice any of its employés who yield to the temptation to violate the trust reposed in them.

THE POSTAL ORDERS SYSTEM

is on the increase and affords almost absolute protection against loss of money through the mails. The magnitude of the operations of the money-order system is well illustrated by the statement that, at the city of New York alone the orders issued during the last year amounted to $650,258 39; the orders paid, to $3,871,516 11; the remittances received

from postmasters, to $5,987,888; and the drafts of postmasters paid, to $3,430,581.

The loss of these registered packages containing remittances of surplus money-order funds causes no detriment whatever, either to the remitters or to the payees of money-orders. It is the Department and not the public, that suffers the loss resulting from the failure of such remittances to reach their destination. It will be observed that losses of this nature form a considerable item in the annual expenses of the money-order system, although the total of such losses, $8,160 50, is very small in comparison with the whole amount of money remitted for deposits during the year, viz.: $23,246,027 70.

Out of 1,675,228 domestic money orders paid during the year, it was claimed that payment of 19, of the aggregate amount of $587 64, was fradulently procured through forgery of the payee's signature, or by false pretenses. After a full investigation, the paying postmasters, in six of these cases, having been found at fault, were directed to pay to the proper owners, respectively, the amounts of the several orders, the total of which was $204. In seven cases, amounting to $178 50, the paying postmasters were not considered as justly responsible for the improper payment, and the Department paid that amount to the true payees. The remaining six cases, amounting to $159 14, are held for examination and report by special agents.

HOW THINGS PROGRESS.

Postmaster Creswell denounces the franking privilege, and refers to the wonderfully rapid expansion of the postal system as strikingly displaying the wonderful growth of the United States in population and wealth. Among other illustrations of this kind he refers to the fact that during the first year of President Washington's administration the number of letters transmitted in the mails did not probably exceed 300,000, and the annual transportation was about 350,000 miles. During the first year of the present administration, the number of letters carried in the mails could not have been less than 590,000,000, to say nothing of the immense amount of printed matter; and the aggregate of distances traveled amounted to 97,024,996 miles. These comparisons are sufficient to exhibit the great advance which the United States has made in the short space of eighty years. The results are so astounding that it seems impossible even at this day to predict the development to which our country will attain at the close of the present century, of which only thirty years remain.

Correspondence.

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

Effect of Artillery Discharges on the Weather.

Messrs. Editors:—The article of E. W. Brown, of Cambridge, Ill., brings to mind what I proposed to do on the breaking out of the late war between the States. I left for Washington, May 1, 1861, and in New York city I met a friend quite well known for his scientific and literary attainments. I said to him that my object was to go with the army as a meteorological observer, as I had for several years made observations for the Smithsonian Institute. On my arrival at the National Capitol, I laid my plans before one whom I believed of all others was likely to approve of them, as he had been a close investigator of the science of meteorology; but from him, or any other, I could get no encouragement. I think I have good cause to remember the terrible storms following the first battles, Bull Run, Fair Oaks, Malvern Hill, and several others, that were followed by storms. When Burnside was "stuck in the mud," and when the terrible storm, commencing in the far West, swept over the whole country, and struck his army when it was well under way, the terrible suffering of that march could have been avoided by a proper system of observations. I now have before me three letters, from the headquarters of as many commanders, declining my services, proffered without hope of reward except my rations. I believe I know why my plan was given the cold shoulder by the man of science in Washington. He cared more for a *cause* than he did for humanity. I hope to yet see a compilation of the observations made during our war on this subject, and I also hope that the governments of Europe now at war will not lose sight of so important a subject.

E. A. Dayton.

Richmond, Va.

Remedy for Ivy Poisoning.

Messrs. Editors:—The experience of several of your subscribers, in reference to the plant called poison ivy, has interested me, and I herewith give my experience.

About the middle of last September, my arms became badly poisoned as I was gathering some fruit that had fallen among a thrifty growth of that venomous weed. As I was very careful not to bruise the plant, I had little fear of poisoning; but I counted without "mine host." Two or three days sufficed to tell me that I had not escaped its baneful influence. I first tried sweet oil, to allay the burning irritation; then I used salt and water, and afterwards strong lye, made from wood ashes. All these seemed to increase the effect of the poison. A friend recommended three or four drops of the medicinal remedy known as *Rhus toxicodendron*, to be drank twice a day, in half a glass of water; this failed. Another friend proposed a wash made from a solution of belladonna, say a teaspoonful to a tumbler full of water, and this was tried with signal success. With this solution I bathed my arms, and two or three applications showed a decrease of the swelling, and a freedom from the irritation and burning.

As the leaves of the poison nightshade cannot always be obtained, an efficient remedy may always be at hand in the form of its extract, known as belladonna.

New York city. W. B. Harris.

Central Shaft of Hoosac Tunnel.

Messrs. Editors:—I read in your excellent journal of October 29th, an article concerning the Hoosac tunnel's central shaft. You, very judiciously, observe that in giving the shaft such a direction as would bring it in the center of the tunnel, "it is quite possible the motion of the earth may affect the plummet, more or less." Experiments made with the greatest care, in Paris, some years ago, under the dome of the Pantheon, leave no doubt on that point.

The plummet string employed in that experiment had a length of about one hundred feet, if I remember well. It demonstrated clearly, by its large deviation, the rotation of the earth, which was the object of the experiment. Consequently, it is proved that it is impossible to obtain a perfect perpendicular line by means of a plummet, and that its deviation to the West will necessarily be increased with the depth of the shaft, in a geometrical progression.

I believe that a reliable result can only be obtained by the aid of a transit instrument, modified according to the exigencies of position, and of surrounding circumstances.

Paul d'Heirry, A. M., M. D.

San Jose, Cal.

A Home for the Aged.

Messrs. Editors:—I herewith send you a list of a few of our citizens, showing the longevity of people in this place:

Age.	Name.	Nativity.
90	David Wright	Vermont.
90	John J. Wever	Germany.
90	Mary Lyons	Ireland.
91	Mary Allen	Connecticut.
92	Elizabeth Bennet	Pennsylvania.
92	Mary Fulton	"
92	Elijah Adams	"
93	J. K. McElroy	Ireland.
94	John Roloson	New Jersey.
99	Rodham Graves	Virginia.
99	William Jenkins	Ohio.

Now, sirs, from this kind of stock has sprung the "fair women, brave men, and beautiful children" that abound in this part of the country. This is truly a good place to live in.

H. Besse, M.D.

Delaware, Ohio.

Railroad Speed.

Messrs. Editors:—In the Scientific American, of Nov. 26, you give the average speed of the *Limited Mail* from London to Holyhead, at from 40 to 45 miles per hour, and quote that as the extreme speed of railway traveling.

At this moment I cannot say what is the actual speed of the *Limited Mail*, but I believe it is nearly 60 miles per hour.

There are two trains each way daily between London and Brighton, running the distance—nearly 60 miles—in sixty minutes. There are three trains each way between London and Grantham, doing the 106 miles in two hours. Thirty-three minutes is the time allowed for fast trains from Hitchin to London—distance 32 miles.

I have made many journeys between the above-named places in the time I have given. A. O. T.

[We have ridden on all the principal English railways, and the only time we remember ever to have gone at the rate of a mile a minute was on the express train from Glasgow to Liverpool, and for a short time only on a down grade. Whenever it came to the locomotive drawing the train, the speed was much reduced.—Eds.

Poisonous Fertilizers.

Messrs. Editors:—On page 129, current volume, of the Scientific American, you gave directions for making bone fertilizers, in which it is recommended to dissolve the bones in oil of vitriol. Common oil of vitriol is, as far as I know, the substance used by all manufacturers; but I think none but the chemically pure acid should be used. The common acid often contains a small quantity of lead and arsenic, both of which are known to be absorbed by plants when presented to their roots.

Dr. Edmund Davy, Professor of Agriculture and Agricultural Chemistry, in the Royal Dublin Society, published a paper, in 1859, calling attention to the danger of using manures containing arsenic; yet there has not up to the present time, I believe, been a pure article of superphosphate of lime put in the market. I think the use, for the purpose mentioned, of acid containing arsenic or lead ought to be prohibited by law.

Charlotte, Me. H. A. S.

Why Mainsprings Break.

Messrs. Editors:—I see by your paper that the cause of watch springs breaking is considered mysterious. Perhaps I can, to some extent, solve this mystery. When the mainspring is taken out in cleaning a watch, and is handled by the watchmaker, it expands in consequence of the warmth of his hands. Upon putting it in the watch, and putting the watch together, the watchmaker usually (if the watch runs free) winds it up to its full power; the spring is then, of course, in its expanded condition, wound close around the arbor; upon cooling it naturally contracts, and, of course, being already tight, something must give, and the spring breaks. My experience has taught me that it is unwise to wind a watch all the way up immediately after cleaning or putting in a spring. If a watchmaker will take the trouble to inquire, when a watch comes in with a broken spring, how long it ran after winding, he will find that it is almost invariably from two to four hours, showing that winding has something to do with the result. Any one who wishes to test the truth of the above can do so by heating a piece of mainspring, and fastening it at full length rigidly at both ends, and then letting it cool. It will almost certainly break if the experiment is well performed.

Camden, N. J. Henry Hollinshed, Jr.

Beams, Girders, Bridges.

Messrs. Editors:—Your quotation from the *Builder* on page 230, and the criticisms upon it by H. C. Pearson, on page 307, current Vol., Scientific American, indicate a wide difference of opinion between the *Builder* and Mr. Pearson on the question of beams, etc.

The *Builder* is unquestionably wrong in saying that "girders are acted on by weights placed on them at stated places, inversely as the squares of the distances of such places to the supports." It should be inversely as the distances, and not as the squares of the distances. The error appears to have arisen from applying to concentrated weights or loads the formula applicable to loads uniformly diffused over the entire length of beams, which is the way in which loads are usually supposed to be applied to beams, girders, and bridges. Under loads thus uniformly applied the strains increase as the squares of the spans.

The positive statement of Mr. Pearson, that "a beam ten times the length of another, of the same size in other respects, has one tenth the strength of the shorter one," appears to be equally erroneous. Take, for instance, a beam of ten feet in length, ten inches depth, of the most approved form, and so proportioned as to make it bear safely a load of 10,000 pounds. Then take a beam of 100 feet in length, having in all other respects the same form and proportions as the first, and see whether it will sustain 1,000 pounds—one tenth part of the load of the first beam. According to the theory of Mr. Pearson, which he claims to be approved by all educated engineers in Christendom, it will. But even the most unlearned mechanic who is accustomed to handle beams knows better. So far from such a beam bearing 1,000 pounds, it cannot sustain its own weight. Mr. Pearson's error in this instance appears to consist mainly in substituting strength of the beam for the strain due to the load, and in not considering the weight of the beam, which in itself forms an element of the first importance in calculations of this kind, especially when the length of the beam greatly exceeds its depth.

Benjamin Severson, Mechanical and Civil Engineer.

Washington, D. C.

How to Prove a Millstone Level.

Messrs. Editors:—First level the bed stone and tram the spindle in the usual way. Now, to prove the operation correct, put the running stone on the spindle, raise it clear off the bed stone, say, one-fourth of an inch, and put the stone in motion up to the usual speed; after it has acquired a uniform motion, commence letting it down until it touches the bed stone. To see that all is right, look between the stones while you are lowering the runner; if the stone is level, there will be no need of letting them come together; if not, there will be no harm done, for it will merely tick and let you know which is the highest side.

To correct any stone not level, find out which is the high side while the stone is running, then raise the lowest side of the bed stone until the runner will tick on all sides alike. Another way to make the stones come evenly together is to move the bottom of the spindle *from* the lowest side of the bed stone. I have seen new mills where the husk was so weak you could not level your stone in any other way, and I have seen stones that were condemned made to grind well by this operation. N. H. Ellis.

To Telegraph Learners.

Messrs. Editors:—I would be glad to give my experience to learners, as it so nearly compares with the article in the Scientific American of November 19th. Two of us learned the alphabet by writing to each other, using the telegraph alphabet in our correspondence. I was always drumming with my forefinger, and now, though out of practice, often find myself writing sentences with my forefinger. When first learning, I was often found drumming on the head-board of the bed, while in my sleep. A brother operator of mine and myself have often amused a company at the table by talking to each other with our knives or forks. A very simple key can be made for practice, of wood and a few screws, by any ingenious boy, that has ever seen one in an office, or picture of one. I made a key and sounder, and procured materials for a battery. The cost of the wire, bent iron for magnet, porous cup, and all, did not exceed one dollar, and I had a set of instruments to practice with. O. E. Goodale.

Martinsburgh, N. Y.

Bee Stings Again.

Messrs. Editors:—On page 298 of the last Scientific American, under the head of "Bee Stings," you say, "No outward application can have any effect in curing the sting of a bee." From this I beg leave to differ. I claim that any substance that is a good absorbent will "draw" a part of the poison, and thereby ease the pain and reduce the swelling. To rub the poison into the circulation may do well enough for a single sting; but we occasionally read of persons receiving so many stings as to produce death if the poison is not extracted. The best absorbing substance that I have tried is lean fresh meat. This will relieve the pain of a wasp sting almost instantly, and has been recommended for the cure of rattlesnake bites. I have also used it with marked effect in erysipelas. Henry A. Sprague.

Charlotte, Me.

The Hon. Isaiah Blood, State Senator from the XVth District, died at his residence in Ballston Spa, Saratoga county, on Tuesday night, at the age of 63. He had suffered greatly during a long attack of typhoid fever, and his death has been hourly expected for several weeks. He was the proprietor of extensive ax and scythe manufacturing works in Ballston Spa, and had accumulated a large fortune.

Something about Bread-Making.

A subject that interests everybody is that of bread-making, and as a general thing, there is too much popular ignorance respecting it. In the process of grinding wheat for superfine flour, the outer shell, composed chiefly of gluten, being tenacious and adhesive, comes from the mill in flakes with the bran, and is sifted out, while the starch is pulverized and constitutes the fine flour. Thus the starch, which is the chief element in fine flour, is saved, which contains no food for brain and muscle; and the gluten, containing phosphates and nitrates which furnish support for brain, bone, and muscle, is cast away with the bran, and is fed to horses, cattle, and pigs. And this is the kind of flour that makes nine tenths of the bread in American cities, besides all that is used in cakes, puddings, and pastry.

A method of making bread from whole wheat, without previously grinding it into flour, has been devised by a Frenchman named Sezille. The grain is first soaked in water for half an hour; then put into a revolving cylinder with a rough inside surface, and shaken up, so as to remove the coarser part of the skin; and then soaked twenty or twenty-four hours more in water of the temperature of 75 degrees Fahrenheit, with which a little yeast and glucose has been mingled. By these means the grain acquires a pasty, doughy consistence, and can be mixed up by machinery and made into bread in the usual way. The invention is an important one, both from its saving the expense of grinding, and from the greater economy of keeping and transporting the whole grain instead of flour.

A HEALTHY BREAD.

The most economical and best bread, especially in cold weather, when a hot fire is constantly kept, is what is sometimes called gems, or unleavened biscuit. For this purpose a group of cast-iron pans or cups 2½ by 3½ inches each, all made in one casting, is used. These pans are set on the top of a hot stove and allowed to become almost smoking hot when buttered for use. Then with cold water and milk, half-and-half, or with cold water alone, and the colder the better, mix and stir quickly with a stiff spoon as much Graham or unbolted wheat-meal as will make a stiff batter or thinnish mush; and when the pans are hot, fill them quickly with the thin dough and let them stand a minute on the stove before putting into a very hot oven, where they should remain twenty or twenty-five minutes, until done. If the mixture be neither too thin nor too stiff, and the pans and the oven be hot, you will have twelve as light and wholesome biscuits as any epicure could wish to eat. They may be eaten smoking warm from the oven, as they contain no poisonous chemical elements like yeast bread, which requires cooling to be rid of. They are good cold, or may be warmed in a steam-kettle. Anybody, however unskilled in cooking, can learn to make these light and nice every time. Nice, fresh wheat-meal, very cold wetting, quickly done, with a very hot place to bake them, will insure the best of "luck" always. These, like all other Graham bread, should be fresh every day.

For growing children, and those people who work or think, and especially students and sedentary persons, there is no other bread, and scarcely any other single article of food, that equals it. Let the poor who cannot afford to lose 14 per cent of the grain in the cast-off bran; let those whose bones and muscles are small, tending to rickets and spinal curvature; let invalids and dyspeptics try it, and they never will go back to superfine bread simply because it looks white and nice, and, when dry, is more pleasant to the mouth than the brown.

Imitation Pearls.

There is no end to the variety of substances which inventive art has at its disposal in creating objects of use and beauty. From the sand upon the seashore, to the moss that grows upon the mountain top, it ranges with ever fresh devices, and with continual success. Moreover, when the real articles of use or adornment cannot be found, it has a thousand ways of replacing them, by means of other combinations. In fact, this business of imitation is one of the most interesting branches of industry, and were we to pursue its investigation, we should find a volume grow upon our hands. We can, therefore, take up but one point of it at a time, and the special one that we have chosen for to-day relates to the manufacture of pearls.

When we read glowing descriptions of the pearl, its wondrous beauty and its great value—the pride of Cleopatra and of the Oriental kings,—we are a little staggered at first, as we hear the assertion that a jewel so rare can be imitated to perfection. Yet, at the London Crystal Palace, in 1862, a French jeweler exhibited in his show-case alternate rows of huge pearls—the real and the imitation articles, side by side—and above them was a placard with the inscription: "Which of these are the artificial?" No one from merely looking at them could tell; and even the best experts were deceived. As nearly as can be ascertained, the first artificial pearls were made in the thirteenth century, judging by the code of rules adopted for the Guild of Goldsmiths in Paris, in the year 1260; but Hardwicke, an authority in such matters, thinks that the imitations then produced were simply opalescent beads of glass, like those still made of different colors, and known as *perles a la lune*.

About the middle of the seventeenth century, the mode of making artificial pearls, by coating little globules of glass on the outside, with a varnish prepared from the scales of a peculiar kind of fish, was discovered and practiced with great success. In 1691 there was a book published in Paris, called the *Livre des Addresses*, or, in plain words, the "Directory," as we would call it in our day. The manufacture of pearls above hinted, was mentioned in that book as a new invention, and the articles were said to be so natural as to defy detection. Jaquin, a rosary maker, gets the credit of the discovery. At that time, these artificials were coated on the outside; now, the coating is put upon the inside, and the process may be described as follows: A number of hollow beads, as thin, transparent glass, are blown with a lamp, and a drop of "pearl-essence," so called, is blown into it, and spread about by rolling the beads. This pearl-essence is obtained by scraping off the scales of the bleak, or *Cyprinus Alburnus*, a fresh-water fish, and repeatedly washing them in pure water, until the whole of the foreign and animal matter is removed. To these, after they have been thoroughly washed, a little quantity of the solution of sal ammoniac is added to prevent putrefaction, and then the preparation is ready for use. In employing it, however, the addition of a little isinglass will cause the varnish to adhere well, and minute traces of carmine, saffron, or Prussian or Paris blue may be thrown into so as to communicate a reddish, yellowish, or bluish tinge, in imitation of the same shades as they may be noticed in fine pearls. The essence thus described has become a regular article of trade, and is chiefly prepared for the French and German manufacturers, at Eberbach, on the Neckar river, in Germany. In old times, the pearl makers had to buy the fish and prepare the essence themselves. About seven pounds of fish scales will yield one pound of the genuine moist pearl-essence, and to furnish these would require 20,000 fish.

The famous English white-bait, hitherto chiefly celebrated for its service at aldermanic dinners and friendly frolics at Richmond, on the Thames, are now said to furnish better scales for the "essence" than the bleak do. The scales of the roach and dace are, also, said to be good for inferior artificials. At one time, says an article in the London *Technologist*, on "Mock Pearls," there was a large trade in the commodity, when necklaces were greatly worn in England, and fish scales were in such demand, that from one to five guineas a quart were paid for them. Mahood, the British manufacturer, has made thousands of beautiful and durable ornaments out of this once totally neglected refuse of the fish. Scale brooches, bracelets, pins, ear-rings, etc., etc., are well known, and can be purchased everywhere. The strong, clear scales of the *corcino* fish—the *Sparus Chilensis*—are excellent for the purpose indicated. So are the golden scales of the king-fish, the *callipeva*, and the large ones of the *pirarucu* fish of Brazil.

The manufacture of artificial pearls is, certainly, one of the most curious applications of what was long considered the merest waste, to the production of exquisite and beautiful things, that even our age of artistic, chemical, and mechanical marvels presents.—*Journal of Commerce.*

The Aurora and the English Telegraphs.

Mr. Culley, Engineer of Telegraphs, writes to the London *Times:*

"As public attention has been directed to the effect of the aurora on the telegraphs, perhaps you will permit one who has been connected with the telegraph from the very first to explain in what manner the transmission of messages is interfered with, and what means are used to keep up the communication.

"The aurora is supposed to be caused by a flow of electricity through the atmosphere at a very great hight, where the air is extremely rare.

"It is, in fact, a kind of lightning, differing from ordinary lightning in being a gentle and gradual flow instead of a violent and sudden discharge.

"The same cause which produces the aurora produces also currents which flow from one part of the earth's surface to another; and, as a telegraphic wire is always connected to the earth at each end, a portion of these currents must necessarily pass through the wire from one station to the other, provided the two stations happen to lie in their course, which is usually, though not always, nearly east and west.

"These so-called 'earth currents' are frequently very powful (they were specially so, as might have been expected, during the late brilliant displays), but what is more troublesome still, they constantly vary in strength, and also in direction, and, consequently, make it impossible to read a message.

"They also affect the mariners' compass, but not sufficiently to be visible, except under special arrangements. They were powerful enough, however, on Tuesday evening, to deflect the magnet of a Thomson galvanometer, which is really a compass needle very delicately suspended, as much as 200 divisions when it was not connected to any wire whatever.

"It will be obvious, from what has been said, that some telegraph wires are more disturbed than others. Those running nearly east and west suffer most. It will also be readily seen that if the connection with the earth can be dispensed with the currents will not enter the wires.

"When there are several wires available between the two stations the earth connections are cut and the wires are looped, so as to use one of each pair as a return wire in place of the earth, thus forming a complete metallic circuit. But, although this plan is effective, it will be seen that it enables us to use only one half of the instruments affected. At the central office, on Tuesday, we were obliged to loop fifty wires in this manner, losing at once twenty-five circuits.

"We can also connect two wires so as to throw the terminal stations out of the line of disturbance, but, as the direction of the earth current is seldom constant, this method does not give very good results.

"It is also possible in some cases to divide the wire at both ends, introducing a condenser, or very large Leyden jar, and signaling by inductive discharges. This answers perfectly for a cable, but has not at present been found effective for land wires.

"It has been said that the "Northern Lights" have only recently affected the instruments to any serious extent, and this because insulation is not now as well attended to as some years since. Permit me to say that this is a misconception; the effect of the earth current is in many cases the greatest in the best insulated line. The Atlantic Cables, whose insulation is absolutely perfect, are more disturbed than any land line, and are always worked either by the loop or the Leyden jar arrangement."

History and Nature of Alcohol.

The intoxicating quality of wine was known in the time of the patriarchs; but although the early Egyptians were acquainted with fermented barley wort, it is only within the history of the present generation that the properties of the active principle in the wine and wort have been clearly ascertained.

The alchemists of Arabia invented the still, and it appears that one Abucasis was the first person who separated the crude spirit by distillation from wine. He it was who gave it the name of "alcohol," the meaning of which is to paint. This term was probably used because spirit will dissolve certain colors and resins and render them fluid, which water will not.

Raymond Lully, a chemist of the thirteenth century, found that alcohol, produced by the ordinary process, contained one half water, and he has the credit of being the real discoverer of spirits of wine. Still, Lowitz, a German chemist of our day, was the first to prepare real alcohol. Alcohol is so cohesive with water that it is only with the greatest chemical skill that the least portion of water combined with it can be separated.

There are only two methods of forming this extraordinary body: the one by fermentation of saccharine fluids, which has been known from time immemorial; the other (a recent discovery) by forcing olefiant gas through sulphuric acid. It was Hannel who made the last discovery; and although nothing of importance has yet resulted from it, yet we may confidently look forward to great advantages. Hannel, and more recently Berthelot, have shown that alcohol can be produced from coal. By the fermentation process it is known that alcohol is derived from starch, being converted first into sugar, then into glucose, then into alcohol. The Mahomedans, Hindoos, and Chinese abstain from alcohol on religious principles.

Alcohol is a transparent fluid. It has never been congealed or rendered solid by cold. It is considerably lighter than water, as about 79 is to 100. It burns with almost colorless flames, and leaves no trace of residue. Alcohol, when free from water, will boil at a temperature equal to a hot day in summer—80 deg. F. It expands immensely with little heat, hence it is used in the thermometer to measure the increase and decrease of heat. Alcohol dissolves resins, attars, ethers, alkaloids, and numerous other bodies; hence it is of immense service in the arts and manufactures. Many trades would cease without alcohol, it being an essential ingredient in many things; we therefore could not dispense with it.—*S. Piesse.*

The Amazon.

This great river rises in the little Peruvian lake of Louricocha, just below the limits of perpetual snow. For 500 miles it flows swiftly through a deep valley, then, turning sharply eastward, it runs 2,500 miles across the great equatorial plains. Two thousand miles above its mouth, its width is a mile and a half, increasing to over ten miles at the head of the delta, where it divides, and, after running 400 miles, presents a front of 150 miles upon the ocean. For a great distance, it is bordered by side channels, or bayous, as they are called upon the Mississippi, named by the Indians igarapes, or canoe paths. From Santarem, the principal town above Para, one may paddle a thousand miles, parallel to the river, without once entering the stream. For twenty-five degrees of latitude, every river that flows down the Eastern slope of the Andes is an affluent of the Amazon. It is as though all the rivers from Mexico to Oregon united their waters in the Mississippi. A half-score of these tributaries are larger—the Danube excepted—than any European river out of Russia. The volume of its waters is greater even than the breadth of the river would indicate. At Nauta, 2,200 miles from its mouth, the depth is forty feet, increasing rapidly as it approaches the ocean. The largest ocean steamer could doubtless steam 2,000 miles up the Amazon.

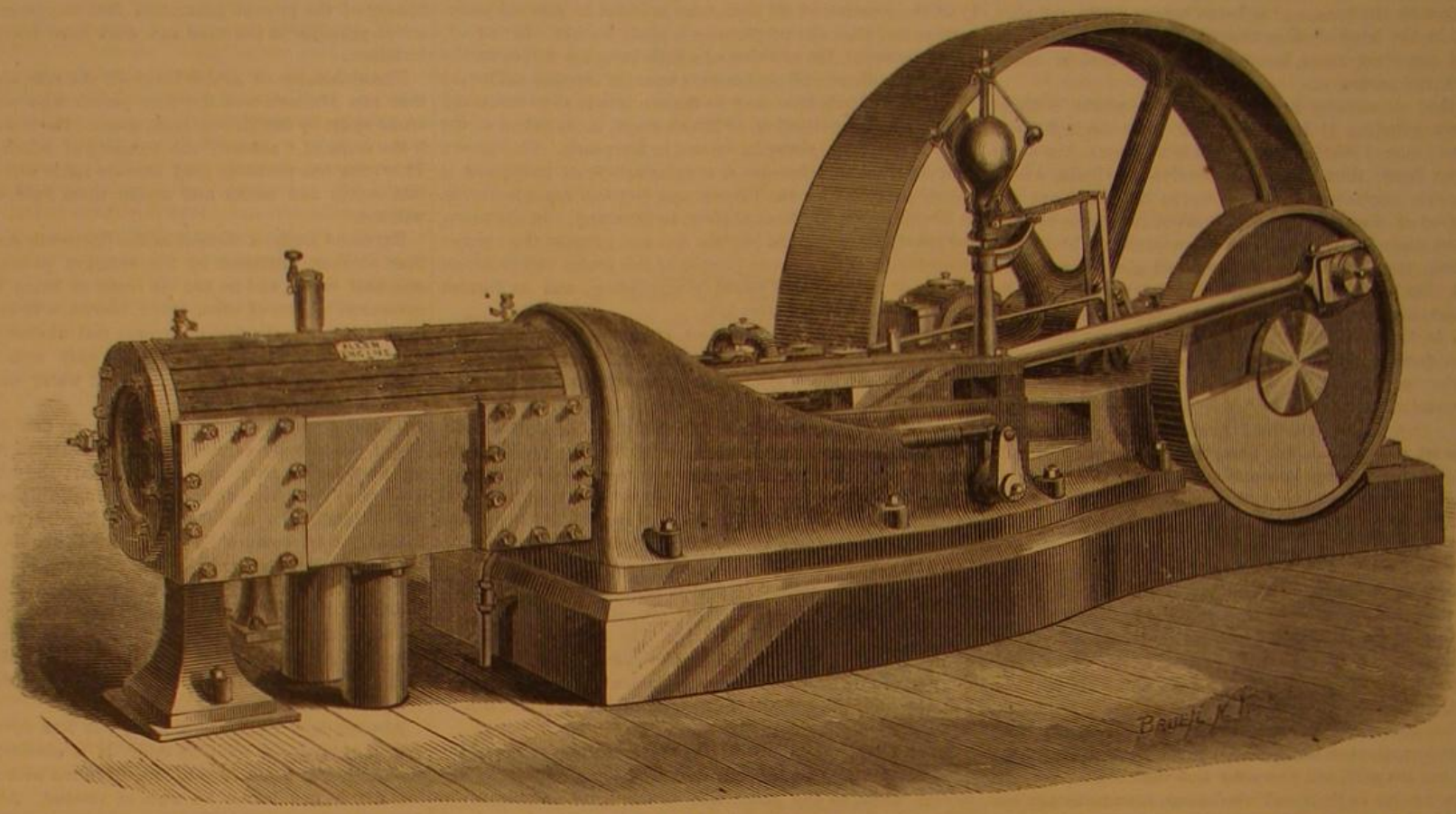
The vegetation of the valley is exuberant. There is a bewildering diversity of grand and beautiful trees, a wild, unconquered race of vegetable giants, draped and festooned by creeping plants. The moment you land upon the shore you are confronted by a solid wall of vegetation, through which, if you wish to proceed, you must hew your way with axe or macheta. Palms, of which thirty variety are noted, constitute the majority of trees. Then there are "cow trees," a hundred and fifty feet high, yielding a milk of the consistency of cream, used for tea, coffee, and custards. The "caucho," or rubber tree, though of a different species from that of the East Indies, produces a gum which constitutes most of the rubber of commerce. Agassiz puts this tree, forty or eighty feet high, in the same class with the milkweed of our American pastures. Of ornamental wood there is no end. Foremost among these is the moira-pinima, or tortoise-shell wood, the most beautiful in grain and color in the world. Enough of this is wasted every year to veneer all the dwellings of the civilized world. For many years to come, the exports of the Amazon Valley must be mainly the products of its forests. Yet, strangely enough, timber is now one of the chief articles of import at Para. A city of 35,000 inhabitants, lying on the verge of a great forest, buys pine boards from far-away Maine. This folly will in time come to an end. Contrary to all that we might expect, the climate of the Amazon Valley is temperate rather than tropical. It is more equal than in any other region of the world.

The Allen Engine.

We present, in the annexed illustrations, a perspective view and a horizontal section, through the cylinder and valve chambers, of the Allen engine—the latest candidate for public favor in the department of steam engines.

This engine was brought prominently into notice at the recent Fair of the American Institute, where two engines were exhibited, running at a rapid speed and giving motion to all the machinery on exhibition, and were doubtless seen and admired by many of our readers.

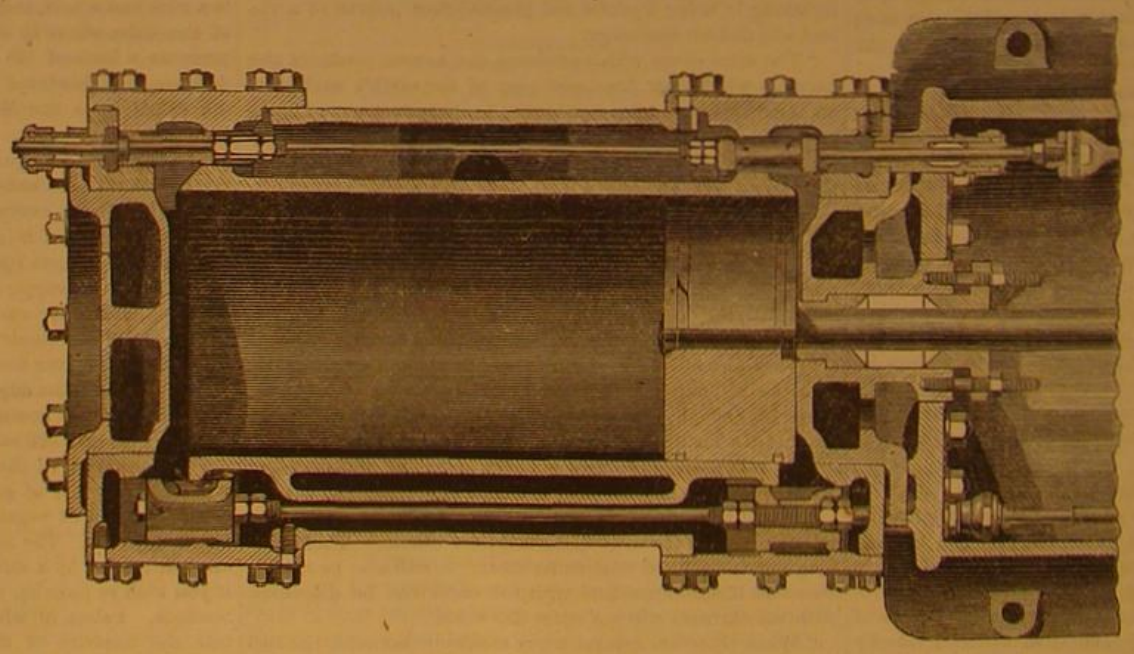
It is a variable cut-off engine, with equilibrium valves, opening large areas for admission and release, and operated by valve gear having positive movements, are admirably fitted for working at high speed. This advantage has been improved by the designer of this engine, who has sought to adapt it for running at what he conceives to be a more useful, and, in every respect, more desirable speed than the moderate gait to which engines are generally limited. Mr. John Penn, the eminent engineer of Greenwich, England, on being consulted by Mr. Whitworth as to the practicability of this innovation, replied, "High speed is wholly a question of construction."



THE ALLEN ENGINE.

having positive movements. The chief points of interest are its valves and valve gear, and its adaptation for running at high speed. It presents a novel and admirable modification of the link motion, by which the link, rigidly connected with the eccentric strap, is worked by one eccentric, which is set on the shaft in the same position with the crank. The link thus operated has movements substantially the same as those of the stationary link, as ordinarily worked by two eccentrics. From this link the admission and the exhaust valves are driven separately, the former from a movable block, and the latter from a fixed point at the extremity of the link. The position of the movable block is varied by the action of the governor, causing the steam to be cut off at any point of the stroke required, according to the resistance to be overcome, from the commencement up to the half stroke, beyond which point it is not allowed to follow. Porter's governor is used on this engine, and exhibits to good advantage its remarkable combination of power and sensibility.

The valves and their arrangement are shown in the sectional view of the cylinder. They are set on opposite sides of the cylinder, and are very easy of access. They all work in equilibrium, between opposite parallel seats. Each admission valve opens and closes, simultaneously, four passages into the port, two on each face. One of these valves is shown partly open, and the arrows show the course of the steam. Each exhaust valve opens two passages for release of the steam, the portion released past the end passing through the body of the valve, as shown.



This seems to be a common-sense way of getting a frictionless valve action. The valves rest on their lower edge, no pressure whatever comes on the working faces, and, the surfaces being of proper hardness, they do not wear sensibly in a great length of time. When necessary the covers can be let up, by slightly reducing the surfaces.

The cylinder and the steam and exhaust chambers are cast in one piece, with a belt of air interposed to protect the cylinder from the cooling exhaust current. The exhaust valves are so arranged as completely to drain any water from the cylinder. All the steam joints are scraped, and are put together perfectly tight without any packing.

The joints of the valve gear consist of hardened steel pins turning in hardened ferules secured in the rod ends. These are found wholly free from wear, while they prevent any derangement of the valve action.

It will be seen that these valves, moving without friction, any pressure can be transmitted through them to the crank that the force required to impart to them the velocity that they attain in passing through the half stroke, is readily computed, on the assumption that this accelerating force is uniform; but that, in fact—and this is the point of advantage claimed—this acceleration and the force required to produce it are not uniform, but are, precisely on the dead center, double their average, and diminish uniformly to nothing at the mid stroke, at which point acceleration passes insensibly into retardation. We have space at present only to state thus briefly the nature of the action claimed. It is certainly novel to engineers, and if real, is likely to make a revolution in engineering.

The fact undoubtedly is, that an engine may be designed and constructed never so badly, and if it is only run slow enough, may do tolerably well, but the instant it is attempted to speed it up, all its defects stand revealed, and the maker naturally concludes that high speed will never answer; while, on the other hand, an engine properly designed and constructed, may be run at any speed, and, within certain limits, we might perhaps say the faster the better.

Just so an unbalanced pulley will give no trouble while revolving slowly, that, if run swiftly, would shake the whole building to its foundation; but let it be truly balanced and we may drive it at whatever speed we choose—all is perfectly quiet.

This engine has certainly been designed with a thorough knowledge of the requirements of a high-speed engine, and exhibits in its running a degree of excellence that must be admired, and that promises a high degree of durability. We will note the points that have been presented to us, bespeaking for them the thoughtful consideration of our readers, for they open a new field in engineering, and present questions of great interest, and which will doubtless awaken much attention.

The successful running of a high-speed engine is claimed to rest principally upon the action of the reciprocating parts. It is contended that these act upon the principle of the fly wheel, absorbing the force of the steam at the commencement and giving it out to the crank at the termination of the stroke, and that if these parts are made of sufficient weight, and are run at a proper velocity, they will have the effect to transform the excessively unequal pressures, which the steam, in an expansive engine, exerts upon the piston at the opposite ends of the stroke, into a uniform rotative pressure on the crank, remedying the practical defect of the crank motion, namely, the shock and strain on each dead center, and giving the smoothness of running of a rotary engine.

The philosophy of this action was first explained by Mr. Porter, in his treatise on the Richard's Indicator, under the heading: "The Indicator Diagram not a Correct Representation of the Pressure on the Crank." It is, in brief, that the piston and rod, crosshead and connecting rod form a projectile, which must first be put in motion by the force of the steam, befor

Subordinate to this leading feature in these engines, we find great rigidity, the avoidance, as far as possible, of over-hanging strains, unusual extent of wearing surfaces, with hardness and truth of form, the utmost simplicity of construction, and admirable devices for lubrication. We are assured that these engines never have a warm bearing, and that the wear of all working parts is quite insensible, as was fully shown at the Fair.

The larger engine on exhibition was tested for its economy, and effective power given off. We learn that the experiments show a consumption of about 2¾ lbs. of coal per horse power per hour, and that the engine, 16 inches diameter of cylinder, by 30 inches stroke, making 125 revolutions per minute, and rated at 125-horse power, was worked up to 140-horse power with 80 lbs. pressure cut off at about one-quarter of the stroke, and gave off upwards of 90 per cent of its indicated power. Four first premiums were awarded to the Allen Engine Works, of this city, for this engine, and other articles exhibited by them.

Dr. Doremus on the Triumphs of Modern Science

The opening lecture of a course of lectures on the "Triumphs of Modern Science," by Dr. Doremus, at the hall of the Young Men's Christian Association, corner of Twenty-third street and Fourth avenue, New York, was delivered to a large and intelligent audience, on the evening of Thursday, Dec. 1. If space permits, we may give an abstract of this lecture in our next issue. Many interesting and brilliant experiments were gived, and others are in store for the future lectures of the course, which will be given December 8th, 15th, and 19th.

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SCIENTIFIC DESTITUTION IN NEW YORK.

There is, perhaps, no large city in the civilized part of the world in which such utter scientific destitution prevails as in New York. However much the citizens may hunger and thirst after scientific knowledge we have no public place in the city where their wants can be supplied. There is no museum of natural history, no collection of mineralogy and geology, no accumulation of models of machinery, no zoological garden, no technological collection for the free use of the people.

We occasionally have a traveling menagerie, to which is attached a "moral drama," but the drama draws much more than the show, and the animals are evidently introduced to make the exhibition respectable.

It is true that some of our generous citizens have liberally subscribed towards a museum in the Central Park, and the Commissioners are putting forth every effort to establish the zoological garden, but it must be a long time before either of these places can be completed. At present, the animals in the Park look as uncomfortable and seedy as the forlorn building in which they are kept. We are glad to see that more comfortable quarters are preparing for them. And yet, as incomplete as everything is, multitudes of people visit the Museum in the Park, and try to draw some amusement and instruction from it.

The Board of Education, of New York, have wisely ordered that instruction be given in natural history to the 100,000 children in our public schools. They direct the pupils to be taught the uses of familiar animals, a knowledge of the principal parts of the human body, covering of animals, how they move, and the food they eat; names of common plants, trees, and flowers; and some knowledge of minerals.

We have visited a number of the schools, and were pleased to find the teachers entering upon this branch of their duties with genuine zest and enthusiasm. They were imparting knowledge under difficulties, as there were no charts, no specimens, and no books for them to use. Some of the children had brought in a few stones, plants, insects, shells, etc., but such things as systematic collections were not to be found. It was while going the round of the schools that our attention was particularly called to the utter scientific destitution of New York, and we resolved to endeavor to excite some public interest in a question of such vital importance.

Our Board of Education have the control of more than $3,000,000 per annum, to be expended upon the schools. It never would occur to them to direct instruction to be given in geography, without the use of maps, globes, and charts. These aids are furnished as a matter of course, but when it comes to object teaching, the specimens are entirely wanting, and the poor teacher must procure them from her scanty earnings, or they must be omitted altogther.

The pupil at Dotheboy's Hall, who was set to weed the garden, was said to be studying botany. "Botany," said Mr. Squeers, "is the knowledge of plants, and when he has learned that, he goes and knows 'em." We are not certain that the system of object teaching adopted by Mr. Squeers' celebrated school was utterly devoid of good points. To teach botany without plants, or natural history without specimens, may help the memory, but not the knowledge of the pupils. It would be better to weed a little in the garden and "know 'em," than to try to commit their names to memory as we do rules of syntax.

All that is necessary to start a school now-a-days is to provide four walls and a few hard benches. Natural objects, if they find their way in at all, are brought in surreptitiously, to be afterwards swept out by the janitor. We all know that the unruly boy, who brings up a slate on the reverse of which he has drawn an unfortunate likeness of the school-master, is sure to come to grief; and yet, there is scarcely a boy who does not try to draw something—a horse, a cow, or a pig—until all such nonsense is knocked out of him. Children take instinctively to animals and birds, but here in New York we are as badly off for an opportunity to study anything in the way of "animated nature" as we could well be. Is it not possible for the Board of Education to face this question squarely, and to provide suites of suitable specimens, just as they now do books, pens, ink, slates, and charts, for other branches of the public instruction?

There are in the city of New York 89 grammar schools, male and female; 96 primary schools; and 3 normal schools, including the Normal College. In all of these, object teaching ought to form a prominent part of the instruction. In many instances the grammar and primary departments are in the same building, so that 134 sets of specimens could be made to supply all the wants of the teachers. As these specimens are intended to represent common objects, the cost of them would be trifling in comparison with the objects to be gained. The chief expense would be in printing labels, and in providing suitable cases. The expenditure once made need not be repeated every year as in the case of school books, but would be in a measure a permanent investment. We venture to say that for $20,000 every school could be provided with sets of specimens of the commonest objects suitable for the use of the teachers, and we have no doubt that the Professors in the School of Mines of Columbia College, would gratuitously give their services, and present many specimens from their private collections in aid of so worthy an object.

If it is not considered feasible to have so many small collections, it is certainly possible to have a complete museum in the new building now about to be erected for the use of the Normal College; or the Board of Education can combine with the Commissioners of the Central Park in constructing and furnishing the museum designed by Messrs. Vanx and Olmsted for the Zoological Garden. Let something be done to relieve the destitution everywhere prevalent in all matters of science now so conspicuous in our great city.

TRACTION ENGINES FOR COMMON ROADS.

The illustrated description of the Thompson road steamer which recently appeared in these columns has attracted the attention of our readers to the subject of traction engines, and it may not be amiss to supplement that article by some further general remarks upon traction engines for common roads, a subject of considerable importance, since the success which has attended the road steamer referred to, and the Aveling and Porter traction engine, has demonstrated the usefulness as well as the practicability of such machines.

Many of our readers are perhaps ignorant of the chief requirements of traction engines for common roads, or at least have not had them concisely and comprehensively stated.

These requirements are quite numerous. To secure them has been a work of many difficulties, only accomplished as yet in expensive machines, like those above alluded to. These difficulties all arise from the various characters of roadways on which such engines are worked. Stones which render roads uneven and rough, sand or mud which render them heavy, all must be met as they occur, and the traction engine, which fully comes up to the requirements of the case, must be able to surmount each in turn without hesitation or material abatement of power.

Such engines are also required to ascend heavy grades with their loads, to turn around in a limited space, to run backwards or forwards, and to endure without breakage the shocks incident to travel on rough roads. And not only the observance of these conditions is essential to success, but a fair measure of economy in their working is also an essential which cannot be overlooked.

As the driving wheels must be maintained in at least an approximately fixed position relatively to the cylinders, it is obvious the introduction of springs of sufficient flexibility to take off the shocks between the axles and the superimposed structure would become a disturbing element, unless some method of compensation for the motion which they allow were devised. For every vertical motion of the body of the machine from the axles lengthens the distance between the axles and the cylinders, and if not, as we have said, compensated for, this lengthening and shortening will interfere with that nice adjustment of parts so necessary to the successful use of steam as a motor.

The employment of the soft rubber tire, as used in the Thompson road steamer, and also in the Aveling & Porter traction engine, obviates all necessity for the use of springs between the axles and the parts which they support, but such tires add greatly to the cost of the machine, give the wheels a clumsy appearance, and certainly forbid the attainment of a speed suitable to passenger traffic.

Rubber tires give great tractile power, but it has been shown that on roads of ordinary smoothness an iron surface will bite sufficiently for most purposes, and will ascend moderate grades with facility.

A method of gradually changing the speed of revolution in the driving wheels, while the speed of the piston and the power of the engine remain unchanged, is a great desideratum in engines of this class. This and this only will enable them to regulate their power and speed in exact proportion to the increased resistance offered by increase of grade, or those offered by changes in the character of roadways. A mechanical movement, by which such a change of motion can be effected, already exists—namely, two cone pulleys connected by a belt; but this movement is not sufficiently positive nor adapted to the transmission of great power in small space. Something which occupies little space and will transmit positively a great power at low speed is what is wanted, not only for traction engines, but for other purposes.

Great as has been the success of the Thompson road steamer, we do not believe that in it that engineer has reached the ultimatum, and we have confidence that Yankee genius is yet to show that the traction engine for common roads which shall be capable of running at high or low speeds, for the transportation of passengers or freight, and shall cost much less than the English machines, is within the limits of the possibilities.

SAFETY VS. ECONOMY IN STEAM BOILERS.

An esteemed Boston correspondent writes us as follows:

"Your able article on the Nitro-Glycerin Explosion at Fairport, Ohio, should be followed by one entitled, 'How Long Shall Boiler Explosions Continue?' recounting the terrible explosion at Anderson, Ind., where the memory of the explosion at the Indianapolis State Fair is still vivid in the minds of the inhabitants, and where five human beings were killed, and a lady sitting in her own private dwelling was torn to pieces. If such sacrifices of human life were the well known conditions on which we could gain the benefits of the steam engine, as a Christian nation, we would indignantly refuse to purchase those benefits at such a cost. But the laws governing steam are so well understood that any first-class engineer can construct a steam-boiler that under any and all possible conditions can cause no such disasters. There are a number of steam-boilers now manufactured, that cannot, even with the greatest negligence, be made to explode, and which are sold for less money, occupy less space, and use less coal, than other boilers, yet still the work of destruction goes on, and life and property are sacrificed. 'How Long Shall Boiler Explosions Continue?'"

This is not the first time this question has been asked, but, in view of the often recurring explosion of boilers, it loses none of its pertinence through repetition.

We are not sure, however, that we can fully indorse our correspondent's statements in regard to the boilers for which he claims entire safety. We grant their safety, and their less cost, but we have yet to be convinced that they will produce more dry steam per pound of coal than other boilers. If their evaporative power is really greater, nothing is easier than to prove it; but it must always be remembered, that mechanically passing water in the form of spray, through a boiler, is not evaporation, and that from true evaporation only is all the mechanical power of a steam engine derived. It seems to us, that were the claims made for greater economy fully established, manufacturers and boiler-users generally would not be slow to respond to an appeal made to their own interest, and that these boilers would speedily replace all other boilers with which they now compete.

But, granting the safe boilers to be *less* economical of fuel than the unsafe ones, it is still questionable whether economy is not too dearly purchased, at the general risk, and the too frequent sacrifice of human life and limb, and we believe that unsafe boilers ought to be legislated out of the market, if such legislation is possible.

It is somewhat difficult to conceive a law that would enforce the proper care in attendance, or prevent the use of boilers improperly constructed. Any system of legal inspection cannot be sufficiently thorough, without subjecting careful, conscientious boiler-users to much inconvenience, brought upon them by the neglect of the unscrupulous and the ignorant; and opinions so differ upon the proper mode of construction, that the exclusion of any particular class of boilers from sale, on the ground of its dangerous character, would be found impracticable.

Something, however, ought to be done to punish the criminal neglect from which the large majority of boiler explosions originate, and the law on this point ought to be made so rigorous that neglect through parsimony, or from any other cause, should entail penalties which even the most reckless would respect.

GUN COTTON AND COLLODION.

There are some facts relative to the early history of gun cotton that are not generally known. When Schoenbein first discovered it, in 1846, he kept the method of its preparation secret, and proposed to sell it to the German Government, as a substitute for gunpowder. He called it "explosive cotton," and tried many experiments in blasting rocks, artillery firing, etc. The French chemist, Pelouze, had previously prepared a somewhat similar compound, by the action of nitric acid on wood, and he claimed the priority of discovery in consequence. He proposed the name "pyroxyline," from the Greek, meaning *fire-wood*. While the matter was still a secret, and with no further knowledge than that cotton had been converted into an explosive compound, the late Professor Ellet, of South Carolina College, invented the best method for the manufacture of gun cotton that has been found. He at once communicated it to the Legislature of South Carolina, and received the thanks of that body, December 3, 1846. His method was to employ a mixture of sulphuric acid and saltpeter. About the same time Dr. John P. Maynard, a medical student, from Dedham, Massachusetts, proposed to use the solution of gun cotton in surgery. He published an account of his experiments in the Boston *Medical Journal*, in 1848. Dr. A. A. Gould, of Boston, advised him to call this new liquid *collodion*, from the Greek word *kollodes*, gluey, and this name was accordingly adopted. Previous to Dr. Maynard's researches, the solubility of gun cotton in a mixture of alcohol and ether was not known, and to him we are therefore indebted for the introduction of collodion.

It will thus appear that the world is largely indebted to two Americans, Professor Ellet and Dr. Maynard, for a knowledge of the manufacture of gun cotton and of collodion, a fact that ought not to be lost sight of in the history of those important compounds.

HOW SHEET MUSIC IS PRINTED.

Passing, the other afternoon, by the music publishing house of John L. Peters, 599 Broadway, New York, it occurred to us to ascertain in what way the sheet music, of which enormous quantities are constantly issued, is printed. It will be evident to any one having a slight knowledge of printing, as performed with movable types, upon a very casual inspection of a sheet of music, that some peculiar method is employed. Not that movable types cannot be used in printing music; they are so used, to a large extent, in music-book work; but sheets of music show lines intersecting lines, and slurs and hooks superimposed upon staff-lines, in a way that gives a superior elegance of appearance, unattainable by the use of movable types.

To learn the details of the art, we stepped into Mr. Peters' establishment, and found that, as in most practical operations, simplicity is the chief characteristic of sheet music printing.

Suppose the compositor to have placed in his hand a manuscript musical composition. To prepare a plate from which this music can be indefinitely printed, he selects a thin sheet of soft metal, of the proper size, and sinks, by the use of a machine constructed for the purpose, the staff-lines into the metal. When this operation is completed, he proceeds to sink in the notes, rests, points, bars, slurs, etc., by the use of suitable punches, each musical character, or element of a character, having its appropriate punch.

The plates thus prepared have thus produced upon them the piece of music, in sunken characters, which characters are next filled up to the uniform level of the plate with beeswax. The musical notation now appears as if printed in wax upon the plates, the surfaces of which are highly polished.

To print from these plates, the ink is first distributed uniformly over the entire surface, by a hand roller. The surfaces are then wiped off with a cloth, which removes all the ink from the polished parts, while it still adheres to the wax in the punched depressions. This part of the work is performed by a special workman, who, when he has completed it, passes the plates to the pressman.

The latter lays the paper upon the surface of the plates, and then passes them through the ordinary lithographers' press.

The process bears considerable analogy to ordinary lithography. In the latter process, the design is drawn upon the plates with chemical inks, which penetrate and change the character of the surface, so that the inks used subsequently in the printing adhere to the lines of the drawing, but are easily wiped off the remainder of the plate. A similar result is attained on the music plates, but by entirely different means.

TECHNICAL EDUCATION.

[Report of the Committee of the Trustees of the Rensselaer Polytechnic Institute, on the System of Instruction, with Proposed Modifications.]

While so much is being thought, written, and said on the subject of technical education, and while so much that is said and written has little to commend it to the attention of earnest thinking men, it is refreshing to meet with a document upon this important topic, bearing upon its face the stamp of sound common sense, and freedom from that conservatism which has too long retained in our system of education much that, if not really worthless, is at least comparatively so, when contrasted with what might constitute the curriculum of a modern school. This conservatism has, while making concessions to the modern demand for scientific and technical learning, still clung to the old course of training, so that the number of studies pursued in our colleges has become so much increased as to become cumbrous in the extreme, and to tend rather to superficiality, than thoroughness in any department of learning.

No one can fail to see signs of a great revolution in the management of our higher institutions of learning. The modern mind no longer has faith in classical study as the best preparation for a successful career in active life. It demands a change, and the change is being gradually conceded by the schools.

One of the most significant of the movements originating in the state of things to which we have alluded, is the action of the Trustees of the Rensselaer Polytechnic Institute, who, in response to a wide-spread conviction among the graduates of that Institution, that the studies pursued comprised too much of the purely theoretical, and too little of the technical, appointed, March 14, 1870, a committee to consider what change, if any, might be advantageously made in the courses of study pursued.

The committee consisted of Messrs. E. Thompson Gale, A. L. Holley, and C. E. Dutton, and the investigations and recommendations are embodied in a report of singular ability, the title of which we have given at the head of this article.

As a first step, the committee sought the advice of eminent educators and engineers at large, addressing to them a circular letter containing the following questions, which themselves sufficiently indicate the practical wisdom which the committee brought to bear upon the investigations:

1. Does the course of study announced in the Catalogue (a copy of which is also sent you), embrace too great a proportion of the higher mathematics, and too small a proportion of the natural and physical sciences; or could the former be curtailed and the latter increased with advantage?

2. Does the course of study seem to you to embrace too large a proportion of purely theoretical instruction, and too small a proportion of practical instruction?

3. Considering the qualifications demanded of American civil and mechanical engineers, is there any study omitted in the course which ought to be introduced; it being premised that such an addition involves a corresponding reduction in some other study already prescribed?

4. Do you think it would be feasible to impart elementary instruction in practical and mechanical engineering, by means of lectures, given by experts, in machine shops, and on the ground where construction is going on; the object being not only to better fit men for practice, but to illustrate and vitalize theoretical study; or would such instruction be too superficial to warrant the necessary expenditure of time?

Abstracts from twenty-four replies to the circular letter are printed in an appendix to the report.

While they indicate a great diversity of opinion on many points, there seems to be a general opinion that the course of mathematics *should not be curtailed*, so far as it relates to civil engineering; but while this opinion was generally expressed, the strengthening of the practical element in the course of training was deemed of equal importance.

To understand the force of these opinions it is necessary to know that the courses of study in the institution are four in number, viz., Civil Engineering, Mechanical Engineering, Mining Engineering, and Natural Science. The report informs us that two of these have only a nominal existence. "The course in Mechanical Engineering is not given, and that in Natural Science graduated only one student at the close of last year."

Practically, then, the instruction in this institution, instead of being polytechnic, is confined to mathematics and civil engineering. And though it has acquired an enviable reputation for thoroughness in these two departments of science, it falls far short of being what its name might lead those unacquainted with its management to infer.

In order to give an idea of the full scope and meaning of the word "polytechnic," as applied to an institution of learning, the report proceeds to detail the characteristics of the school system of Germany, from which we make the following extract, containing much condensed information in regard to one of the most perfect educational systems in the world:

"It is necessary to premise that the whole range and scope of education, from the highest to the lowest, is, in all the German States, supervised and sustained by the governments. There is no question there whether government ought to undertake the higher education of citizens. It assumes it as a duty and a privilege; and though it requires that those who receive its benefits should pay part of the expense, it sees to it that nothing is lacking, which is in its power to provide, to the widest development, most thorough efficiency, and ample equipment of all its schools, from the highest to the lowest. Hence it has come to pass, that not only is every grade of public school the best possible in itself, but it is part of a great system. The schools are graded in such a manner, that each lower grade is preparatory to a higher, and each higher grade begins where the next lower left off. Up to a certain period and stage of development, the course of education in the public schools is uniform for all pupils. Beyond it, there is a divarication into two parts, one of which is chiefly literary, and has its culmination in the university; the other, scientific, culminating in the polytechnic school. These embranchments are co-ordinate, equal and complementary, each representing an education upon a basis, to a certain extent peculiar and distinct. The preparatory school for the university is the *gymnasium*, which corresponds pretty nearly to our American college,—the university itself being a type of organized education which cannot be adequately represented by anything in this country. The preparatory school for the polytechnic is the *real-school*, which has not the remotest trace of a representative among us. In it are taught the whole range of the lower mathematics, including plane geometry, algebra, trigonometry, and conic sections; also the elements of the physical and natural sciences, with the languages, including Latin, French, and generally English, and those moral, ethical, and æsthetic branches which are deemed absolutely indispensable to what is understood to be a liberal and thorough education. When the pupil of the real-school enters the polytechnic, he is reasonably proficient in every kind of general study, excepting the higher mathematics. Henceforth his efforts are occupied with higher and technical studies alone. He has mastered the elements of nearly everything which can be systematically taught, and all that remains is to give special, and in some cases, extended developments to certain branches, selected with reference to the trade or profession he expects to pursue. Among the many excellencies of this admirable system, it will be seen that the polytechnic schools are not hampered with the early and preparatory education of the scholar, but have solely to deal with his professional training, a feature, the importance of which cannot be exaggerated, and which relieves the schools of one of the most perplexing and annoying difficulties which your committee have been compelled to face."

The committee indicate in the last portion of the above quotation, a difficulty which, in the present state of American education, is well nigh insurmountable. A school system to be effective in the highest degree, must comprise in its provisions the regular and systematic gradation of study from first to last. As matters now stand with us, we have separate and widely differing systems of primary instruction, and there is no uniformity in the studies of intermediate schools. The consequence is, that, while for higher institutions many pupils may be well enough prepared in some things, all have not had the same training, and most are in some respects utterly deficient. Their deficiencies have subsequently to be supplied, and their acquirements to be brought to some common level before uniform progress can be made.

But we are extending this article much beyond what we first intended. The fertility of the subject tempts us to expand still further, but we must close. The report under consideration is one of the most important and instructive papers upon the subject of technical education in America, we have ever met with, and its wide circulation would be extremely desirable.

EIGHTEEN HUNDRED men make a locomotive engine in one day—boiler, cylinders, frame, driving wheels, truck, stack, cab, pilot, and tender, complete—the speed of forty miles an hour and the power of a thousand tuns created in a day.

MICRO-PHOTOGRAPHY.

Micro-photography is the word employed to signify the manner of taking photographs of microscopic objects as they appear when magnified. The process, or at least a modification of it, was known as long ago as 1840, when daguerreotypes were taken in this manner, and the plates afterwards engraved for printing. There are two methods used at present, namely, with the microscope itself brought into a horizontal position, and the eye-piece fitted into the camera box; or, by using instead of the compound microscope an instrument consisting of the table and stage of the microscope, so arranged as to carry the objective and necessary focusing apparatus, at the same time screwing into the flange of an ordinary camera.

The most ingenious apparatus has been contrived by Dr. Woodward, of the Army Medical Bureau, in Washington, and he has found the magnesium and electric lights to yield the best results. Some of the specimens of infusoria were magnified 2,500 diameters.

So much for the micro-photography, or photo-micrography. We have now the information of the practical use of the reverse process in reducing large objects to very minute ones, and thus obtaining a microscopic photograph. One side of the London *Times* has been reduced to the size of the finger-nail, and photographed so sharply as to be legible with the microscope. The apparatus for producing this effect is the opposite of the one just described, and it is now proposed to use it for the conveyance of intelligence into Paris, by means of carrier pigeons.

Telegrams, news items, and intelligence from all parts of the world, is pasted on a wall, and a microscopic photograph taken, a print of which is made upon tissue paper less than an inch square. If, by good luck, this message should reach Paris, it is enlarged according to Dr. Woodward's process, and becomes legible to the naked eye, and copies can be taken for distribution.

It is curious to see a department of scientific research thus suddenly appropriated for carrying information on the common affairs of life. We certainly can never predict to what uses a scientific discovery may some day be applied.

Concrete and Iron Bridge.

A new bridge erected for Sir Shafto Adair, from the designs of Mr. H. M. Eyton, of Ipswich, over the Waveney, at Homersfield, England, has been recently tested. In designing the bridge advantage was taken of the principle of Messrs. Phillips' patent fire-proof construction, a system in which all the ironwork is completely embedded in Portland cement concrete. The bridge has one arch of a clear span of 50 feet, with a rise of 5 feet 3 inches. The skeleton of the bridge is of iron, and this is entirely filled in with Portland cement concrete, and rendered with Portland cement, thus formiug one continuous beam, getting stronger every year, in addition to the iron skeleton, which is of itself sufficient to do the ordinary statical work of the bridge; the weight of concrete alone is over 100 tuns. The spandrels of the bridge are relieved by a raised panel, and in the center is a casting of the Adair arms, taken from the old three-arched brick bridge The first test applied was that of a five-tun road roller drawn by four horses. This was passed across several times, and not the least deflection was perceptible. Afterwards a heavy wagon, laden with sacks of flour, weighing altogether six tuns, was passed over, and still, it is stated, no deflection could be noticed.

St. Louis Bridge.

The following is a brief statement of the condition of the work upon the bridge at St. Louis, according to the latest advice from its constructor, Jas. B. Eads, C. E.: "The masonry of the west abutment is about fourteen feet above the present stage of the river. The western pier is about sixteen feet, and the eastern pier about four feet above water. The laying of the masonry is progressing on the west abutment, and on the east pier. The granite (from Portland, Me.) for the west pier is on its way up the river. Some fifty or sixty vessels, laden with granite for the work, are now upon the ocean, and two cargoes on their way up the Mississippi from New Orleans. No further delay is therefore anticipated on account of material for masonry. The caisson for the eastern abutment is nearly finished at Carondolet, six miles below the city, and will be launched and placed in position in about two weeks. This abutment will be sunk to the bed rock, 136 feet below extreme high water mark, and will consequently penetrate eight feet deeper than the pier which was put down last winter. These four masses of masonry constitute the foundations for the bridge proper, those for three of the smaller piers in the western approach have already been put in, the deepest one extending twenty-one feet below the city directrix. This one has been recently put down, and is nearly completed to the wharf level.

The Vitality of Seeds.

The following schedule gives the length of time that seeds will grow, if properly kept, but it is true that some varieties will even keep longer than the period mentioned, but their strength will be greatly impaired. Imported seeds of all kinds lose their vitality much sooner than those of American growth, which is occasioned by the dampness which they absorb in transit across the ocean. Seed of all kinds should be kept in a dry situation, and in sacks, in preference to barrels. Asparagus, cabbage, Brussel sprout, cress—four years; beans, borecole, cauliflower, celery, corn-salad, lettuce, mustard, okra, parsley—three years; carrot, corn, wheat, oats, broom-corn, egg-plant, endire, leek, onion, peas, pepper, salsify, tomatoes—two years; beets, nasturtium, pumpkin, radish, squash, turnip—five years; cucumbers—ten years; melon—six years; parsnip, wrinkled peas, rhubarb seeds, spinach—one year.

SCIENTIFIC AMERICAN.

1871.

Special Club Premium.

A New Volume of this journal will commence on the first of January next. Any person sending us yearly clubs for ten or more copies will be entitled to receive, free of postage or express charge, one copy of the celebrated engraving, "MEN OF PROGRESS," for every ten names.

This large and splendid Steel Plate Engraving is one of the finest art works of the day, possessing a rare and peculiar value over ordinary pictures, by reason of the life-like accuracy of the personages it represents. The scene of the picture is laid in the great hall of the Patent Office, at Washington. The grouping is spirited and artistic. Among the persons represented are the following eminent inventors:

S. F. B. MORSE,.....Inventor of Electric Telegraph.
CYRUS H. McCORMICK,.....Inventor of Reaper.
THOS. BLANCHARD,.....Inventor of Lathe for Irregular Forms.
WILLIAM T. G. MORTON,.....Inventor of Chloroform.
SAMUEL COLT,.....Inventor of Revolving Fire-Arms.
CHARLES GOODYEAR,.....Inventor of Rubber Fabrics.
FREDERICK E. SICKLES,.....Inventor of Steam Cut-Off.
HENRY BURDEN,.....Inventor of Horse-Shoe Machine.
JOHN ERICSSON,.....Inventor of the first Monitor.
JAMES BOGARDUS,.....Inventor of Iron Buildings.
JOSEPH SAXTON,.....Inventor of Watch Machinery.
PETER COOPER,.....Inventor of Iron-Rolling Machinery.
JOSEPH HENRY,.....Inventor of Electro-Magnetic Machine.
ISAIAH JENNINGS,.....Inventor of Friction Matches.
RICHARD M. HOE,.....Inventor of Fast Printing-Presses

These noble men, by their own efforts, raised themselves from the depths of poverty, and by their wonderful discoveries, conferred incalculable benefits upon the human race, entitling them to rank among its greatest benefactors. It is but fitting that the remembrance of their achievements, and the honored forms of their persons, as they lived and walked among us, should be perpetuated by the highest skill of art. The picture, which is three feet long and two feet high, forms an enduring and desirable object for the adornment of the parlor. It was engraved by the celebrated JOHN SARTAIN, from a large painting by SCHUSSELE, and all the portraits were taken from life. Every lover of Science and Progress should enjoy its possession. Single copies of the Engraving $9; Three copies, $25.

One copy of the SCIENTIFIC AMERICAN for one year, and a copy of the Engraving, will be sent to any address on receipt of $10.

MUNN & CO.,
37 Park Row, New York City.

OATS.—The Scotch are great eaters of oat-meal grits, and in this city the consumption of this article of food is largely increasing. Unlike wheat, the muscle-making materials in oats are not connected with the hull, and are not, therefore, removed and lost in making fine flour. The eaters of oats are strong, enduring, and thoughtful; those who subsist largely on buckwheat and rice have far less power in these important respects. The oats should be cracked and separated from the hull, then allowed to soak over night in milk, and boiled in the same material. With cream and sugar or sirup the dish is very palatable.

WOODEN WATER PIPES were recently taken out in Woodward avenue, Detroit, laid there forty-three years ago. The wood is apparently as sound as ever, showing no signs of decay, even retaining the bark, and on cutting through it into the wood, the timber was found as bright and sound as ever. The pipes were made of tamarack logs, about sixteen feet in length, and eight or ten inches in diameter; bore of log, three inches in diameter. The pipes were disconnected from the distribution pipes several years ago. They were embedded in clay at a depth of four or five feet.

A CAUTION TO LADIES.—DEATH IN THE CHIGNON.—A correspondent from Liberty, Pa., writes that a physician of that place has discovered a species of microscopic insect which infests the material used for chignons, called mohair. These insects enter the scalp, and cause speedy death. He states that a young lady, who had been wearing the article in question, now lies in a critical condition, her scalp being filled with these insects, and her recovery is considered hopeless by the best physicians of the locality.

"THE trials made with a view of testing the stability of the *Monarch*—considered one of the most powerful English ironclads in the world—are said to have been 'very unsatisfactory,' and the ship, it is understood, will not proceed to sea with the Channel Squadron on its next cruise." Commenting on the above item, a Manchester paper very sagely remarks: "If our turret ships are unseaworthy, it can be no adequate compensation to us to know that they are no worse than the turret-ships of other nations."

THE ATLANTIC CABLES CEASE WORKING.—The cables of 1866 and 1865 have (Thursday, Dec. 1) ceased working altogether, and the French cable has ceased to transmit eastward, though messages are sent westward with the usual facility. This peculiar freak of the French cable is up to the present writing unexplained. It is evident that to secure uninterrupted communication between the continents, more cables must be laid.

CURIOUS PHENOMENON.—The Bridgeport Manufacturing Company send us the following extract from a letter to Mr. Wm. Belk, of Mount Vernon Lime Company, Iowa: "My well is dug and walled through 50 feet of clay, then drilled through 8 feet more of clay, and 32 feet of rock. The water stands just at the top of the drill the year round, except at the change and full of the moon, at these times it rises 16 inches into the dug well, and gradually subsides until the moon quarters. This I have noticed for over twenty months."

WE publish elsewhere the prospectus of the New York *Times*, a journal we are happy to recommend to our readers. The *Times* is very ably edited, and contains all the intelligence of the day—literary, political, social, and financial. As a family journal it is exceptionally good. No parent need fear to allow the children to read the *Times*.

RUSSIA has nine universities, all under the control of the government. The largest, that of Moscow, has seventy-five professors and one thousand six hundred students.

RECENT dispatches announce that the Suez Canal has passed into English hands and is henceforth to be managed by an English joint stock company.

Facts for the Ladies.

I have used my Wheeler & Wilson Machine for more than fourteen years, without a cent's worth of repairs, and I would not give it for a new one today. It looks rather the worse for wear, but works like a charm. I used one needle for five years, until it was worn too short for further use. I have made one thousand custom shirts, and stitched fifty-six dozen collars, four-ply, each day, for four years. MRS. MARY E. KINGSBURY.
Green Island, Albany Co., N. Y.

If Every Man

Who spends money in advertising would go or send to Geo. P. Rowell & Co., the New York Agents for most of the United States, the number of successful advertisers would be largely increased.

QUERIES.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers, and hope to be able to make this column of inquiries and answers a popular and useful feature of the paper.]

1.—SOLDERING SPRINGS.—How can I solder a piece of spring wire (either brass or steel) to another piece of metal with hard solder without softening the wire, or at least without destroying its elasticity? I see brass pin tongues, at least they appear to be common spring brass, and are soldered to the joint with hard solder, but I cannot imagine how this can be, as I suppose it takes a red heat to melt hard solder, and a red heat will destroy the elasticity of spring brass.—J. E. W.

2.—EMERY WHEELS.—How can I make emery wheels. I need them sometimes of peculiar shape. I do not need any over two inches in diameter.—W. E.

3.—REMOVING TATTOOED MARKS.—Is there any process by which India ink can be removed from the skin? When a boy I was so foolish as to greatly disfigure my hand by tattooing, and it has been an eyesore to me ever since. How can I obliterate the marks? All the suggestions I have tried have failed.—G. R.

4.—WIRE OF SOLDER.—Can solder be drawn into wire? or how can it be got into that form?—E. E. D.

5.—GAS-TIGHT COATING FOR FABRICS.—What is the best gas-tight coating for fabrics of silk, linen, nankeen, etc.—L. Van A.

6.—SCREW PROPELLER.—How will the revolutions of a screw propeller be affected, respectively, when the vessel is running in still water, when it is running with the tide or against it? Or, in other words will the revolutions per minute be greater when running in still water than when running against the tide; and greater when running with the tide than when running in slack water, carrying the same steam pressure in each case? —F. G. F.

7.—TELODYNAMIC CABLE.—Suppose a sixty saw cotton gin on a hill, and a six horse engine at the bottom of the hill (near water) one hundred yards apart; a grooved wooden pulley is attached to the driving wheel of the engine to carry a 1¼ inch wire rope running in the groove, the pulley to be large enough to maintain sufficient adhesion, without too great tension. A pulley of the same size is placed at the top of the hill, grooved, as is the one at the engine. A band pulley is attached to this top pulley the size of the driving wheel of the engine, and a band passing from this pulley to the gin, the gin thus running at the same speed, as if belted directly with the driving wheel of the engine. What percentage of the power of the engine is expended in driving the two pulleys and the ¼ in. wire rope, the whole length of the rope being 200 yards? If the rope passed over a ravine perhaps there would be no necessity for idle pulleys to prevent sag; otherwise there would be two idle pulleys half way between the engine and the gin.—J. M. E.

8.—STEP FOR WATER WHEELS.—The bottom bearing of a water wheel being of hardened steel, what is the best material for the step? —G. B. L.

9.—CLEANING FIRE ENGINE BOILER.—How can I clean the boiler plates of a Cole Brothers fire engine? The outside and inside shells are so constructed that a scraper cannot be got to them, and I find it impossible to get the mud which collects on the plates off. I have tried blowing out and washing out with an old hand engine, but these plans do not succeed. Is there anything I could put in that would dissolve the deposite from creek water and blow out?—H. C.

10.—RAISING WATER.—What would be the friction of piping or other difficulties in the way of raising water through a continuous line of piping a distance of 1,200 feet off, and up a slope of twenty-five feet to where the pump is stationed, over and above the difficulties of raising it from a well by the side of the pump, the top of the water being the same distance (twenty-five feet) below the pump? and would there be any advantage in having the pipe to enter a large pipe or cylinder just before entering the pump, in order to make the flow of water from the spring more uniform or easier on the pump? No doubt many of your readers have had all the practical experience wanted in just such cases. Our wells fall in the limestone regions of this State (Georgia) in summer and fall. Such is the case at my mill. I am using one of Woodward's steam pumps at the mill twenty-five feet above the level of the spring. The steam pump is Woodward's largest size.—A. J. W.

11.—BARKER'S MILL.—What is the cause of the motion of this machine? I have never seen what I consider the true cause assigned. the cause assigned by Quackenbos seems plausible; if correct, the arms can revolve no faster than the water would issue under the head of water in the shaft. With a shaft containing a depth of water four feet, and arms projecting two feet, the arms would make about seventy-seven revolutions per minute. But the arms will certainly run faster; thus the cause assigned by Quackenbos and others is not correct.—CURIOUS

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.

POWER OF ENGINES.—In answer to J. B.'s query, in No. 21 current volume, I give the following rule: To find the number of revolutions per minute, divide the number of foot-pounds in the required horse power (equal to the number of horse power multiplied by 33,000) by the pressure on the surface of piston; divide the quotient by the number of feet the piston travels for each revolution, and this quotient will be the required number of revolutions per minute. To find the pressure per square inch, divide the number of foot-pounds by the number of feet the piston travels per minute; the quotient will be the entire pressure on the piston, which, divided by the number of square inches in the piston, will give the required pressure per square inch.—M. M., of Mich.

GLAZIER'S DIAMONDS.—In answer to E. P. G.'s query, No. 22, current volume, I would say that as the diamond spark in a glazier's diamond has many angles, it can be reset to act as well as ever. E. P. G. can unscrew the head in which the diamond is set, and—stating kind of stock it belongs to, and if to cut thick or thin glass—send it by mail to any good manufacturer of glaziers' diamonds, and have it reset at small cost.

TO PUMP HIGHER.—Answer to query 6, in No. 22, SCIENTIFIC AMERICAN: If a small hole be made in the suction pipe, about ten feet above the water in the well, the air will enter and mix with the water in the pipe; and as the mixture is much lighter, it will rise to a higher point than water alone. "J. K. F." will find this matter treated of in "Ewbanks' Hydraulics, pages 224-5, edition of 1842.—T. J. W. R.

REMOVING PAINT AND TAR.—"Old Tar," who inquires in No. 21, current volume, for a method of removing oil-paint and tar from oil-cloths, can do so by soaking them in a solution of potash.—O. F., of Pa.

R. S., of Ill.—We know of no way whereby ordinary fermented bread can be kept for a long time, except by drying it perfectly. A patented process for effecting the desiccation of bread is as follows: Well-made and well-baked bread is exposed to a current of dry air; the evaporation of the moisture should be slow, in order that the bread may not crack. The duration of this drying process varies from eight to fifteen days, and depends on the size of the loaves and the form of drying apparatus adopted. If the bread were compressed in the state in which it is left by the desiccation it would break; and to prevent this it must, before being pressed, be submitted during four or five minutes to a heat of from 150° to 200° C., in a stove filled with steam. To effect this operation the bread is arranged in layers, separated by iron plates, which form molds in which the bread will assume the shape and size previously determined upon. These layers are loaded upon cast-iron carriage running upon rails, and thus introduced into a stove which is immediately closed; in a few minutes the bread becomes soft, although it will have absorbed but a very small quantity of water; the load or batch is then withdrawn and pushed by means of a carriage between two pressing plates, in order to be compressed. Any press will serve, but as the pressure should be rapid and powerful the hydraulic press is best. The bread should remain in the press for twenty-four hours; it may then be removed, is dry and cold, and will preserve the shape which has been impressed upon it. The bread thus prepared is packed in cases to preserve it from insects, and, it is said, will keep several years.

J. S. B., of Tenn.—Milk should not be kept in leaden vessels, and the less of this metal used in the soldering of milk cans the better. A case is recorded by Dr. Darwin of a farmer's daughter, who used to wipe the cream off the edge of the milk, which was kept in leaden cisterns, and being fond of cream licked it from her fingers. She was seized with symptoms of lead colic, afterwards with paralytic weakness of the hands, and she died of general exhaustion.

J. E. W., of N. H.—Gun-flints are so little employed now, that a description of the process of manufacture would not be of general interest. You may find it fully described in Dr. Ure's "Dictionary of Arts, Manufactures, and Mines."

F. R. S., of Minn.—The metals found in meteoric stones do not possess qualities not found in metals of terrestrial origin. The mass you have found is, judging from your description, only an unusually large nodule of iron pyrites.

G. R. T., of Fla.—You may make a varnish of shellac without alcohol, by using instead a solution of potash. A little experiment will enable you to get the right proportions. This varnish answers very well for cheap toys, etc.

L. M. V., of Mich.—If you have, as you say, invented a cheap preparation which will prevent spruce flooring planks from splintering under wear in stores, factories, etc., it is valuable, and a thing much needed.

F. D., of N. Y.—The sample of clay sent will not make good bricks; it contains too many limestone fragments. In burning, these fragments will be made into quick-lime, which subsequently slacking, will crack the bricks to pieces.

W. B. G., of Ohio.—Will a steam pump throw water as fast when the pump stands twenty feet above the water, as when it stands four feet above the water. *Answer.*—No.

J. R. K., of Wis.—Your mixture for waterproofing boots is, we think, patentable. All such articles are readily salable if good and cheap.

L. G., of N. Y.—The yellowish color of tartar emetic is not, as you suppose, a new phenomenon. Though usually white, it sometimes has a yellowish color when powdered.

M. L. G. of S. Ca.—For answer to your inquiry, see "perpetual motion" articles, now in publication in this journal.

W. H. H. H., of Pa.—You should apply to an expert steam engineer for the information you seek. It involves calculations which would make too great demand on our time.

O. F., of Pa.—Spelter is only another name for commercial zinc. You will find in back numbers of this paper full descriptions of the processes of reducing zinc ores.

H. P., of ——.—In our column devoted to queries, we do not propose to give space to questions of a merely speculative nature. We have no room for such discussion.

F. L. and T. L. C., of Ill.—It will not interest our readers to know that you have discovered a flux for welding cast steel to cast steel, unless you at the same time give the composition of the flux.

W. E., of N. Y.—We have seen nothing from which to infer that the nitro-glycerin explosion, at Fairport, produced any sensible effect on the weather.

L. M., of Mass.—A recipe for polishing marble was published on page 351, current volume.

R. J., of Ill.—We think your skate is patentable. A good

Business and Personal

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

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Patent for Sale—A Watchmaker's Tool for topping, rounding up, and equalizing the teeth of Watch Wheels. To be used on Watchmakers' lathe. Address Jas. L. Hathaway, Norfolk, Va.

Self-closing Telegraph Key—Frey's Patent. Liberal terms to Agents. Call at, or address, A. Illing, 213 Church st., New York.

Diamond Carbon of all sizes and shapes, furnished for drilling rock, sawing and turning stone, conglomerates, or other hard substances, by John Dickinson, 64 Nassau st., New York.

Wanted—A Partner, with capital, to take an interest in and manufacture two articles, under separate patents, for Iowa and Minnesota. Address H. K. Averill, New Oregon, Iowa.

Crampton's Imperial Laundry Soap, washes in hard or salt water, removes paint, tar, and grease spots, and, containing a large percentage of vegetable oil, is as agreeable as Castile soap for washing hands. "Grocers keep it." Office 84 Front st., New York.

Patent Elliptic-geared Punches and Shears.—The greatest economy of power, space, and labor. Can be seen in operation at our factory, in Trenton, N. J. Address American Saw Co., 1 Ferry st., New York.

Hand Screw Punches and Lever Punches. American Saw Co., New York.

For Sale—The entire Right of the best Adjustable Wrench. Price $5,000. J. F. Ronan, at Chickering's Factory, Boston, Mass.

Corn-shuck Collars.—C. H. Leffler, of Montgomery, Ala., wants a machine that will receive the Corn Shucks and plait them into a collar.

Rotary Steam engine.—A new patent for a superior improvement in Steam Engines, patented this week. The whole, or portion of territory for sale. J. N. Pomert, Greenfield, O.

Self-testing Steam Gage—Will tell you if it is tampered with, or out of order. The only reliable gage. Send for circular. E. H. Ashcroft, Boston, Mass.

The Darling Self-supplying Penholder, writing 1400 words at a dip, mentioned Nov. 19, page 324, sent by mail. Desk holders 75c., pocket holders, $1 50. B. L. Goulding, 108 Fulton st., New York.

An active man who is a rapid workman in iron, knowing something of the general variety business, and who possesses good managing abilities, can hear of an opening by addressing W. M. Tilden, Pittsburgh, Pa.

R. R.—Some Engine builders are too penurious to put on first class Lubricators and Oil Cups. The best are made by H. Moore, 41 Center street. Send there for a circular.

Excelsior Stump Puller & Rock Lifter. T. W. Fay, Camden, N. J.

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Wanted—Hooks for my Carpet Molding. Address J. H. Stanton, Franklin, Ohio.

Scientific American—Back Vols. and Nos. for sale. Volumes bound, $3. Nos. 10c. each. Address Theo. Tusch, 37 Park Row, New York.

Thrifty Mechanics, who require no discounts, but desire a safe place of deposit for their earnings in an institution where they can enjoy all the advantages possessed by Banks of Circulation, with the additional one of drawing interest on their accounts, are referred to the advertisement of the Mutual Benefit Savings Bank, published in our advertising columns.

Peteler Portable R. R. Co., contractors, graders. See adv'ment.

Peck's Patent Drop Press. Milo Peck & Co., New Haven, Ct.

House Planning.—Geo. J. Colby, Waterbury, Vt., offers information of value to all in planning a House. Send him your address!

The Merriman Bolt Cutter—the best made. Send for circulars. Brown and Barnes, Fair Haven, Conn.

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.

Manufacturers and Patentees.—Agencies for the Pacific Coast wanted by Nathan Joseph & Co., 619 Washington st., San Francisco, who are already acting for several firms in the United States and Europe, to whom they can give references.

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Improved Foot Lathes. Many a reader of this paper has one of them. Catalogue free. N. H. Baldwin, Laconia, N. H.

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Belting that is Belting.—Always send for the Best Philadelphia Oak-Tanned, to C. W. Arny, Manufacturer, 301 Cherry st., Phil'a.

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Parties in need of small Gray Iron Castings please address Enterprise Manufacturing Co., Philadelphia.

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

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Recent American and Foreign Patents.

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

SHUTTLES.—Walter Bennett, Springfield, Ill.—This invention relates to improvements in shuttles, and consists in an improved arrangement with the shuttle having a recess or depression along the upper edge of one of the sides of a bar, with eyes for the thread and slots leading from the lower edge to the said eyes for threading them, said bar being pivoted at one end to the shuttle inside, and arranged to close down by the inside of the recessed side, so that the thread will be retained in the eyes by the upper edge of the shuttle side. The said improvement is mainly designed for swing-machine shuttles, but may be applied to others.

BRICK MOLD.—Samuel H. Taylor, Jacksonville, Ill.—This invention relates to improvements in brick molds; and it consists in a novel arrangement of the handles with the end pieces of the mold, which are hinged to the side pieces, for opening to free the bricks and the side pieces, which spring open when the ends are free when discharging, by which the handles are made to clamp the said sides and ends tight for receiving the clay, and to release them when the bricks are to be discharged.

GATE.—Elijah Gemberling, Elkhart, Ind.—This invention relates to improvements in gates, and consists in hinging the gate to the post so that it can rise and fall readily in opening and closing, and in combining with it an arm hinged to the post to swing with the gate, which arm carries at the swinging end a roller on which an angle plate mounted on the gate at about the center, works so as to cause the gate to rise when swinging open either way, for the purpose of causing it to close by gravitation, also for preventing it from sagging at the swinging end.

STEAM WHEEL.—John N. Pommert, Greenfield, Ohio.—This invention relates to improvements in wheels to be propelled by steam, and consists in the application to a hollow shaft, of a cased wheel with buckets or vanes of peculiar arrangement, and a pair of radial discharging arms, the latter arranged for obtaining the reacting force of the steam after its action on the vanes of the wheel in a direct manner, to which it is admitted from below by discharging the steam obliquely upon the surface of water in a tank surrounding the shaft above the wheel.

AWNING FRAME.—Carl Werner, Charlestown, S. C.—This invention relates to improvements in awning frames, and consists in supporting the horizontal bar, or rod, at the outer and lower part of the frame which is commonly placed on vertical posts rising up from the ground, on arms projecting from the wall of the building, and oblique suspending irons or rods, the latter attached to the ends of the arms, and extending to the building where they are made fast at such a distance above the arms to suspend their outer ends in a very efficient manner.

OIL CANS.—Henry C. Warfel, Philipsburg, Pa.—This invention relates to improvements in oil cans of that class used for oiling machinery, and consists in the application to the spout of a plug, and a spring arranged inside of the pan for closing the passage when the spring (which is forced down by the thumb) is let go. The invention also consists in the combination with the apparatus for working the plug of an air valve kept closed by a spring, and a device for opening it by the operating device for the plug, so that air will be admitted at the time the plug is opened, to facilitate the discharge of the oil; and it also consists in the application to the filling tube of a sieve for separating any solid matter from the oil that may be in it.

BRICK MACHINE.—Samuel H. Taylor, Jacksonville, Ill.—This invention relates to improvements in brick machines, and it consists in the application to the pressing follower of a weighted lever for forcing it down to press the brick, and a mechanism for raising it, connected with the shaft of the wind-mill. The invention also consists in an improved construction of the mold carriage calculated to simplify it, and to facilitate the adjustment of it with the bottom of the mill; and it also consists in an arrangement with the carriages of a clamping lever for building the mold box, in such a way that it will be forced against the box by cornering against a stop where the carriage is moved under.

BOOK ATTACHMENT TO SEATS.—Joseph A. Dixon, New York city.—This invention consists in the attachment to the backs of chairs, benches, or other seats of public halls, theaters, churches, and the like, of self-closing hat hooks, whereby the occupants of seats may be provided with the means of hanging their hats, umbrellas, canes, or other articles on the seat backs fronting them, and yet not be interfered with or annoyed when entering or leaving the seats with projecting hooks. At the present time public assembly rooms afford no place for placing the hat except on the floor under the seat, and this place is very objectionable, as when placed therein they are frequently injured by the feet of the sitter being thrust back under the seat against them or by the unclean floor.

DOVE-TAILING MACHINE.—John B. Schmid, Salem, Va.—This invention relates to improvements in machines for cutting the tenons and notches of dovetailed joints, and consists in an arrangement of a tool-supporting frame and a gang of tools thereon for adjustment to work vertically or obliquely on either of the sides of the vertical line, for cutting the vertical walls of the notches, or the oblique walls of the tenons. The invention also consists in certain arrangements of the work-supporting and feed tables for feeding the boards to have the notches with vertical walls cut in them obliquely to the plane of the boards; also for feeding when the tenons are to be cut.

SEWING MACHINE.—J. W. Lamb, Northville, Mich.—This invention has for its object the construction of a machine by which, with one single thread, a stitch can be produced which has every new loop put first around and then through the previous loop under the fabric.

BURGLAR ALARM GUN.—E. T. Clegg, North Harpersfield, N. Y.—This invention relates to a new burglar alarm gun, which is so constructed that it will be operated when set in motion, and not otherwise. The instrument is applicable to buildings, gardens, etc., and may also be placed into money safes and vaults.

CHURN.—Floyd Ogden, Fisherville, Ky.—This invention relates to a new and useful improvement in churns for making butter, having more especial reference to the formation of the dasher and the operation thereof in the churn.

CONFECTIONERY.—August Seitz, Hoboken, N. J.—This invention has for its object to construct confectionery which may contain two or more pieces of hardened saccharine material. The invention consists in securing a piece of crystallized sugar in another outer piece, while the latter is still in a semi-liquid state, so that when the latter piece is hardened, the two pieces will be firmly worked and held together.

TUBULOUS BOILER.—Joseph A. Miller, New York city.—The object of this invention is to improve the construction of steam generators, in which the water to be evaporated is contained in tubes whose outer surfaces are exposed to the heated products of combustion, and to allow these tubes to freely expand and contract, and without danger to such tubes or their joints.

GANG SAW.—O. C. Meigs, Dubuque, Iowa.—This invention relates to a new manner of securing gang saws in the reciprocating frames, and has for its object to provide a secure fastening and still allow the ready removal of the several saws.

CARDING MACHINE.—Walter A. Lawton, Providence, R. I.—This invention has for its object to provide an attachment to the feed mechanism of carding engines, whereby the "feed" or sliver is properly kept on the aprons, after having been spread on the same by the traverse.

CORN DROPPER.—R. W. Caldwell, Jackson, O.—This invention relates to improvements in apparatus for dropping corn, and consists in the combination with a small sheet metal or other cylinder, of an oscillating valve arranged in a circular case attached to the cylinder, and working in conjunction with a partition and a cut-off brush.

PUMP.—Wm. Shearer, Atlanta, Ga.—This invention relates to improvements in pumps, and consists in an arrangement of diaphragms of leather, india-rubber, or other flexible and elastic substance, to be used in substitution for the pistons, for economizing friction, the arrangement being such that no piston or piston-rod packing is needed, and the valves are formed in the diaphragms and parts thereof, in a simple and inexpensive manner.

BEE-HOUSE.—James W. Wood, Alden, Ill.—This invention relates to improvements in bee-houses and the hives therein, the said improvements being designed to furnish a simple and convenient arrangement of a number of hives in a house, to facilitate the introduction of the bees, the removal of the honey, and to prevent swarming.

BACK BAND HOOK.—Henry Beagle, Jr., Philadelphia, Pa.—This inventio has for its object to furnish a simple, cheap, strong, and durable back strap hook, which shall be so constructed that it can be easily and conveniently attached to the back strap, and which will keep the traces from getting out of the hook and will not catch upon the harness of the other horse.

DOVETAILING MACHINE.—John B. Schmid, Salem, Va.—This invention relates to improvements in dovetailing machines, and consists in certain new and improved arrangements of the common foot-power mortising machines whereby they may be converted into dovetailing machines, and preserve their functions as mortising machines.

POLISHING MACHINE.—John Gooden, Lockport, N. Y.—This invention relates to a new machine for polishing the inner surface of metallic and other cylinders of different sizes, and has for its object to allow of an equal expansion and contraction of the polishing blocks, for the purpose of accommodating the same to cylinders of different diameters.

GATE.—Jackson Wright, Versailles, Ill.—This invention relates to a new and useful improvement in gates for farm and other purposes.

MANGLING AND IRONING MACHINE.—Stephen Williams, Philadelphia, Pa.—This invention has for its object to furnish an improved machine for mangling and ironing clothes and other cloths, which shall be simple in construction and effective in operation, applying the same pressure steadily to to the clothes, whatever may be their thickness, and which shall at the same time be light and portable, weighing only about fifty pounds.

MACHINE FOR SOLDERING CAN CAPS.—William B. Bishop, Brooklyn, N. Y.—This invention has for its object to furnish a simple, convenient and effective machine for soldering caps upon sheet-metal cans.

PROPELLER.—James Salter, Williamsburgh, N. Y.—The present invention relates to an improved propeller, whose fans are made flat, and their base countersunk in the hub, to which they are held secure by means of suitable braces, provided with nuts and screws to adjust the pitch.

BEE HIVE.—William A. Ruth, Wyoming, Del.—This invention relates to a hive constructed with a central chamber for occupancy by bees, and with side boxes opening therefrom, to be withdrawn after being filled with honey.

COMBINED CASTER AND SPOON-HOLDER.—Louis Evans, Pittsburgh, Pa.—This invention relates to a caster of that class in which there are radial revolving arms which bear the rings that hold the bottles or crusts, and the invention consists in the adaptation of such radial arms to the purpose of holding spoons or forks, and generally, in the combination of a spoon or fork holder with a caster.

FRICTION CLUTCH.—Walter W. Jerome, Samuel B. Alger, and Clinton H. Sage, Norwich, N. Y.—This invention has for its object to furnish an improved friction clutch, which shall be so constructed as to connect a twelve-inch pulley to a three-inch shaft, but which shall be equally applicable in cases where the ratio between the diameters of the shaft and pulley shall be either greater or less than one fourth.

APPARATUS FOR CLARIFYING CANE JUICE WITH SULPHUROUS ACID GAS.—John W. Austin, Plaquemine, La.—This invention has for its object to furnish an improved apparatus for bleaching, clarifying, and otherwise affecting cane juice and other liquids by the application of sulphurous acid gas, or other gases, which shall be simple in construction and effective in operation.

DIES FOR FORGING FIFTH-WHEEL HEADS.—F. Van Patten, Auburn, N. Y.—This invention has for its object to furnish an improved means for forging the heads for fifth wheels, finishing their tops or upper sides, and finishing their front and rear ends ready for welding.

PILE DRIVER.—Jacob Huy, Whistler, Ala.—This invention has for its object the raising and lowering of weights, generally with special application to the raising and lowering of the hinged upper section of a frame that may be used as a pile-driver, or as a wrecking machine for restoring to their proper positions engines and cars that have run off railway tracks.

LOG GUIDE FOR CIRCULAR SAW MILLS.—Benjamin Fitts, Toledo, Ohio.—This invention relates to a new and useful improvement in a device for governing the set of the log in circular saw mills, by means of which a uniform thickness in the boards sawed is secured.

AUTOMATIC CHIMNEY TOP.—M. E. Mead, Darien, Conn.—The present invention relates to a new and improved automatic chimney top, consisting of a metallic hook pivoted to the chimney, and operated upon by the wind striking against one or more vanes, whose supporting rods extend through a staple in one or both sides of the said hood, and are pivoted to the chimney a sufficient distance below to give an easy swing, and by having a balance weight attached to the end of each rod, it will necessarily be sensitive to the least air stirring, thus always closing on the windward side and opening on the lea side of the chimney.

STUMP JOINTS FOR CARRIAGE TOP BRACES.—Frederick Van Patten and E. D. Clapp, Auburn, N. Y.—This invention has for its object to furnish improved joints for carriage-top braces, known among carriage builders as "stump joints," which shall be so constructed as to facilitate the labor of welding them to the round or oval iron that forms the arms of the braces, the joints being so forged and finished that they can be easily welded by the smith without injury to the joint or to the milled and finished parts.

SAFETY SWIVEL FOR CHAINS.—Richard Richards, Albany, N. Y.—This invention has for its object to furnish an improved safety swivel for connecting watches to their chains, which shall be simple in construction, easily attached and detached, and which shall, at the same time, be strong, secure, and not liable to become accidentally detached.

STAMP AND CANCELER.—Augustus Zantzinger, Louisville, Ky.—The object of this invention is to produce an instrument that shall make a clear and full impression at every stroke, in whatever position the stamp may be held. It consists in the provision of a globular head on the bar connected with the stamp canceler, the same fitting in a socket of corresponding form, and having elastic blocks so arranged as to relieve the parts from the concussion incident to the use of the stamp.

SEWING MACHINES.—C. H. Palmer, New York city.—This invention relates to improvements in attaching needles to the arms or posts of sewing machines, the said improvements being designed more especially for the attachment of those needles which are split or divided from the eye upwards for the purpose of receiving the thread into the said divided part and the eye through a slot leading from a large hole in the needle post, through which the thread is passed; but the said improvements are also applicable to the needles of ordinary construction, and are calculated to hold them more firmly than the present arrangements. The said improvements consist in providing grooves in the face of one of the parts, by which they are clamped to the needle post or arm, in which grooves the lugs or arms at the upper ends of the said divided needles are fitted, or similar lugs or arms on the common needles may be fitted to be held by the other part of the clamp.

EXCAVATOR.—C. H. Sage and S. B. Alger, Norwich, N. Y.—This invention has for its object to furnish an improved excavator for making excavations for railroads and other purposes, and for dredging in shallow or deep water and which shall be so constructed as to work at a distance from the frame of the machine and move the material to a distance when required, and which shall, at the same time, be simple in construction and easily and conveniently operated.

MOWER AND REAPER.—Solomon Rawson and Isaac Rawson, Almond, N. Y.—This invention consists in the method of connecting the lower supplementary frame, to which the cutter and sickle bars are hinged, with the main frame to which the tongue is attached, whereby a leverage is exerted calculated to lessen the draft strain; and also in the employment of a spring bar or plate for connecting a caster wheel with said lower frame for the purpose of supporting it at its front end.

ATTACHABLE AND DETACHABLE BASTER FOR SEWING MACHINES.—Dr. F. T. Grimes, Liberty, Mo.—This invention consists of a rod to be attached by any convenient means to the cloth table of a sewing machine, or to an adjustable plate connected with the cloth table, said rod being provided with arms at its ends, one of which arms is furnished with teeth, while to the other is fastened one extremity of an elastic strip, that is also furnished with teeth at its other extremity, which teeth are fastened into the fabrics to the sewed together, and into these fabrics, after being duly stretched, the teeth of the arm aforesaid are inserted, by which means the cloth is kept smoothly extended, and prevented from drawing or puckering.

WAGON BRAKE.—James Robinson, Sedalia, Mo.—This invention relates to improvements in wagon brakes, and it consists in an arrangement of the brake blocks on separate levers mounted so that the blocks may be drawn under the box when released from the wheels, to prevent an accumulation of mud on them, and be thrown out again, previous to being forced on to the wheels, by a combination, with the said levers and the ordinary brake operating lever, of apparatus for so operating the brakes by the said lever when applying or releasing the brakes.

APPLICATIONS FOR EXTENSION OF PATENTS.

ABDOMINAL SUPPORTER.—Julia M. Milligan, New Albany, Ind., has petitioned for an extension of the above patent. Day of hearing Jan 25, 1871.

WINDOW BLINDS.—Daniel Kelley, Muskegon, and William Livingston, Grand Rapids, Mich., have petitioned for an extension of the above patent. Day of hearing Jan. 25, 1871.

TRUSS BRIDGE.—Reuben Comins, Troy, N. Y., has petitioned for an extension of the above patent. Day of hearing Jan. 25, 1871.

MACHINE FOR PARING APPLES.—David H. Whittemore, Worcester, Mass., has petitioned for an extension of the above patent. Day of hearing Feb. 1871.

WAGON.—Edgar Huson, Ithaca, N. Y., has petitioned for an extension of the above patent. Day of hearing Feb. 1, 1871.

MARKING SLATE.—John W. Hoard, Providence, R. I., has petitioned for an extension of the above patent. Day of hearing Feb. 8, 1871.

OPERATING VALVE OF STEAM ENGINES.—Samuel R. Wilmot, Bridgeport, Conn., has petitioned for an extension of the above patent. Day of hearing Feb. 1, 1871.

SOLAR CAMERA.—David A. Woodward, Baltimore, Md., has petitioned for an extension of the above patent. Day of hearing Feb. 8, 1871.

HINGE.—John D. Brown, Cincinnati, Ohio, has petitioned for an extension of the above patent. Day of hearing Feb. 8, 1871.

Official List of Patents.

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FOR THE WEEK ENDING NOV. 29, 1870.

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109,569.—CUTTING APPARATUS FOR HARVESTERS.—Joshua L. Abell, Cummington, Mass. Antedated Nov. 12, 1870.
109,570.—RUBBER CEMENT.—H. J. Ball, Oswego, N. Y. Antedated Nov. 19, 1870.
109,571.—APPARATUS FOR TREATING CANE JUICE WITH SULPHUROUS ACID GAS.—John W. Austin, Plaquemine, La.
109,572.—BACKBAND HOOK.—Henry Beagle, Jr., Philadelphia, Pa.
109,573.—SPIRAL SPRING FOR BEDSTEADS.—W. L. Beardsley, Binghampton, N. Y.
109,574.—SHUTTLE FOR SEWING MACHINES.—Walter Bennett, Springfield, Ill.
109,575.—RIVETING MANDREL.—James Berry, Buffalo, N. Y.
109,576.—CHEMICAL FIRE EXTINGUISHER.—Edmund Bigelow, Springfield, Mass.
109,577.—MACHINE FOR SOLDERING CAN CAPS.—W. B. Bishop, Brooklyn, N. Y.
109,578.—COMPOSITION FOR THE MANUFACTURE OF BOOT AND SHOE HEELS.—Carl Bocking, Boston, Mass. Antedated Nov. 12, 1870.
109,579.—ELASTIC ROLLER FOR WRINGERS, ETC.—Augustus Bourn, Providence, R. I.
109,580.—CLOTHES PIN.—George Bradley and N. A. Walker, Rockford, Ill. Antedated Nov. 14, 1870.
109,581.—CONSTRUCTION OF GLOBES, MAPS, ETC., FOR SCHOOLS.—John De Witt Brinckerhoff and James Duthie, Morrisania, N. Y.
109,582.—ARM SUPPORT FOR KEYED INSTRUMENTS.—Leopoldin Buchberger, Chicago, Ill. Antedated Nov. 12, 1870.
109,583.—ROLLER TEMPLE FOR LOOMS.—W. H. Burns, Grafton, assignor to Jonathan Luther, Worcester, Mass.
109,584.—CORN DROPPER.—Major R. W. Caldwell, Jackson, Ohio.
109,585.—HEMMER AND FELLER FOR SEWING MACHINES.—Cyrus Carleton, Brooklyn, N. Y., assignor to Wilcox & Gibbs Sewing Machine Co., New York city.
109,586.—HORSESHOE BAR.—Ebenezer Cate, Watertown, Mass.
109,587.—HYDRANT.—Elias Clampitt, Baltimore, Md.
109,588.—BURGLAR ALARM.—E. T. Clegg, North Harpersfield, N. Y.
109,589.—GLOBE FOR GAS LIGHTS.—Charles Collier, Selma, Ala.
109,590.—COMBINED RAILROAD JACK AND PINCH BAR.—M. G. Collins, Meadville, Pa.
109,591.—MACHINE FOR MAKING KEY BOARDS FOR WOOD PAVEMENTS.—P. D. Cummings, Portland, Me.
109,592.—FILTER.—George Curtis (assignor to himself and E. Bigelow), Springfield, Mass.
109,593.—FILTER.—George Curtis (assignor to himself and E. Bigelow), Springfield, Mass.
109,594.—COMBINED VISE AND DRILL.—Otis Dean, Richmond, Va.
109,595.—BOILER FOR PREPARING PAPER PULP.—Lorenzo Dean, Fort Edward, N. Y.
109,596.—PREPARATION OF STRAW FOR THE MANUFACTURE OF PAPER.—Lorenzo Dean, Fort Edward, N. Y.
109,597.—ASPHALT PAVEMENT.—E. J. De Smedt, New York city.
109,598.—HOOK ATTACHMENT FOR SEATS.—Joseph A. Dixon, New York city.
109,599.—HEALING SALVE.—Robert Dobbins, Binghampton, N. Y.
109,600.—PROJECTILE.—Ellis Drake, Stoughton, Mass.
109,601.—APPARATUS FOR THE MANUFACTURE OF OZONE.—C. F. Dunderdale, New York city.
109,602.—CASTER AND SPOON HOLDER COMBINED.—L. Evans, Pittsburgh, Pa.
109,603.—THERMO-ELECTRIC BATTERY.—M. G. Farmer, Salem, Mass.
109,604.—REVERSIBLE BUTT.—G. W. Field (assignor to himself and Robert H. Butcher), Lowell, Mass. Antedated November 12, 1870.
109,605.—LOG GUIDE FOR CIRCULAR SAW MILLS.—Benjamin Fitts, Toledo, Ohio.
109,606.—FENCE.—Rodolphus J. Flanner, Plainfield township, Mich.
109,607.—MANUFACTURE OF ARTIFICIAL STONE.—W. H. Foye, San Francisco, Cal.
109,608.—ELASTIC RUNNING GEAR FOR CARRIAGES.—G. E. Garretson, Russellville, Ky.
109,609.—GATE.—Elijah Gemberling, Elkhart, Ind.
109,610.—POLISHING MACHINE.—John Gooden, Lockport, N. Y. Antedated November 26, 1870.
109,611.—APPARATUS FOR AGING WHISKEY AND OTHER SPIRITS.—John P. Greeley, Boston, Mass. Antedated November 17, 1870.
109,612.—ATTACHMENT FOR SEWING MACHINES.—Franklin T. Grimes, Liberty, Mo.
109,613.—COMBINED SEED SOWER AND CULTIVATOR.—H. L. Hall, Woodbridge, Iowa.
109,614.—ANIMAL TRAP.—William R. Hampton, Fairfield, Ill.
109,615.—PHOTOGRAPHIC PRINT CUTTER.—John Haworth, Philadelphia, Pa. Antedated Nov. 26, 1870.
109,616.—STEAM GENERATOR.—John Houpt, Springtown, Pa.
109,617.—GARTER.—H. A. House, Bridgeport, Conn.
109,618.—AUTOMATIC ROPE WALKER.—H. A. House, Bridgeport, Conn.
109,619.—ADDING AND SUBTRACTING REGISTER.—H. A. House, Bridgeport, Conn.
109,620.—COMBINING KEYS WITH WATCHES.—Alfred Humbert (assignor to himself and Gustavus Gigor), Philadelphia, Pa.
109,621.—MANUFACTURE OF PAPER.—C. B. Hutchins, Ann Arbor, Mich.
109,622.—WATER ELEVATOR.—T. H. Hutchinson, Gorham, N. H.
109,623.—PILE DRIVER.—Jacob Huy, Whistler, Ala.
109,624.—PUMP.—Joseph Icard, Donaldsonville, La.
109,625.—FRUIT JAR.—C. G. Imlay and W. L. Imlay, Philadelphia, Pa.
109,626.—EMBELLISHMENT OF GLASS.—Elias Ingraham, Bristol, Conn.
109,627.—HEATING STOVE.—G. B. Isham, Burlington, Vt. Antedated November 17, 1870.
109,628.—TRUSS BRIDGE.—William Johnson, Lambertville, N. J.
109,629.—CULTIVATOR PLOW.—T. F. Jones, Hick's Ford, Va.
109,630.—MACHINE FOR CUTTING, SCORING, AND CORNERING PAPER FOR BOXES.—J. M. Keen (assignor to himself and C. C. G. Armeling), Philadelphia, Pa.
109,631.—PUMP.—H. K. Kenyon, Steubenville, Ohio, assignor to himself and Jarecki, Hays & Co., Erie, Pa.
109,632.—SEWING MACHINE.—I. W. Lamb, Northville, Mich.
109,633.—ELECTRO-PLATING IRON AND STEEL WITH SILVER.—Alexander Lawe, Kingston, Canada.
109,634.—FEED MECHANISM FOR CARDING MACHINES.—W. A. Lawton, Providence, R. I.
109,635.—LIFTING JACK.—S. C. Leonard, Oberlin, Ohio.
109,636.—FIFTH WHEEL.—Joseph Le Roy, Marathon, N. Y.
109,637.—PIER FOR BRIDGES.—C. H. Lilienthal, Yonkers, N. Y.
109,638.—DEODERIZING THE AIR AND GASES IN FAT RENDERING, BONE BOILING, ETC.—Alfred Lister, Edwin Lister, and C. J. Eames, Newark, N. J.
109,639.—PUMP.—Charles Markley, New York city.
109,640.—BOLT.—F. G. McClelland, Attica, Ohio. Antedated November 19, 1870.
109,641.—HAT.—J. W. McGill, Washington, D. C.
109,642.—CHIMNEY TOP.—M. E. Mead, Darien, Conn.
109,643.—GAGE FOR GANG SAWS.—O. C. Meigs, Dubuque, Iowa.
109,644.—VEHICLE.—F. H. C. Mey, Buffalo, N. Y. Antedated September 17, 1870.
109,645.—STEAM GENERATOR.—J. A. Miller, Boston, Mass.
109,646.—MANUFACTURE OF GLASS ARTICLES.—C. A. Moore, Westbrook, Conn.
109,647.—CLOTHES DRYER.—W. N. Moore and A. K. Moore, Neenah, Wis.
109,648.—TOWEL RACK.—Frederick Myers, New York city.
109,649.—METALLIC AND ELASTIC STAIR PLATE.—P. W. Neefus, New York city. Antedated November 26, 1870.
199,650.—METALLIC AND ELASTIC DOOR MAT.—P. W. Neefus, New York city. Antedated November 26, 1870.
109,651.—STAIR AND FLOOR PLATE.—P. W. Neefus, New York city. Antedated November 26, 1870.
109,652.—STEAM GENERATOR.—Eugen Neumann, New York city, assignor, by mesne assignments, to C. D. Tyler, Newark, N. J.
109,653.—HAND POWER BALING PRESS.—W. R. Newman, Galesburg, Ill.
109,654.—CHURN DASHER.—Floyd Ogden, Fisherville, Ky.
109,655.—SEWING MACHINE.—John Palmer, Randolph, Mass.
109,656.—COMPOUNDS FOR BATING HIDES AND SKINS.—C. F. Pankin, Charleston, S. C. Antedated November 26, 1870.
109,657.—COMBINED GARDEN TOOL.—Louis Perrot, Greenville, and Frank Perrot and C. H. Bates, Appleton, Wis.
109,658.—ENAMELED CAST-IRON RETORT.—T. D. Phillips, Cassadaga, and T. S. Phillips, assignors to B. S. Brown and T. S. Phillips, Buffalo, N. Y.
109,659.—STEAM WHEEL.—J. N. Pommert, Greenfield, Ohio.
109,660.—MATCH FOR CIGAR LIGHTERS.—William Porter, St. Stephen's Parish, Canada.
109,661.—SHUTTER WORKER.—C. A. Potter, Providence, R. I. Antedated November 19, 1870.
109,662.—CLOTH-CUTTING ATTACHMENT FOR SEWING MACHINES.—W. E. Prall, Washington, D. C., and A. B. Rand, Staten Island, N. Y.
109,663.—SHOW CASE.—Philip Price, West Chester, Pa.
109,664.—WATER WHEEL.—Demmon Reynolds, Napanock, N. Y.
109,665.—MANUFACTURE OF WRENCH.—John Richards, Philadelphia, Pa.
109,666.—SAFETY SWIVEL.—Richard Richards, Albany, N. Y.
109,667.—EARTH CLOSET.—George W. Roberts (assignor to himself and John H. Graham), Wilmington, Del.
109,668.—CLOTH-GUIDING ATTACHMENT FOR SEWING MACHINES.—Simeon Rogers and Edwin K. Sperry, Fleming, N. Y. Antedated November 26, 1870.
109,669.—MANUFACTURE OF ARTIFICIAL STONE.—James L. Rowland, Milwaukee, Wis.
109,670.—RAILWAY FROG.—John C. Rupp, Newark, Del.
109,671.—COCK FOR CARBURETERS, ETC.—Samuel Rust, Jr., Cincinnati, Ohio.
109,672.—BEE HIVE.—Wm. A. Ruth, Wyoming, Del.
109,673.—PROPELLER.—James Salter, Williamsburgh, N. Y.
109,674.—DOVETAILING MACHINE.—John B. Schmid, Salem, Va.
109,675.—DOVETAILING MACHINE.—John B. Schmid, Salem, Va.
109,676.—ELEVATOR.—George Scott, New Orleans, La.
109,677.—CONFECTIONERY FOR DRUGGISTS.—August Seitz, Hoboken, N. J.
109,678.—PUMP.—Wm. Shearer, Atlanta, Ga.
109,679.—AGRICULTURAL CALDRON.—E. E. Sill and A. H. Bennet, Rochester, N. Y.
109,680.—GRAIN AND FRUIT-CLEANER.—Silas A. Slocomb, Philadelphia, Pa.
109,681.—AXLE FOR CARRIAGES.—Alfred E. Smith, Bronxville, N. Y.
109,682.—SLEIGH.—Samuel S. Spear, South Weymouth Mass.
109,683.—CURTAIN FIXTURE.—Thomas Stewart, Philadelphia Pa.
109,684.—WHEEL PLOW.—John E. Swallow, Hagerstown Md.
109,685.—WATER WHEEL.—Wm. A. Terry, Bristol, Conn.
109,686.—APPARATUS FOR MARKING CLOTH.—Alfred Thomas Hoboken, N. J.
109,687.—APPARATUS FOR MARKING CLOTH.—Alphonse Thomas, Hoboken, N. Y.
109,688.—RECORDING INSTRUMENT FOR THE ELECTRIC TELEGRAPH.—Wm. Thomson, Glasgow, Scotland.
109,689.—AUTOMATIC STOVE REGISTER.—J. S. Toan, Rochester, N. Y.
109,690.—STRETCHING-FRAME.—John Tonner, Canton, Ohio
109,691.—SIRUP-CAN.—Antony Tumler, New York city.
109,692.—BUFFER AND CATCH FOR BOOTS.—A. A. Veer, Delaware, Ohio.
109,693.—OIL CAN.—Henry C. Warfel, Philipsburg, Pa.
109,694.—AWNING FRAME.—Christopher Werner, Charleston S. C.
109,695.—ATMOSPHERIC CAR-BRAKE PIPES.—George Westinghouse, Jr., Pittsburgh, Pa.
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109,705.—SEWING MECHANISM.—Josiah L. Young, San Francisco, Cal. Antedated November 18, 1870.
109,706.—DRYING DISINTEGRATED FIBERS.—Wm. Adamson, Philadelphia, Pa.
109,707.—CARRIAGE-WHEEL HUB.—Simeon Atha, West Liberty, Ohio.
109,708.—TRAVERSE MOTION FOR WINDING AND SPOOLING MACHINERY.—John E. Atwood, Mansfield, Conn.
109,709.—PULLEY COUPLING.—John E. Atwood, Mansfield Conn.
109,710.—WASHING MACHINE.—B. C. Bailey, Constitution Ohio.
109,711.—GRATE BAR.—Hosea Ball, New York city.
109,712.—IRONING BOARD.—Jacob H. Beidler, Adrian, Mich
109,713.—GATE.—Robert T. Bowne, Fallston, Md.
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109,721.—OSCILLATING PISTON-ENGINE.—James B. Davis and Seth M. Davis, Harrisonville, Mo.
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109,728.—SHOE.—John W. Fisher, Albany, N. Y.
109,729.—SHOE.—John W. Fisher, Albany, N. Y.
109,730.—FAUCET.—Oscar Hanks, Cincinnati, Ohio. Antedated November 19, 1870.
109,731.—BREECH-LOADING FIRE-ARM.—John Hanson, Rashcliffe, near Huddersfield, England.
109,732.—AIR-PUMP.—John F. Haskins, Fitchburg, Mass.
109,733.—CLOTHES-LINE FASTENER.—Bryant B. Herrick, (assignor of one-half his right to John H. Wallace,) Decatur, Mich.
109,734.—FLOOD-GATE.—Nathaniel Hinckley, Marston's Mills, Mass. Antedated November 26, 1870.
109,735.—SAFETY-TUBE FOR LAMPS.—George M. Hopkins and John A. Straight, Albion, N. Y.
109,736.—GARTER.—Henry A. House, Bridgeport, Conn.
109,737.—GARTER.—Henry A. House, Bridgeport, Conn.
109,738.—FLUTING-MACHINE.—Arthur Y. Hubbell, Elmira, N. Y.
109,739.—PACKAGE FOR LARD, BUTTER, etc.—George M. Huntly, Grand Rapids, Mich.
109,740.—FRICTION-CLUTCH.—Walter W. Jerome, Samuel B. Alger, and Clinton H. Sage, Norwich, N. Y.
109,741.—ROTARY PLOW.—Nelson T. Judd, Washington, D. C.
109,742.—PAPER-STOCK.—Morris L. Keen, Jersey City, N. J., assignor to himself and Samuel A. Walsh, New York City.
109,743.—SEPARATING LEAD FROM THE PRECIOUS METALS.—Solomon W. Kirk (assignor to himself and William Bailey), Philadelphia Pa.
109,744.—FAN ATTACHMENT FOR ROCKING-CHAIRS.—Rudolph Knafl, Nashville, and Theodore M. Schleier, Knoxville, Tenn.
109,745.—RAMMING-MACHINE FOR WOOD AND OTHER PAVEMENTS.—Arthur Livingston Lansing (assignor to Henry Seymour Lansing), Philadelphia, Pa.
109,746.—DEVICE FOR CUTTING SCREW-THREADS AND FOR DRILLING METALS.—James W. Mahlon, Brooklyn, N. Y.
109,747.—DEVICE FOR CLAMPING OR CUTTING OFF TUBES AND RODS.—James W. Mahlon, Brooklyn, N. Y.
109,748.—COTTON-BALE TIE.—John F. Milligan (assignor to Joseph W. Branch), St. Louis, Mo.
109,749.—HEATING-STOVE.—Lyman Ayrault Morse, Battle Creek, Mich. Antedated November 21, 1870.
109,750.—MACHINE FOR VARNISHING PENCILS.—Teile H. Muller and Henry C. Benson (assignors to Joseph Reckendorfer, New York City.
109,751.—STATION-INDICATOR.—Louis Nelke, Chicago, Ill.
109,752.—MANUFACTURE OF IRON AND STEEL.—Charles Motier Nes, York, Pa.
109,753.—NEEDLES AND THEIR CARRYING-ARMS FOR SEWING MACHINES.—Charles Henry Palmer (assignor to A. F. Sawyer, William H. Sharp, Jacob Regensburger, Charles D. Carter, and Mary P. Carpenter) New York City.
109,754.—WHEEL-HARROW.—Edwin R. Powell, Jeffersonville Vt.
109,755.—HARVESTER.—Solomon Rawson and Isaac Rawson, Almond, N. Y.
109,756.—MACHINE FOR HEELING BOOTS.—Timothy K. Reed, East Bridgewater, and Asa B. Keith, North Bridgewater, Mass.
109,757.—MANUFACTURE OF PAINT.—Thomas C. Rice, Worcester, Mass.
109,758.—WINDOW-SHADE.—William S. Rice, Biddeford, Me.
109,759.—CHURN.—Stacy Risler, Locktown, N. J.
109,760.—APPARATUS FOR DRESSING MILL-STONES.—Henry Robinson, Lewisham and John Smith, Carshalton, England.
109,761.—WAGON BRAKE.—Jas. Robinson, Sedalia, Mo., assignor to Geo. Scheer.
109,762.—INSECT-POWDER EJECTOR.—Solomon Rose and Nathan Goldsmith, Cincinnati Ohio.
109,763.—MILK STRAINER.—P. S. Ryan, Rutland, Vt.
109,764.—EXCAVATOR.—C. H. Sage and S. B. Alger, Norwich, N. Y.
109,765.—STEAM GENERATOR.—W. G. Savage, Knoxville Iowa.

109,766.—MANUFACTURE OF PAPER PULP.—Chas. B. Sawyer, Fitchburg, Mass., assignor, by mesne assignments, to William Pratt and A. A. Williams.
109,767.—PAPER-TRIMMING MACHINE.—J. F. Schuyler, Tiffin, Ohio.
109,768.—ROAD SCRAPER.—David L. Shepard, Foxborough, Mass.
109,769.—FILLINGS FOR WOOD.—Theron R. Sherry, Newark, N. J.
109,770.—SCHOOL DESK AND SEAT.—W. A. Slaymaker, Atlanta, Ga.
109,771.—DOOR HOLDER OR CHECK.—Otto Sliker, Lincoln, Ill.
109,772.—PURIFYING AND REFINING OILS.—W. M. Sloane, New York city.
109,773.—PERFUMERY.—Gibson Smith, Groton Junction, assignor to himself and C. W. Bannon, Athol, Mass.
109,774.—WASH BOILER.—H. L. Sprague, and J. N. Guyon, Tottenville, N. Y.
109,775.—UMBRELLA.—Mary Stephens (assignor to Wright Brothers & Co.), Philadelphia, Pa.
109,776.—DUMPING APPARATUS.—L. B. Stilson and J. G. Payson, Minneapolis, Minn.
109,777.—BRICK MACHINE.—S. H. Taylor (assignor to himself and Le Grand Parker), Jacksonville, Ill.
109,778.—BRICK MOLD.—S. H. Taylor (assignor to himself and Le Grand Parker), Jacksonville, Ill.
109,779.—VENTILATOR, ALARM, AND BILGE PUMP FOR VESSELS.—W. F. J. Thiers, New York city.
109,780.—PORTABLE FURNACE.—Chas. Van De Mark, Phelps, N. Y.
109,781.—DIE FOR FORGING FIFTH WHEEL HEADS.—Frederick Van Patten (assignor to himself, E. D. Clapp, and M. S. Fitch), Auburn, N. Y.
109,782.—STUMP JOINT FOR CARRIAGE-TOP BRACES.—Frederick Van Patten and E. D. Clapp (assignors to themselves and M. S. Fitch) Auburn, N. Y.
109,783.—STEAM ENGINE.—Francis Wedge (assignor to himself and Thos. Griffith), Zanesville, Ohio.
109,784.—WATER WHEEL.—G. W. Werntz (assignor to himself and R. A. Shull), Auburn, Ind.
109,785.—HEATING METALLURGIC AND OTHER FURNACES.—J. D. Whelpley and E. D. Storer, Boston, Mass.
109,786.—CASTING STENCH TRAP.—J. E. White (assignor to L. A. Cauvet), New York city.
109,787.—ELEVATOR.—Frank Wicks, Decatur, Ill.
109,788.—BAG HOLDER.—D. S. Wing, Rome, N. Y.
109,789.—ANIMAL TRAP.—Romanso E. Wood, Santa Cruz, Cal.
109,790.—MECHANICAL MOVEMENT.—Jacob Woolf, Burr Oak, Mich.
109,791.—DEVICE FOR MANUFACTURING METALLIC CARTRIDGE SHELLS.—E. A. Worthen, Springfield, Mass.
109,792.—HAND STAMP.—Augustus Zantzinger, Louisville, Ky.

REISSUES.

4,185.—ATTACHING SLEIGH BELLS TO STRAPS.—William E. Barton, East Hampton, Conn.—Patent No. 46,629, dated March 7, 1865.
4,186.—STEAM GENERATOR.—American Gerner Boiler Co., New York city, assignees of Henry Gerner.—Patent No. 73,595, dated Jan. 21, 1868. Division B.
4,187.—AUGER HANDLE.—J. M. Horton, Chicago, Ill., assignor to "The Miller's Falls Manufacturing Co.," Miller's Falls, Mass.—Patent No. 35,856, dated July 8, 1862, reissue No. 2,229, dated April 17, 1865.
4,188.—VESSEL FOR BOILING.—Werner Kreger (assignor to Wm. Frankfurth), Milwaukee, Wis.—Patent No. 47,038, dated March 28, 1865.
4,189.—STONE CHANNELING MACHINE.—E. G. Lamson, Windsor, Vt. Patent No. 89,365, dated April 20, 1869.
4,190.—SCHOOL DESK.—C. H. Loomis, New Philadelphia, O.—Patent No. 104,472, dated June 21, 1870.
4,191.—SKATE FASTENING.—Harshaw Scott, New York city assignee of Henry Pickford.—Patent No. 16,653, dated February 17, 1857.

DESIGNS.

4,493 and 4,494.—CARPET PATTERN.—Alfred Heald (assignor to McCallum, Cresse & Sloan), Philadelphia, Pa. Two Patents.
4,495.—SADDLE TREE.—John T. Million, Fayette, Mo.
4,496.—CLOCK FRONT.—Nicholas Muller, New York city.
4,497.—SAW.—Edward Rhodes (assignor to Henry Disston & Son), Philadelphia, Pa.
4,498.—WATER COOLER STAND.—Charles C. Savery, Philadelphia, Pa.
4,499.—MEDAL.—T. R. Timby, Tarrytown, N. Y.
4,500.—DRESS TRIMMING.—Robert Werner, Hoboken, N. J.

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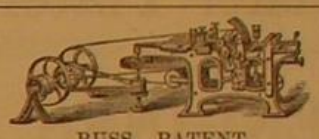

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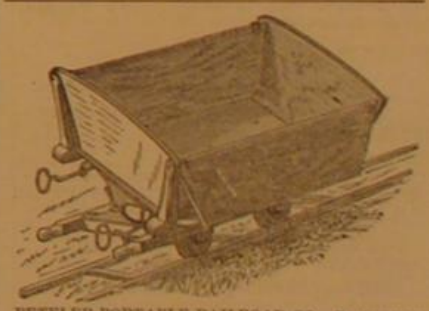

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