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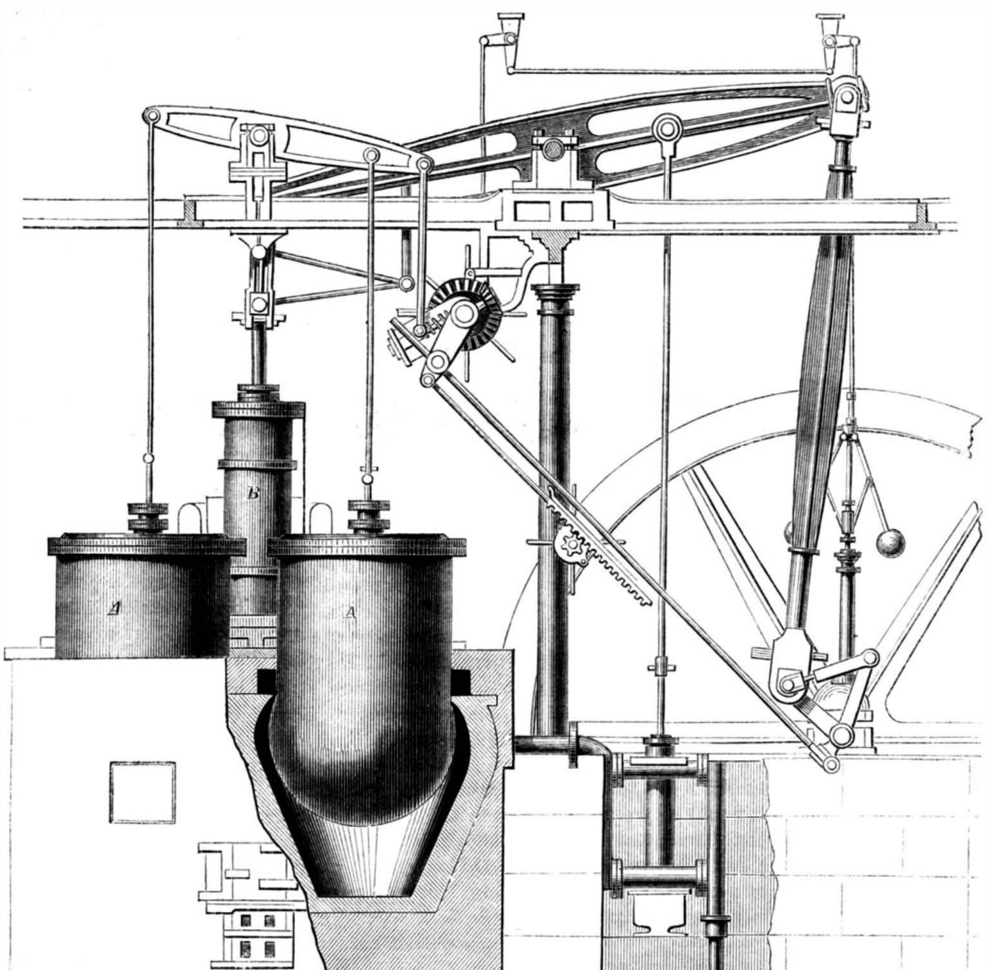
Important Discussion on the Air Engine.

At the third meeting of the session of the Institution of Engineers in Scotland, held in the Philosophical Society's Hall, in Glasgow, on Wednesday, 26th December, 1860, the President in the chair, the following paper was read by Mr. Patrick Stirling :—

The subject of this paper may require some apology for being introduced at this time; but at a recent meeting of this institution there was one of Mr. Ericsson's air engines exhibited and explained, without any account of its performance as to power, consumption of fuel, &c., being given; and it has been considered that a description and statement of the performance of Stirling's air engine might be interesting to members of the institution. The engine forming the subject of this paper was constructed by Mr. James Stirling, at the Dundee Foundry, in 1842, for the purpose of driving the machinery there, and was erected in room of the steam engine, by removing the boiler, cylinder, air pump and condenser, and making use of as many of the parts of the steam engine as could be made available, which will account for the apparent want of arrangement of the different parts of the engine. In this engine, which is represented in the engraving, there were two strong air-tight vessels, A A, connected by passages with the opposite ends of the working cylinder, B, in which last was a piston of the ordinary construction used in the steam engine. The lower ends of the air vessels were kept at a high temperature by a furnace which was common to both, and the upper ends of the vessels were kept from accumulating heat by a series of water pipes, through which there was a constant flow of water.



STIRLING'S AIR ENGINE.

In each of these vessels there was an air-tight vessel or plunger filled with a non-conducting substance, such as pounded bricks, to prevent the radiation of heat. These plungers were slung to the opposite ends of a lever, and were capable of being moved up and down in the interior of the air vessels, and their use was to shift a body of air from the hot ends of the vessels to the cold ends alternately, and in such a manner that the quantity in one would be at the hot end whilst that in the other was at the cold end.

If we consider, then, that the movements of the air engine depend upon the well-known principle in pneumatics that air has its bulk or pressure increased when it is heated and decreased when it is cooled, there will not be much difficulty in understanding that the movement of the plungers up and down will cause a pressure to be exerted on the opposite sides of the piston alternately; and upon the difference of pressure obtained on the opposite sides of the piston depends the power of the engine. It may be mentioned that the plungers were moved by an eccentric or crank on the crankshaft of the engine, in the same way as the slide valve of a steam engine, and at nearly the same angle to the crank.

This engine was made to work on the high pressure principle, as it was found that engines working at the simple atmospheric pressure gave so little power in proportion to their size as to render them unfit for practical use. It was found necessary, therefore, to apply a double-acting air-pump for the purpose of increasing the density of the air in the air vessels, and the usual minimum pressure was ten atmospheres, which, on being thrown to the hot end of the air vessels, was converted into a pressure of fifteen and a half atmospheres by the addition of heat. The difference, then, in the pressure of the air when hot and cold constituted the disposable pressure upon the piston for the purpose of producing power. When the pump had got up the full working pressure in the engine, the air, instead of being blown off, was allowed to pass into an air-tight magazine, where a sufficient quantity was kept over night to fill the engine up to full pressure at starting in the morning, and this done, the suction valves of the pump were nearly closed together, the leakage of the engine being so small that scarcely any addition of air was necessary.

Having explained in a general way the principles of the air engine, and by what means power was obtained from two opposing volumes of air, it will be necessary to consider the means by which economy in fuel was effected, as it must be evident to the most casual observer that, were the whole heat that was necessary in making one stroke taken from the hot end of the air vessel and thrown away at the cold end, the power produced by its expansion and contraction would be more expensive than that which is gained by the use of steam. To obviate this waste of heat, Dr. Robert Stirling discovered that the air could be divested of its heat to a great extent, on its passage from the hot to the cold end of the air vessels, by dividing the air into a multitude of thin films by means of strips of thin sheet iron kept apart from each other, and presenting a great metallic surface for receiving the heat. Now, as everybody, by contact, will give out heat to one that is colder than itself, the air, when it enters the narrow passages, must give out a portion of its heat even at the hottest end of the passages, and must continue to give out more and more heat in its progress upward, as the temperatures of the passages diminish, until it ultimately escapes into the cold end of the vessel, where there is only a small portion of heat to be extracted to reduce it to the required temperature. Thus, the temperature of the air at the hot end may be 600°, and when it arrives at the cold end it may be down to 150°, so that the whole heat constituting the difference of these two temperatures must have been left in the sheets of iron forming the narrow passages; and this being the case, there is no room to doubt that the cold air, when again made to enter the narrow passages for the purpose of being heated, immediately comes in contact with metal that is hotter than itself, and consequently has its temperature increased by so many degrees every inch it travels downward, until, on its arrival at the hot end, it requires but a comparatively small addition to its temperature to complete the necessary pressure to move the piston. The thin sheets radiate from the center of the air vessel, and fill up the space between it and the plunger. In this may be said to lie the grand principle of the air engine, and when it was applied to highly compressed air it produced a large amount of work for the fuel consumed.

The engine under consideration had a working cylinder of 16 inches diameter, with a stroke of 4 feet, and when tested with a friction brake, it was found capable of sustaining a weight of 1,250,000 lbs. raised 1 foot per minute; or 37 horses' power for a whole day, on a consumption of 1,000 lbs. of Scotch Chew coal, including the quantity necessary to get up the heat in the morning. This gives a consumption of 2.7 lbs. per horse-power per hour; but when the engine was not fully burdened, the consumption was considerably under 2.5 per horse-power per hour. This was considered a very fair result to be obtained eighteen years ago; and it is not unreasonable to suppose that, had the construction of engines of this kind been persevered in, still greater economy in fuel would have resulted. The engine drove the works at the Dundee Foundry for several years at a very small cost for maintenance.

The whole interior of the machine being entirely free from dust and moisture, there was little or no tear and wear of the different parts, and the piston, and piston and plunger-rods, did not consume a gill of oil in a week.

The principal cause of the failure of the air engine was the difficulty experienced in getting heat to pass through the lower ends of the air vessels with sufficient rapidity to supply the place of the heat that was carried away by the water pipes or refrigerator at each stroke; and in order to compensate for the slowness of the conducting power of the metal, which was necessarily pretty thick, it was necessary to keep the outside of the vessel at a very high temperature, which induced irregular expansion and contraction and incipient decay, resulting in the cracking of the metal and consequent destruction of the vessels. Notwithstanding this hitherto unsurmounted defect, the writer is of opinion that small engines upon this principle could be constructed and used with economy, in situations where the use of steam is impracticable from want of room to erect steam boilers, or from other causes. There would be less smoke emitted from the chimney; there would be no noise as with a steam boiler blowing off, or a high pressure engine exhausting; and accidents from explosion would be entirely avoided, as, when the air vessels did give way, a very small opening made its appearance, which allowed the air to escape in a few seconds without doing the slightest injury.

In answer to various questions from different members, Mr. Stirling said that as long as the plunger was moving up the pressure kept up well, but of course it did not continue as great as at the commencement of the stroke. The plunger was over the center before the engine piston. When the plungers were placed at half stroke the whole was in equilibrio, and the engine was set in motion by moving one plunger up and the other down. The heating vessels were four feet internally in diameter, and on every side there were minute air passages formed by metal plates, arranged not quite 1-32d of an inch apart. The plungers fitted as closely as they could make them, but there was no packing except about the piston and plunger rods. The packing of the plunger rods was peculiar. There was a copper tube filled with a solution of pitch and oil, fixed to the top of the plunger, and into this there dipped a pipe attached to the stuffing box, whilst a leather collar above encircles the rod, so that by no amount of pressure could any air get through. He had not heard of any air engine since this one was made which had been so successful as it. This engine could be made to work at 10, 15, or even 20 horses' power, with every satisfaction. For such powers the air vessels were not so large, but that they could make their bottoms comparatively thin. If these vessels were efficiently constructed, and with their bottoms thin—for example, not thicker than the upper part of the vessel's sides—the success of the engine would be complete. There was no practical difficulty, except in getting air vessels to withstand the heat. So far as the piston and cylinder were concerned, he had never seen better working machinery. The piston has worked for years without alteration, and it was observed that the sides of the cylinder were polished like mirrors. The piston packing was a pair of common cast iron rings, such as in ordinary steam engines, and made self-springing. The piston rod was packed with a leather like that of the heating vessel, and exactly like the plunger of a Bramah press. These leathers would work for three or four months. The temperature of the cylinder varied between 120° and 150°. He could not say exactly what was the highest temperature of the air vessels, but the bottoms were kept red hot. The temperature in the cylinder was almost constant, and also in the tops of the air vessels, where it never rose above 150°, but it was not so easily measured at the bottom. It had been assumed, however, that it was 600°. In the practical working of the engine the plates in the side passages of the air vessel took up heat from any body hotter than itself, passing over it, which heat it gave out again in the reverse process. The air entered at 150°, got heated during its descent by coming in contact with gradually hotter portions of the plate, and so, by the time it got near the bottom of the vessel, it had become heated to nearly 600°. The great difference between this engine and Mr. Ericsson's was this:—The engine of Mr. Ericsson on board the steamer which attracted so much attention, was a low pressure one, and it took in fresh air at every stroke, and as quickly threw it away. The blowing of the air through a wire gauze was the first thing tried by his father to obtain economy, and for which a patent was taken out in 1816. He might state that, in 1827, when his father was taking out his second patent, he met Mr. Ericsson, who asked him if he confined the air before using it; to which he answered that he did. Then Mr. Ericsson said their plans were quite different, and he would not require to oppose my father's patent. The air vessel no doubt might be made of copper, but it would not be so strong; and there was another objection, if it became red hot it might stretch or get out of shape. No doubt platinum would be the best metal to make it of. He could not arrive at the first cost of an air engine as compared with that of a steam engine; but of course there were no boilers nor slide valves required in the air engine. Diagrams of the engine had been taken, but they could not be depended upon as absolutely perfect, from the fact that there was a great deal of friction with the indicator piston, which required to be very tight on account of the great pressure. They never got a very truthful figure on account of the friction, but the diagram was a good one so far as it went. He had not one of the diagrams now in his possession.

Mr. Milne said he had seen this air engine working, and had never seen any description of engine work more smoothly.

Mr. Stirling, in answer to an inquiry, said that he was not aware of any engine of this kind being now in operation. The engine described had worked for four years, and in that time they had to renew the air vessels once. It took very little water to keep the top part of the engine cool. They allowed it to run down into a cistern, where it cooled, and was then used over again. The temperature of the water rose to 150° or 160° on passing through the refrigerating coils.

Mr. Brownlee thought that, in some cases, one difficulty in connection with this engine would be, that it required more water than a high pressure steam engine. He considered that it would not require a very high temperature to get a pressure of five atmospheres in this engine; for, the lowest temperature of the air being 150°, with a pressure of ten atmospheres, it would only require a temperature of 455° to get an additional pressure of five atmospheres.

Mr. Stirling did not admit that more water was required in the air engine than in high pressure steam engines, as they always got back the water, and so could use it again and again. With regard to the pressure obtained in this engine, he remarked that there was always a pressure of about six atmospheres at the starting, but after working a little it generally went back half an atmosphere, and at that it worked steadily. One great matter to be attended to in the construction of air engines was to have as little vacant space as possible, anywhere about it, into which the air could be compressed. Of course, great attention was paid to have all the passages in the air vessels as small and all the parts as close fitting as possible, so that the air was pumped out very completely every time the plunger came down.

The President remarked that still there would be a large quantity of air that would never leave the lower parts of the air vessels. The thin plates referred to as inserted in the sides of the vessel presented great surfaces for communicating heat. They did not, he supposed, assist in the economy of heating the air directly, but they were a means by which the heat applied through the bottom of the vessel was more rapidly distributed to the air. They took up the heat and gave it back again to the air when returning to the lower parts of the air vessels.

Mr. Stirling said that economy was undoubtedly the reason for the use of the plates, as they offered a large surface for picking up heat from the air when it was wanted to cool it, and which heat was given back again to the air when it was wanted to heat it, so that very little extra heat was required to raise the pressure to its maximum. These plates received their heat from the air, and not directly from the fire. They received heat in the same way as Dr. Jeffery's respirator did. There were only about eight or nine cubic feet of air in the vessels altogether. If this process of abstracting and giving up heat by the plates were absolutely perfect they would throw away no heat. They had only to make up for loss of heat by radiation.

Mr. Brownlee did not quite agree with that; for they knew that when air was compressed it gave out heat, so that, when the piston returned and the plunger partly returned, the consequent compression of the air must raise its temperature. If they could utilize all the heat of the fuel it would require only about a quarter of a pound of coal per horse-power per hour. He believed that this engine might be made to work with one pound of coal per horse-power per hour.

Mr. Lawrie asked what was the cause of the total failure of Ericsson's engine. He thought it was very extraordinary, seeing the high success of Mr. Stirling's engine.

Mr. Stirling replied that he could not say, as no data had been published. All that they could get were newspaper notices.

Mr. D. Rowan said if the economy of this engine was so great why did they not continue to work it?

Mr. Stirling answered, because they could not get the vessels to stand any length of time. The thickness of the vessels was about four inches. Possibly thinner metal would have stood, and they would have lost less heat from the outside. The vessel was the one difficulty of the engine.

The President drew attention to the principle of a new furnace, whereby fire-brick was used to save the wrought iron vessel from being burnt. He thought an air vessel might be got to stand, made on that principle.

Mr. Downie asked if, in Stirling's engine, any means of protecting the bottoms of the air vessels by fireclay or other refractory material had been tried.

Mr. Stirling said the fire did not act directly on the vessels. The furnace was in a central space, from which the fire gases entered the two heating chambers containing the heating vessels, which chambers, with their fire-brick lining, were converted into a red hot bath. There were slips of fire-bricks between the furnace and the chambers, so that no part of the vessels were directly exposed to the fire; all the heat was got at second hand.

Mr. Downie said it occurred to him that if the bottom of the air vessel had been concave, and with fire-bricks built close up to it, it would have given better results.

Mr. Stirling said they had tried a number of bottoms, and amongst them one having a bottle shape, which gave good results, but the hemispherical one was found to stand best.

One Hundred Years Ago.—In the last part of the eighteenth century appeared, nearly at the same time, the edicts of Turgot for the enfranchisement of labor, and the book of Adam Smith on the nature and the causes of wealth. At nearly the same epoch, Lavoisier laid the foundation of the discoveries which were to transform chemistry; Watt took his first patent for his perfections of the steam engine, and Arkwright obtained a patent for spinning by rolls. These events contain the germ of the principles and of the means adopted by modern industry. Modern chemistry gave birth to numerous industrial processes; the perfected steam engine furnished a motive force applicable to the most varied mechanism; mechanical spinning and weaving replaced the ancient mode of manufacturing tissues and multiplied the productions of manual labor; finally, the ideas until that time dominant gave place to notions more just and more exact on the nature of wealth and on the means of developing it.

Homogeneous metal, so called, is made by melting Swedish wrought iron, cut into scraps, along with about one per cent of powdered charcoal; six oz. of the latter being allotted to a charge of 40 lbs. of iron.

THE CHEMICAL HISTORY OF A CANDLE.

By Professor Faraday.

A Course of Six Lectures (adapted to a Juvenile Audience) Delivered before the Royal Institution of Great Britain.

LECTURE V.

Oxygen present in the Air—Nature of the Atmosphere—Its Properties—Other Products from the Candle—Carbonic Acid—Its Properties.

We have now seen that we can produce hydrogen and oxygen from the water that we obtained from the candle. Hydrogen, you know, comes from the candle, and oxygen, you believe, comes from the air. But then you have a right to ask me, "How is it that the air and the oxygen do not equally well burn the candle? If you remember what happened when I put a jar of oxygen over a piece of candle, you recollect there was a very different kind of combustion to that which took place in the air. Now, why is this?—it is a very important question, and one I shall endeavor to make you understand; it relates most intimately to the nature of the atmosphere, and is most important to us.

We have several tests of oxygen besides the mere burning of bodies; you have seen a candle burnt in oxygen, or in the air; you have seen phosphorus burnt in the air, or in oxygen, and you have seen iron filings burnt in oxygen. But we have other tests besides these, and I am about to refer to one or two of them for the purpose of carrying your conviction and your experience further. Here you have a vessel of oxygen. I will show its presence to you. If I take a little spark and put it into that oxygen, you know by the experience you gained the last time we met, what will happen—if I put that spark into the jar, it will tell you whether we have oxygen here or not. Yes! We have proved it by combustion; and now, here is another test for oxygen, which is a very curious and useful one. I have here two jars full of gas, with a plate between them to prevent their mixing; I take the plate away, and the gases are creeping one into the other. "What happens?" say you, "they together produce no such combustion as was seen in the case of the candle." But see how the presence of oxygen is told by its association with this other substance. What a beautiful curious gas I have obtained in this way, showing me the presence of the oxygen. In the same way we can try this experiment by mixing common air with this test gas. Here is a jar containing air—such air as the candle would burn in—and here is a jar or bottle containing the test gas. I let them come together over water, and you see the result; the contents of the test bottle are flowing into the jar of air, and you see I obtain exactly the same kind of action as before, and that shows me that there is oxygen in the air, the very same substance that has been already obtained by us from the water produced by the candle. But then, beyond that, how is it that air does not burn the candle as well as oxygen will? We will come to that now. I have here two jars; they are filled to the same hight with gas, and the appearance to the eye is alike in both, and I really do not know at present which of these jars contains oxygen and which contains air, although I know they have previously been filled with these gases. But here is our test gas, and I am going to work with the two jars, in order to examine whether there is any difference between them in the quality of reddening this gas. I am now going to turn this test gas out into one of the jars, and observe what happens:—There it is reddening, you see; there is then oxygen present. We will now test the other jar, but you see this is not so bright, not so red, not so distinct, as the first; and, further, this curious thing happens, if I take these two gases and shake them together well with water, we shall absorb the red gas; and then if I put in more of this test gas and shake again, we shall absorb more, and I can go on as long as there be any oxygen present to produce that effect. If I let in air, it will not matter, but the moment I introduce water, the red gas disappears, and I may go on in this way, putting in more and more of the test gas, until I come to something left behind which will not redden by the use of that particular body that rendered the air and the oxygen red. Why is that? You see in a moment it is because there is, besides oxygen, something else present which is left behind. I will let a little more air into the jar, and if it turns red, you will know that some of that reddening gas is still present, and that, consequently, it was not for the want of this producing body that that air was left behind.

Now, you will begin to understand what I have got to say. You saw that when I burnt phosphorus in a jar, as the smoke produced by the phosphorus and the oxygen of the air condensed, it left a good deal of gas unburnt, just as this red gas left something untouched—there was, in fact, this gas left behind which the phosphorus cannot touch, which the reddening gas cannot touch, and this is something which is not oxygen, and yet is part of the atmosphere.

So that is one way of opening out air into the two things of which it is composed—oxygen, which burns our candles, our phosphorus, or anything else, and this other substance, which will not burn them. This other part of the air is by far the larger part. Now, this substance is a very curious thing when we come to examine it; it is remarkably curious, and yet you say, perhaps, that it is very uninteresting. It is uninteresting, in some respects, because of this—that it shows no bright appearance of combustion. If I test it with a taper, as I do oxygen and hydrogen, it does not burn like hydrogen, nor does it make the taper burn, like oxygen. Try it in any way I will, it does neither the one thing or the other; it will not take fire; it will not let the taper burn; it puts out the combustion of anything. There is nothing that will burn in it in common circumstances. It does not smell; it is not sour; it does not dissolve in water; it is neither an acid or alkali; it is as indifferent to all our organs as it is possible for a thing to be. And you might say, "It is nothing; it is not worth chemical attention; what does it do in the air?" Ah! then come our beautiful and fine results shown us by an observant philosophy. Suppose, in place of having nitrogen, or nitrogen and oxygen, we had pure oxygen as our atmosphere. What would become of us? You know very well that a piece of iron lit in a jar of oxygen goes on burning to the end. When you see a fire in an iron grate, imagine where the grate would go to if the whole of the atmosphere were oxygen. The grate would burn up more powerfully than the coals; for the iron of the grate itself is even more combustible than the coals which we burn in it. A fire put into the middle of a locomotive would be a fire in a magazine of fuel, if the atmosphere were oxygen. The nitrogen lowers it down and makes it moderate and useful for us, and then with all that it takes away with it the fumes that you have seen produced from the candle, disperses them throughout the whole of the atmosphere, and carries them away to places where they are wanted to perform a great and glorious purpose of good to man, for the sustenance of vegetation, and thus does a most wonderful work, although you say, on examining it, "why, it is a perfectly indifferent thing." This nitrogen, in its ordinary state, is an inactive element; no action short of the most intense electric force, and then in the most infinitely small degree, can cause the nitrogen to combine directly with the other element of the atmosphere, or with other things round about it; it is a perfectly indifferent, and therefore to say, a safe substance.

But before I take you to that result, I must tell you about the atmosphere itself; I have written on this diagram the composition of one hundred parts of atmospheric air:—

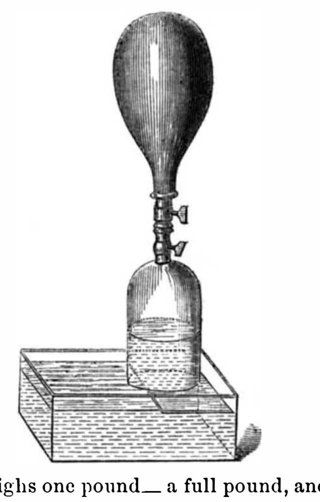
	Bulk.	Weight.
Oxygen	20	22.3
Nitrogen	80	77.7
	100	100.0

It is a true analysis of the atmosphere, so far as regards the quantity of oxygen and the quantity of nitrogen present. By our analysis, we find that 5 pints of the atmosphere contain only 1 pint of oxygen, and 5 pints or 4 parts of nitrogen by bulk. That is our analysis of the atmosphere. It requires all that quantity of nitrogen to reduce the nitrogen down, so as to be able to supply the candle properly with fuel, so as to supply us with an atmosphere which our lungs can healthily and safely breathe; for it is just as important to make the oxygen right for us to breathe, as to make the atmosphere right for the burning of the fire and the candle.

But now for this atmosphere. First of all let me tell you the weight of these gases. A pint of nitrogen weighs $10\frac{4}{10}$ grains, or a cubic foot weighs $1\frac{1}{6}$ oz. That is the weight of the nitrogen. The oxygen is heavier; a pint of it weights $11\frac{9}{10}$ grains, and a cubic foot weighs $1\frac{3}{4}$ oz. A pint of air weighs about $10\frac{7}{10}$ grains, and a cubic foot $1\frac{1}{5}$ oz.

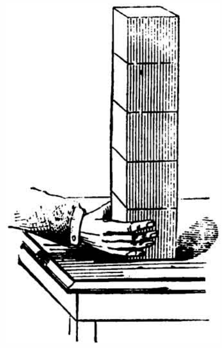
You have asked me several times, and I am very glad you have, "How do you weigh gases? I will show you; it is very simple, and easily done. Here is a balance, and here is a copper bottle made as light as we can, consistent with due strength, turned very nicely in the lathe, and made perfectly airtight, with a stopcock which we can open and shut, which at present is open and, therefore, allows the bottle to be full of air. I have here a nicely adjusted balance in which I think the bottle, in its present condition, will be balanced by the weight on the other side. And here

is a pump by which we can force the air into this bottle and with it we will force in a certain number of volumes of air as measured by the pump. [Twenty measures were pumped in.] We will shut that in and put it in the balance. See how it sinks; it is much heavier than it was. By what? By the air that we have forced into it by the pump. There is not a greater *bulk* of air, but there is the same bulk of *heavier* air, because we have forced in air upon it. And that you may have a fair notion in your mind as to how much this air is, here is a jar full of water. We will open that copper vessel into this jar, and let the air return to its former state. All I have to do now is to screw them tightly together, and to turn the taps, when there, you see, is the bulk of the twenty pumps of air which I forced into the bottle; and to make sure that we have been quite correct in what we have been doing, we will take the bottle again to the balance, and if it is now counterpoised by the original weight, we shall be quite sure we have made our experiment correctly. It is balanced; so, you see, we can find out the weight of the extra volumes of air forced in in that way, and by that means we are able to ascertain that a cubic foot of air weighs $1\frac{1}{5}$ oz. But that small experiment will by no means convey to your mind the whole literal truth of this matter. It is wonderful how it accumulates when you come to larger volumes. The bulk of air [a cubic foot] weighs $1\frac{1}{10}$ oz. What do you think of the contents of that box above there which I have had made for the purpose? The air which is within



that box weighs one pound— a full pound, and I have calculated the weight of the air in this room—you would hardly imagine it, but it is above a tun. So rapidly do the weights rise, and so important is the presence of the atmosphere, and of the oxygen, and the nitrogen in it, and the use it performs in conveying things to and fro, from place to place, and carrying bad vapors to places where they will do good instead of harm.

Having given you that little illustration, with respect to the weight of the air, let me show you certain consequences of it. You have a right to them because you would not understand so much without it. Do you remember this kind of experiment: have you ever seen it? Suppose I take a pump somewhat similar to the one I had a little while ago to force air into the bottle, and suppose I place it in such a manner that by a certain arrangement I can apply my hand to it. My hand moves about in the air so easily that it seems to feel nothing, and I can hardly get velocity enough by any motion of my own in the atmosphere to make sure that there is much resistance to it. But when I put my hand here [on the air pump receiver, which was afterwards exhausted], you see what happens. Why is my hand fastened to this place, and why am I able to pull this pump about? And see! how is it that I can hardly get my hand away? Why is this? It is the weight of the air—the weight of the air that is above. I have another experiment here which I think will explain to you more about it. When the air is



pumped from underneath the bladder which is stretched over this glass, you will see the effect in another shape; the top is quite flat at present, but I will make a very little motion with the pump, and now look at it—see how it has gone down, see how it is bent in; you will see the bladder go in more and more until, at last, I expect it will be driven in and broken by the force of the atmosphere pressing upon it [the bladder, at last, broke with a loud report]. Now, that was done entirely by the weight of the air pressing upon it, and you can easily understand how that is. The particles that are piled up in the atmosphere stand upon each other, as these five cubes do; you can easily conceive that these five cubes are resting upon the bottom one, and if I take that away, the others will sink down. So it is with the atmosphere; the air that is above is sustained by the air that is beneath and when the air is pumped away from beneath them, the change occurs which you saw when I placed my hand on the air pump, and which you saw in the case of the bladder, and which you shall see better here. I have tied over this jar a piece of sheet india-rubber, and I am now about to take away the air from the inside of the jar, and if you will watch the india-rubber, which acts as a partition between the air below and the air above, you will see when I pump how the pressure shows itself. See where it is going to; I can actually put my hand into the jar; and yet this result is only caused by the great and powerful action of the air above. How beautifully it shows this curious circumstance.

THE NEW FLORAL BEAUTY.—The new pink, *dianthus Heddewigi*, which took the prize, as the finest floral novelty, at European exhibitions last year, is now being very extensively grown in this country. Considerable quantities of the seed have been imported, and almost all of the prominent florists now have the young plants on sale. It is easily raised from the seed, and is a strong and vigorous grower. The flowers are said to be beautiful beyond description. They are nearly three times larger than other pinks, are of rose, crimson and violet colors with some delicate marbled shades, white and mottled flakes. The plant grows to a foot in hight, is very bushy, is covered with a profusion of flowers, and presents a most magnificent appearance. The flower is named after its introducer, Mr. Heddewig, a Russian gardener.

A NEW KIND OF BRONZE.—Workers in metal are finding good uses for a new kind of bronze, made by melting together ten parts of aluminum with ninety of copper. It is described as being tenacious as steel, and well adapted for the bearings of machinery. A polisher, who used it for bearings in his lathe, which made 2,000 revolutions a minute, found it lasted six times longer than bearings made of other kinds of metal. It is good also for pistol-barrels, and is to be tried for rifles and cannon.

COPPER, containing twenty-four per cent of phosphorus, will resist a strain of 48,000 lbs. to the square inch.

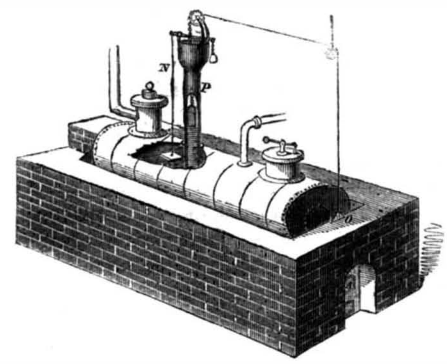
ROMANCE OF THE STEAM ENGINE.

ARTICLE XVII.

WATT—STEAM BOILERS.

The comprehensive mind of Watt took in all the principles of motion—all the devices and parts of the mechanism, and the power which gave motion to the steam engine. The heat developed by the decomposition of fuel undergoing combustion, transmitted to water in a close vessel, combines with the water in definite quantities, and becomes the elastic vapor known by the name of "steam." This is the agent or rather the power which gives motion to the engine; the latter is simply a mechanical agent which receives the first motion from the steam and transmits it to other mechanism. An engine may be constructed of the best proportions, and in the most perfect manner, and yet it may be deemed an expensive motive agent, if the boiler, or the furnace of the boiler, is defectively arranged and constructed. One boiler may evaporate twelve pounds of water with one pound of fuel, while another may be so defective as to evaporate only four pounds. Such cases are not, by any means, uncommon. Watt's attention was early directed to the improvement of boiler furnaces, and the engraving of his boiler, on page 181, present volume of the SCIENTIFIC AMERICAN, affords evidence that he was really the first inventor who understood the scientific principles which should govern the construction of furnaces, to burn coal economically without smoke. The early boilers were of what was called "wagon" shape, that is, they had curved sides and a convex cover, resembling the covers of old-fashioned country wagons. Watt rendered them as perfect in operation as it was possible, by making them self-acting in feeding water, and in regulating the combustion or intensity of the fire by the damper.

The accompanying engraving shows how these ideas were carried out. The boiler is inclosed in an arch of brickwork. A is the furnace, situated directly under the boiler bottom, which is concave in form, and the heated products of combustion pass to the back



end, then return by a split flue on each side to the boiler front, where the chimney is built (not shown). In the neck of the flue passing into the chimney is a damper, which is simply a broad plate of iron working up and down in a slot, like a vertical gate or sluice. Its object is to open and close the space, for the purpose of regulating the draft, and the draft is regulated by the pressure of the steam, so as to have it very uniform for work. The water rises in the standpipe, P (which has its inner end situated below the water level), to a hight proportioned to the pressure of the steam. A float is placed in this pipe, and it communicates by means of a chain passing over pulleys with the gate damper in the chimney. The float in the pipe rises and falls with the level of the water, and this level is regulated by the pressure of the steam, so that the damper rises and descends to close more or less of the opening in the throat of the chimney, and thus regulate the draft.

The water is also fed in by a self-regulating mechanism. A balance buoy or float, in the inside of the boiler is attached to a rod, N, which passes up through a stuffing box, where it is attached to a lever set on the top of the large upright pipe, P. The upper part of this pipe is wide, and is actually a small cistern into which the water is led from any suitable source. No water, however, can pass down the pipe, P, without a valve fixed to the lever or rod, N, being opened. When the float in the boiler descends to a certain line the outer end of its lever is drawn down, and this opens the valve in pipe, P, to allow the water to pass down. The water is fed in by pipe, P, and the damper also regulated as described. A steam pipe and safety valve are also shown on the boiler. Such boilers are designed for low pressure steam, and they are still in extensive use in several parts of England. It is here illustrated principally to show how the draft is regulated by the self-acting mechanism of the damper.

Nothing could be more fair and honorable than the condition of sale of the first engines made by Watt & Bolton. This consisted of what, in England, is called a "royalty" or annual rent, and amounted to *one-third* of the saving of fuel in comparison with the old Newcomen engines. Watt was sometimes compelled to be absent for long periods in Cornwall, especially when his engine was first introduced, as he had to contend against great obstacles in properly applying it to flooded mines, and among a class of men full of obstinacy and deep-rooted prejudices. How little the real merits of good machinery were appreciated by the common miners, the following amusing incident connected with one of his first engines, erected near Truro, will show. Watt, in writing to Bolton, says:—"At present, the velocity, violence, magnitude and horrible noise of the engine give universal satisfaction to all beholders, believers or not. I have once or twice trimmed the engine to end its stroke gently and make less noise, but the proprietor cannot sleep unless it is quite furious, and so I have left it to the engine man. The noise serves to convey great ideas of its power to the ignorant, who seem to be no more taken with modest merit in an engine than in a man." At meetings of mining adventurers, when he argued with reason upon science, his opinions often met with rude opposition, which caused him to suffer greatly from severe headaches. He possessed a great mind, and a most gentle, sensitive nature. A rude remark, a hasty, unkind word, would make him sick for several hours afterwards.

No sooner had success attended the efforts of himself and partner than several patent pirates endeavored to appropriate his inventions; and with that despicable meanness common to all such characters, they also endeavored to cast a stigma upon his character by misrepresenting his claims and discoveries. In several suits at law, however (pursued by the younger Watt and the younger Bolton), the patentees put down all opposition and established the title of Watt to his great inventions, by the evidence of the greatest men of science and art then living in Europe.

Watt first invented condensation in a separate vessel from the cylinder; he was the first to operate the piston both backward and forward in the cylinder, by means of steam, making it truly the steam engine; he invented the parallel motion, applied the governor to the throttle valve, the mercury gage to the boiler, the dash pot to the puppet valves, used the adjustable cut-off, and worked steam expansively, invented and applied the steam jacket, and made the damper self-acting; in short, he left the low pressure engine essentially as it is at the present day. Macintosh said of him:—"Mr. Watt has long been, by the consent of the greatest men of science in the world, placed at the head of all inventors in all ages and nations." Professor Robinson said of him:—"Every new thing that came into his hands became a subject of serious and systematic study, and terminated in some branch of science." He died at Heathfield, England, on the 19th of August, 1819, in great tranquillity and with devout trust in his Redeemer. His remains were followed to the grave by a vast concourse of all classes, by whom he was revered and admired. A colossal statue by Chantrey was erected to his memory in Westminster Abbey, which bears the following inimitable inscription by Lord Brougham:—

"Not to perpetuate a name which must endure while the peaceful arts flourish, but to shew that mankind have learnt to honour those who best deserve their gratitude, the king his ministers and many of the nobles and commoners of the realm raised this monument to JAMES WATT, who directing the force of an original genius, early exercised in philosophic research, to the improvement of the steam engine, enlarged the resources of his country, increased the power of man and rose to an eminent place among the most illustrious followers of science and the real benefactors of the world. Born at Greenock MDCCXXXVI. Died at Heathfield in Staffordshire MDCCCXIX."

BY rolling iron cold, its strength is greatly increased, while its surface is render more beautiful.

AN HISTORICAL SKETCH OF THE AIR ENGINE FROM THE YEAR 1700.

The attention of many ingenious men has been lately turned to this motor, on account of its success when only small power is required, and from the undoubted advantages it has over steam for many purposes.

The past history of all that has been attempted and abandoned will be of service to that class of inventors who are trying to improve the motor, and to make it useful on a larger scale, by informing them of the various plans that have been tried and found useless, and by pointing out to them those parts of the machine that offer the best opportunities for improvement. With this information they may avoid that waste of time and talent that so often occurs from the difficulty of learning from the usual channels of communication what failures have occurred and what successes have already been achieved in this field of scientific pursuit.

In the earlier part of the eighteenth century, attempts were made to use the power of heated air applied to such mechanical work as "grinding corn, and other work performed by water, wind and horses." This was applied to a wheel in London; the current of hot air being used in place of water; but eight years of experiments taught the inventor that the subtle force must be in some way confined before its power could be made subservient. Soon afterward, Rumsey did not think it incompatible with his claims for the application of steam to join with it the use of air for the same purposes. The real history of steam shows the difficulties that attended the efforts to confine so dense a medium, and the same want of success attended the unskillful attempts to obtain power from air. After success had been attained with the present form of steam cylinder and piston, those designing to use air naturally tried to employ its power in a similar manner; but the attempts to use it all failed from the difficulties to be overcome, resulting from the action of the heat on lubricated surfaces.

In 1792, the first attempt appears to have been made to transfer heated air from one end of a cylinder to the other by means of a plunger; and soon after, additional advance was made in an attempt to compress the air, to cause it to absorb water (the cloud engine?), and then to move a piston in a steam cylinder. The same inventor added an important feature a few years later, by applying a "refrigerator" to cool the air by passing it through a series of thin metallic plates or tubes.

At this time, also, the definite claims to the use of surcharged steam were distinctly advanced. About the year 1825, attempts were made to use all the products of combustion, by forcing air under the grate bars and carrying all the results through the cylinder. All such air engines have failed. Like a consumptive patient, such an engine draws in the element of its own destruction at every breath.

The next advance was a new application of the regenerator in the machine of R. and J. Stirling. The plunger had already been used to transfer the air, also the refrigerator, to take away the heat that remained after the air had been used.

From the success that attended the first practical application of this machine, and because it was worked for several years before it was laid aside, it may be regarded as the first decided proof that an air engine may be made to supersede steam on a large scale. The illustrated description of this engine on another page obviates the necessity of referring to it at further length here.

The metallic surfaces to retain the heat and impart it again to the air in Stirling's engine form an important part of the most successful of those that have been used. Their true function is to act as a reservoir of heat that is not used, by taking it from the air and again transferring it back to the air so that it may enter the heater prepared to take a further dose of heat.

About the same time an attempt was made to apply the vacuum produced by compressing gases over water, in order to have the water absorb them; they were then to be expanded in a cylinder and condensed by a jet of water, to use them over again. The first intention of the inventor was to employ water as a means of transferring the power from the end of the plunger to a separate cylinder; but he soon simplified his arrangement by putting the cylinder upon the end of the heater and using a plunger and piston in one cylinder. This had been done before, it is true, but in a complicated manner, and now, for the first time, the simple combination of three pieces—a long cylinder, a plunger, and a piston—constituted the engine. By gradual steps and cautious trials, difficulties were overcome as successively the plunger and cylinder were lengthened and reservoirs of water placed around them. This general arrangement has been but slightly modified to make a most durable engine; it is in use at the present time. It was farther improved in 1843, by having a bowl in the piston, kept filled with water, and an addition to its power was made by fluting the interior of the heater, so as to give more surface for heating the air. Ericsson had a differential engine at work, of a similar form, but it does not seem to have been introduced into common use. Amongst the various plans attempted was that of increasing the fire surface, either by subdividing the heaters, or by using a number of tubes in which air was heated, thus giving an increased area with the same cubic capacity. But every addition complicates the machine, in which simplicity is essential.

In 1853, an air engine was built of the shape of a bow or half hoop, in which the string would represent the cylinder, with a piston moving in it. When at one end of the string, the weight of the piston would cause that end to descend into a furnace, and the heated air moving the piston to the upper end would next cause that end to descend, and thus an alternate movement would be produced by the weight of the piston.

The next addition was an attempt to heat wire gauze by plunging it in a bath of fusible metal, to acquire its heat, and then raising it out, to allow the air to pass through it. The same inventor cooled the air between strips or ribbons of metal. This method of heating the air seems worthy of attention, as the heating surface of fusible metal may be enlarged to any extent and the heating surface thus indirectly applied to the air may be increased to any desired quantity. An arrangement by means of cranks at right angles to each other, to move the various pistons and plungers, was also applied to a machine at this time. This does not give so perfect a movement as other methods, but its simplicity is such that it has since been adopted on various small machines with as good results as those obtained with more complicated mechanism.

Napier and Rankine, pursuing the steps of Stirling, added heat screens, to prevent the heat acting on any air but that in the hot parts, during its expansion.

The Ericsson engines, applied to moving vessels, have been so fully described in former volumes of the SCIENTIFIC AMERICAN that a mere reference to them is all that is necessary, as no new facts can be presented. Since 1856, there have been many air engines designed in France, and some of them in England; but none of them have yet passed the test of trial for a long enough period to displace other motors.

The various plans that have been attempted in America, from the success of Capt. Ericsson's smaller motor, are as follows:—Attempts to use Stirling's machine in some modified form, and to carry the products of combustion through the cylinder, to improve the simpler machines of Franchot; McDonough's engine is perhaps the most simple; it is vertical, has only two moving pieces, and an equal power acting against the piston during both its inward and outward movement. Wilcox's engines, which have been illustrated in the SCIENTIFIC AMERICAN, are well known.

In conclusion, the attention of inventors is directed to two points as susceptible of improvement. The life of the engine resides in the heater; from this it derives its force, as the steam engine from its boiler; and the modifications which the force acquires in the machine, and the difficulties of managing it when obtained, are pretty well understood and arranged. But the various attempts to give increased fire surface by tubes, by ribbon-like coils of metal with the air in a thin sheet, by flanges inside and outside of the heater, and by corrugations, have not resulted in the simplicity that is required, and, at the same time, in obtaining sufficient power to displace steam by a machine of the same bulk.

It is believed that no important points in this history of the air engine have been overlooked. Enough has been mentioned to show how much labor has been expended, and probably to give such information as may keep inventors from bringing forward rejected plans as new discoveries, and also to direct them to those points in which the machine is at present defective, and in which improvements are to be expected that will enable it to rival the steam engine in power, whilst it already surpasses it in economy and simplicity.

Adulterations of Food.

Before the Society of Arts in London an able paper was recently read by Mr. Wentworth Lascelles Scott, on the important subject of the adulteration of food, from which we make the following extracts:—

BREAD.

My experience shows that on an average the bread of London is more or less adulterated to the amonnt of 87 per cent—by which I mean to say that if I were to buy 100 loaves, at as many different bakers in various parts of the metropolis, I should get about 13 of good and genuine bread. Alum is about the most frequent adulterant of bread, very few samples being uncontaminated with this salt." So it seems that most Englishmen put a quantity of the valuable metal, aluminum, into their stomachs at every meal.

PICKLES.

I have here a bottle of pure pickles, and here an adulterated sample; the difference in tint, you see, is very apparent, and if I add to both a little solution of ammonia, the presence of a large quantity of copper in the one case, and its entire absence in the other, will be speedily shown. The properties of dissolved copper, as an active poison and powerful irritant, are very generally known. According to my calculation, about 91 per cent of the pickles sold in London are more or less adulterated. In relation to pickles, I must say that consumers are open to very great blame, for the too general rule with them is to buy those pickles which are of the deepest green, for no better reason, it would appear, than that they are considered prettier. It is quite time all such weaknesses were dissipated, and I hold that he who buys girkins where he can get them greenest is of the same intellectual tint personally, and, whenever he purchases a pickle, deserves to get into one.

FRUIT.

The question has often been put to me—Can fruit ever be adulterated? As often, my answer has been in the affirmative. Without going into what might be called the natural and accidental adulterations—such as blight, mildew, insects, &c., I may mention that I have seen English apples, of rather inferior quality than otherwise, colored superficially in imitation of the American Newtown pippins, and sold as such at the rate of two and three shillings per dozen! Although we may admire the artistic genius thus displayed, we must still condemn the fraud. Old and inferior oranges, well boiled, with a little saffron added to assist Nature, when her shortcomings in the matter of external coloring are a little too obvious, may be purchased at many shops, as we all know. Melons and cucumbers, too, when looking pale and dejected from waiting so long to be eaten, have their rusty coats furbished up with a little acetate of copper, so that a "green old age" at least is accorded to them.

SUGAR.

The common practice of selecting the very coarsest and darkest colored sugars (popularly known as *foots*) for the preparation of cakes, puddings, &c., is one which I cannot too strongly reprehend; if it be required to "make a cake look rich"—the usual pretext—why not employ a pure white sugar for the purpose of sweetening, and supply the place of the deficient dirt and coloring matter by a little wholesome burnt sugar, which will answer a great deal better. As to the finance part of the question—a delicate point with housekeepers—it will always be found cheaper to employ a fine white, or at least a light-colored sugar, than to use a dark brown variety of a lower price.

COLORED CONFECTIONARY.

I have condensed in a table some general information relating to the chief coloring matters used for purposes of (what might be called) ornamental adulteration, amounting to upwards of sixty in number, of which twelve or thirteen are active and powerful poisons—a like number are harmless, except in special cases of disease or morbid debility—while the remainder are either more or less injurious to health, or we know too little about their effects upon the animal economy to venture a decided opinion either way.

How Swiss Watchmakers Live and Work.

Frederika Bremer gives the following picture of watchmaking in Geneva :—

I was introduced into the watchmakers workshops by M. Vlande, one of the merchants of Geneva, a man of great humanity, and also of rare amiability of disposition and character. I could not have had a better guide, even with regard to the moral inquiries which I wished to make.

We began with the schools of pupils, where young girls learn, for a term of three years, to make every part of a watch. After this time, they select that particular part for which they have most inclination, or in the doing of which they are most expert. The perfected pupils may be sure, on leaving the school, of obtaining immediate employment among the watchmakers. Young girls from 12 to 18 years of age appear very healthy and well cared for. Each one has her own little table and her own window niche for her work.

The manufacture of pocket-watches is, at the present time, carried to a great extent in Geneva. An immense number are required for the Chinese market. A well-equipped Chinaman, I have been told, carries a watch on each side of his breast, that he may be able to regulate the one by the other. Wealthy Chinese cover the walls of their rooms with watches. These watches are of a more ornamental character, and have more filigree work upon them than those made for Europeans. Long live the Chinese!

At one of the greatest and best conducted manufactories of Geneva nothing but watch faces are prepared, and elderly, well-dressed and well-looking women sat by twenties and thirties in clean, well-warmed rooms, working upon watch faces.

"Do you not get tired of always doing the same work?" I inquired of some of them.

"Oh, no!" replied they, and showed me that each little dial had to pass through fifty different operations before it was finished. This kept the attention awake, and prevented any sense of monotony. They work here from eight o'clock in the morning till six or seven in the evening, and thus earn about 50 francs a month.

"Are you able to lay by anything for old age, or in case of sickness?" I inquired from a mother who had worked there with her daughter, side by side, for ten years.

"Oh, no!" they replied, "we have no longer been able to do that, since provisions have been so dear."

"Nor yet for a litte journey of pleasure or holiday in the summer?"

"We never think of such a thing. We should by that means lose, not only money, but also our time, and possibly our place."

"Is not such a life as this heavy and void of interest?"

"We have Sundays for rest and refreshment, and the evenings for reading or occupation of another kind. Besides which, we need not, during our work, be continually thinking about it."

They seemed perfectly satisfied.

The workwomen who are able to execute certain more difficult parts of the watch get higher wages, and can earn from five to ten francs a day.

In the meantime, this great division of labor causes the great part of the women not to earn much more than their maintenance.

"My randmother made whole watches!" said an old woman, with a sigh, who was now sitting at home with her daughter, employed in one single operation in a little cog for the great manufactory, "and at that time women were much higher in the work than they are now, and also got higher payment. They were few in number, but extremely dexterous. Now they are innumerable, but their dexterity is employed upon a mere nothing—a very crumb."

And this was true as far as the old woman was concerned, for the whole of her work consisted in drilling one little hole in a small steel plate, with a little machine which resembled a tiny spinning wheel. Her daughter was seated at another little machine, and was merely making a little alteration in the hole which her mother had drilled; and six hundred of such holes must be made before they could earn three francs.

Important Hint to Foreign Applicants for Patents.—Foreigners, under the new Patent Law, who have cases pending before the United States Patent Office, can have their applications withdrawn and receive back two-thirds of the fees paid, and then renew their application by paying only $15. Thus, an Englishman who has paid $500 for government fee under the old law, can receive back from the Patent Office $333.33, and make a new application by returning only $15 to the Treasury. Foreigners from any other country, who have applications pending, can withdraw $200 and have their cases renewed by paying $15, thus saving quite a sum. We wonder if the makers of the new law thought of this when they framed the statute?

A Great Vessel of Olden Time.—Ptolemy Philopater, who lived some 200 years before Christ, had a ship with forty banks of rowers, being 560 feet in length—100 feet longer than the *Persia*, and 120 feet shorter than the *Great Eastern*—76 feet from one side to the other; hight to gunwales was 96 feet; and, from the highest part of the stern to the water-line, was 100 feet. It had four rudders, each 60 feet long. When it put to sea it held 5,000 rowers, and 400 supernumeraries, and on the deck were 3,000 mariners.

USE AND ABUSE OF THE EYESIGHT.

More pleasure and information are derived through the single sense of sight than from all our other senses. The condition of our eyes should therefore be an object of concern to all. In the last number of the *Methodist Quarterly Review*, there is an article on this subject by L. Henry Clark, M. D., containing a great deal of practical and important information. Diseases of the eye are very prevalent at the present day, which are attributed, in a great measure, by Dr. Clark, to an increase of injudicious reading. He says:—

The art of printing has increased the value of eyesight. The promise is, in a sense, fulfilled, that "the child shall be born a hundred years old." A much higher amount of professional attainment is necessary now than in the days of our fathers. We have reached a book-making and a book-reading age. In no former period were the eyes so valuable. That they are so much used may help to account for the unusual prevalence of diseases of the eye in our time.

We believe these to be correct views. Close reading is very trying to the eyes, because the nerves are required to operate so as to adjust the eye to convey the impression of every letter to the brain. Some idea of the labor imposed upon the nerves of adjustment will be obtained, when we state that they are required to convey no less than four thousand impressions to the brain in reading a single column of the Scientific American. The labor of the eye in reading is therefore very great; this is the reason why so many of the best students, while at college, become affected with diseases of the eye at about the age of nineteen, and are threatened with that dreadful malady amaurosis. The only effectual remedy for this disease of vision, in such cases, is to pitch Homer and Virgil upon some upper shelf for twelve months, and take to the mountains and rustic recreations. We have known three cases treated successfully by this mode. "The most excellent recreation with which a weak eye can be indulged," says Dr. Weller, "is to move about in the free air and in regions which command an extensive and pleasant view of the face of Nature."

On this topic, Dr. Clark gives some excellent admonitions. He says:—

Frequently some imprudence in youth during the student period, while the body is in a state of immature development, results in permanent disability of the eyes. A few nights of successive study, or days of constant application, during a period of physical debility; a day with the microscope, viewing an eclipse; a few hours' reading in the cars, or any continued exercise of the organs of vision without sufficient rest, will frequently give a shock to the nervous apparatus of adjustment from which the eyes never fully recover.

Asthenopia or disarrangement of the adjusting power of the eyes is a disease more common in America than in Europe. As this is a nervous disorder, our climate, habits, food and houses receive blame for producing it. On this head, Dr. Clark says:—

There is no doubt but the tightness of our houses, the smallness of our sleeping rooms, the use of anthracite coal, the abuse of gaslight, the great variety of our edibles, the indigestion produced by our love of sweets, and the want of simplicity in our diet, all contribute to produce this result. The working part of our population are overworked, and very few learn to economize nerve-power, or by timely relaxation to prevent exhaustion.

We have heard quite a number of persons complain of anthracite coal fires tending to produce headaches and pain in the eyes; but the want of fresh air, or of sufficient moisture in the atmosphere of rooms where anthracite coal is burned, must cause those affections, not the coal itself. Dr. Clark gives us some very practical information for taking care of the eyesight, and preventing morbid sensibility of the retina. He says:—

We find this diease (asthenopia) frequently among clerks, bookkeepers, tailors, jewelers, engravers, printers and seamstresses, as well as students, who seem to be its principal sufferers. Those who work by artificial light suffer most frequently. This arises from the defective chromatic constitution of the rays of artificial light, its great heating power, the production of carbonic acid gas, and the unsteadiness, inequality and concentratedness of the light. Labor of the eyes in which the mind is concerned, conjoined with feebleness of the body, temporary or permanent, most frequently produce this form of disease.

As an indication when persons should cease reading, &c., we are told that—

When, after reading, writing, sewing, or the like, there is an obscurity or confusion of objects, or if there is a feeling of fatigue in the eyes. * * Or if black motes and sparks and flashes of light appear, or if objects appear to be surrounded with a halo, it is time to stop. No man can afford to continue the employment of the eyes upon near objects. * * Absolute rest of the eyes and mind are requisite—or, what will often do better, an entire change of employment. * * By giving the eyes timely rest, and guarding carefully the general health, the asthenopic may accomplish much eye labor. * * The worst time to employ the eyes is at night; the worst part of daylight is immediately on rising from bed. * If the eye feels pained, tired or uneasy, it is hazardous to continue its particular use; no work is so important as to justify a continuance of it when symptoms of uneasiness are produced. * * The eye, especially if nervously diseased, is the first to sympathize with an overworked brain.

The proper adjustment of light for reading and writing is a question of great importance. Light-blue colored shades are recommended for artificial light, because the rays contain an excess of red. Sudden transitions from darkness to light are dangerous; several persons have been smitten with complete blindness by being removed from dark dungeons into the sudden glare of bright sunlight. Reading by the light of the moon at twilight, gazing at fireworks, and using the microscope frequently, should be avoided; also, reading by a sidelight, when reclining. Many persons who read and write a great deal at night have informed us that they prefer sperm and wax candle light to any other. It produces a softness—so to speak—which is more natural to the action of the eye than gaslight, coal oil, or any of the other burning fluids. The dazzling, unshaded gaslight in many churches is very injurious to delicate eyes. Sir David Brewster considers that ground glass shades are the best which can be used; Dr. Clark recommends a shade made of blue barege; we have found that common white printing paper makes the best and most agreeable shade for reading and writing by artificial light.

Squeezing the eyes and rubbing them roughly should always be avoided.

It is generally believed that, with advancing age, the eye loses rotundity and becomes flattened; and a few years since, several pretenders to ocular science gave out that, by squeezing the eye and manipulating it into proper shape, aged, semi-blind persons could be made to see as well as in their youthful days. Dr. Clark quotes the late Dr. W. C. Wallace on this subject. He states that—

It is untrue that the outer surface of the eye becomes flatter with advancing age; therefore, manipulations to restore what is not wanting in organs so delicate should be avoided. The principal lens of the eye is situated behind the pupil, and is kept in position by membranes finer than a goldbeaters' skin. These delicate membranes are liable to be ruptured by blows, falls and squeezing.

A case is related of a German oculist who was made permanently blind in consequence of the fingers of a companion from behind being pressed upon his eyes. Young people frequently practice this as a surprise trick upon one another. It is a very unpleasant and rude, not to speak of its being a very dangerous mode of surprising friends.

The use of some medicines is dangerous to the eyes; this is the case with strychnine and veratrine. Tobacco has caused amaurosis, and chickory in coffee tends to produce cataract.

The foregoing admonitions, respecting the use and abuse of eyesight, we trust will not be neglected. In order to enjoy healthy eyes, Dr. Clark says, with great force and truth:—

It is necessary to guard with care the general health. The student must sit in a pure atmosphere, and frequently breathe the out-door air. He should use cold water in bathing, if it does not disagree with him, to invigorate his nervous system, and he should frequently change his position and vary his labor. His dress should be easy, his hat brim wide, and he should have regard to the condition of his stomach and bowels. He should employ his eyes sufficiently, but not immoderately, as they may be injured by too little as well as too much labor.

He who would enjoy continued health and soundness of vision must regard as sacred all the rational laws of health.

The new Patent Law is working very satisfactorily. The change comes quite opportunely, as only $15 is now required to be paid on presenting an application. The abolition of the excessive fees heretofore required of foreigners will do much to stimulate them to introduce many valuable inventions into this country, and enable them to protect themselves against unscrupulous pirates who lay violent hands upon everything within their reach.

Beware of Cobwebs.—An acquaintance of ours happening into the wine cellar of one of our large liquor dealers the other day, found boys employed in enveloping bottles of wine with cobwebs, so as to convince the customers that their wines were old, from the webs which had accumulated upon the bottles. This is the last way of *ageing* wine which has come to our knowledge. It goes far ahead of the old plan of smoking the labels upon the bottles.

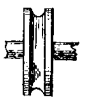
Correspondence

Ropes versus Belts.

Messrs. Editors :—On the subject of substituting ropes for belts, I have to inform you that within two years ropes have been frequently used instead of belts in this vicinity, and have, I believe, given entire satisfaction. The first experiment was, I think, made by the Greenwood Company, of New Hartford, which, for nearly two years, has worked well. It transmits the power for a manufactory, employing several circular saws, across the river, 225 feet distant, by a ⅝-inch rope running over two pulleys, six feet in diameter, making 300 revolutions. The pulleys are sheltered, but the rope runs exposed, in all kinds of weather, without causing any trouble.

In our own works (American Hoe Company) we are running a drop weighing 225 lbs. with an inch rope, running from an 18-inch pulley, making 80 revolutions to a 30-inch pulley; distance between pulleys, say 25 feet. Previously to using the rope, we had a 5-inch belt, and was much troubled with its slipping. We have many others, for various uses, transmitting as high as six-horse power, in some instances exposed to all kinds of weather. I give the above as examples of the extremes of motion within our knowledge. I consider it valuable for many reasons—it is far cheaper, costing but about one-tenth the expense of belts, and, in our forging shops, they will resist much better the action of the gas from anthracite coal. Then, too, they can transmit power for any distance without any shelter, except for the pulleys.

The cost of the pulley is no greater than the ordinary one, only requiring a rim properly grooved thus,



the rope needing no attention, except at times to be rubbed with grease having a very small amount of rosin mixed with it. At first the rope will stretch very much, and often require "taking up," which should only be done by one experienced in splicing rope, as a poor splice will make it run badly. Of course there are places, as with cross or very short belts, where it connot be used; but for all open belts of fair or extreme length, I certainly would recommend it as cheaper and as economical of power as any belt in use. L. R. B.

West Winsted, Conn., Feb. 24, 1861.

The Form of Chimneys.

Messrs. Editors :—Will you favor me by giving your opinion of the construction of a chimney; whether it should be constructed of larger diameter at the top than at the bottom, or the reverse? My opinion is that a chimney should be constructed in such a way that the flue or passage will gradually contract from the bottom to the top, being widest at the bottom and smallest at the top. At the base of the chimney the hot volume of smoke fills the entire passage, but as the hot smoke ascends, it gradually cools and contracts, occupying less space. If, therefore, the chimney were the same size all the way up, the tendency would be for the cold external air to rush down and fill up the space left by the contraction of the hot volume of smoke. This action would still further cool the hot air of the chimney and diminish the draft. G. H. R.

Morrisville, N. Y., March 11, 1861.

[Yes; diminish the draft by the momentum of the descending currents.—Eds.]

Explosions of Fluid Lamps.

Messrs. Editors :—Explosions of fluid lamps are of such common occurrence, and so many valuable lives are lost, and so much useful property is destroyed thereby, that the undersigned has been induced to make public, a very simple and successful plan which he has lately discovered to prevent the explosion of fluid, camphene and kerosene lamps. Drill a very small hole through the tube plate of the lamp, and insert a common brass pin, the head of which shall prevent the pin from falling through. By this means you will obtain a perfect safety valve, that will admit the air contained inside of the lamp to escape whenever it is expanded by being heated from the burning light. Elisha D. Blakeman.

Groveland, N. Y., March 11, 1861.

Air Engines Wanted.

Messrs. Editors :—Several persons hereabouts want air engines, but do not know the best, cheapest, lightest, &c. Why do not the manufacturers advertise their engines, with price, power, weight, &c., in the Scientific American, and thus enable them to sell and us to buy satisfactorily? S. S. Rembert.

Big Creek P. O., Shelby Co., Tenn., Feb. 24, 1861.

Cream Nectar or Vegetable Beer.—Among the patents which expired last year was one granted March 21, 1846, to Simeon Whiton, of Hartford, Conn., whose claim reads as follows :—"What I do claim as my invention, and desire to secure by Letters Patent, is the combination of the four following ingredients, or either two of them, with the above (*i. e.*, with ginger, essence of pipsissewa, yeast and water), viz.: cream oftartar, pumpkins, nut (peanuts or walnuts) and sweet corn, substantially as set forth in the specification, for the manufacture of vegetable transparent beer."

The new postal laws passed by Congress provide that seeds and cuttings of plants may be sent by mail at the rate of one cent per ounce. Over 1,500 miles two cents per ounce. Each package must not exceed 8 ounces in weight. Postage to be prepaid. Cards, prints, engravings, books, and paper may also be mailed at the above rates, packages not to exceed 4 pounds. Trees, with roots attached, and saw logs not allowed.

P. Henderson, florist, Jersey City, N. J., has a green house, 125 feet long, built on Dingwall's plan, *i. e.*, with one end lower than the other. The grade is 5 feet to 100. By this system it is said that an even temperature may be maintained throughout the entire house, without extensive flues. The heater is placed at the lower end of the house, and the warm air, gradually ascending the grade, readily diffuses itself through the whole structure.

Auld's Mode of Hanging Circular Saws.—Sawyers who examine the engraving of this improvement on page 168 of the current volume, will see that the teeth of the saw were turned the wrong way by our artist. The saw should cut toward the pivoted end of the frame.

Glycerine is a peculiar liquid; it seems to hold a place between water and oil, as it partakes of the qualities of both. It unites with water, alcohol, lard and tallow, and it makes an excellent linament. Nitro-glycerine is a terrible poison; a drop of it is sufficient to produce the death of a human being.

Louis Napoleon has decided that a movable photographic establishment shall be attached to every regiment in the French army, under an officer versed in all the details of the art. During battles, their duties will consist of painting blood and thunder with sunlight.

A girl advertises in a German newspaper for a situation as barmaid or waitress in a refreshment saloon. Among her qualifications for such a position, she says she can cut 225 pieces of bread, of satisfactory appearance, out of one pound of bread, and butter them with two ounces of butter.

The Paris, Lyons, and Mediterranean Railway, whose lines now comprise 1,201 miles, is the largest establishment of the kind in the world. Its receipts for January were $1,783,335, whilst those of the London and North Western (966 miles) were $1,450,465.

Meteoric dust occasionally falls on the decks of vessels in the middle of the Atlantic. Besides a variety of mineral oxides, it has been found to contain as much as 18½ per cent of organic matter, and often infusoria.

Experiments lately made at Pittsburgh, on the strength of iron compressed by cold rolling, show that the operation imparts to this metal a strength of about 110,000 lbs. per square inch, when before it bore but 65,000 lbs.

Indian Corn contains four times the amount of fat that is usually found in wheat.

Column of Varieties.

The alpaca has been acclimated in Australia. Its fleece makes fabrics of a nature between wool and hair.

From the annual report of the Commissioner of Statistics for Ohio, that State contains a population of 2,343,639.

Mr. Whipple, the distinguished photographic artist in Boston, has been making huge glass negative pictures five feet by four.

The Niagara railway suspension bridge is 821 feet in span over a gorge 240 feet deep, and is the longest of its class yet erected.

Sun flowers planted between houses and malaria swamps, have been found effectual in several cases for preventing fevers in the vicinity.

The fall of Schaffhausen, on the Rhine, 90 feet in hight, was illuminated one evening last Fall with five electric lights. The effect was magnificent; the falling waters resembled sheets of fire.

According to investigations lately made in Paris, it has been discovered that the gaudy colors and the great glare of gas lights in the *cafés* tend to produce brain diseases in persons who frequent such establishments.

Photographic pictures have lately been taken in London with Way's electric light. It is scarcely possible to detect portraits so taken from those obtained with sunlight. Such pictures are sharp in outline, and the toning is said to be excellent.

A bill has passed the Virginia Legislature, making it a misdemeanor to send a false statement by telegraph. The penalty inflicted for violation of the law is a fine of not more than $500 and not less than $50, or imprisonment as the court may direct.

A correspondent of the *Franklin Journal* states that the use of superheated steam, varying from 450° to 500° Fah., has greatly injured the pistons and valve faces in the English Pacific mail steamers, the new engines of which were built by Randolph & Elder, of Glasgow.

A fire broke out last November in the cellar of a candle manufacturer in Paris, in which were 200 tuns of oil and great quantities of candles. The doors and windows were closed tight and steam was introduced from a boiler by a pipe, when the flames were extinguished in five minutes.

A suspension bridge is now being constructed by Mr. J. Roebling over the Kentucky river, on the Lexington and Danville Railroad, which will have a span of 1,224 feet from center to center of the towers, over a chasm 300 feet deep. When completed, it will be the longest single span in the world.

In a recent paper on the form of ships, by Robert Duncan, Glasgow, the following proportions for side-wheel steamers are given :—Length, equal to ten times the beam; depth, six-tenths of beam; draft of water, seven-tenths of depth, or forty-two of beam: the coefficient of displacement, fifty-five per cent.

The canal over the Allegheny river at Pittsburgh, Pa., is carried on a suspension aqueduct of seven spans of 160 feet each. The two suspending cables are of iron wire, and from these hang iron rods, supported by timber crossbeams, and the wooden tank which forms the water channel, 16 feet deep and 8 feet wide.

Telegraph stations are maintained along the whole coasts of Great Britain, and constant communication is kept up between them, so that the state of the weather and the course of the wind along the coast at any hour is known in every English port. Lieutenant Maury recommends such a system to the new Secretary of the Navy.

No less than 1,600 steamboats run upon the Missisippi river and its tributaries. The total value of these is estimated at $60,000,000. The Mississippi drains an area of 1,200,000 square miles, washes the shores of twelve States; and from the Gulf of Florida to the source of the Missouri, it is 4,500 miles in length, its average depth 50 feet, and its width over half a mile.

At a late meeting of the British Institute of Architects, London, Mr. Gilbert Scott stated that a very great variety of substances had been experimented with for preserving the decaying stone of Westminster Abbey. Water glass, aluminate of potash, silicate of lime, shellac varnish and oil mixed with sulphur had been tried. The shellac varnish was found the best for stone not exposed to rain, and the oil and sulphur best for exposure to the atmosphere.

The Largest Telescope in the Country.

Arago, in his work on astronomy, expressed his regret that France had no telescope equal to some in other countries, mentioning particularly, among a few others, the one at Cambridge, in the United States. For the purchase of this famous instrument, the college received a bequest of $100,000 from one of her young graduates. A few days since we saw, at the house of Mr. Henry Fitz, No. 237 Fifth-street, in this city, a telescope that he has just finished, which is larger than the Cambridge instrument, having an object glass sixteen inches in diameter; the one at Cambridge being fifteen inches.

In the workshop of Mr. Fitz, we saw the whole process of making these great instruments. The glass for the lenses is imported from Europe in blocks or plates, from two to eighteen inches square, and an inch or more in thickness. The outsides of these plates are very rough, but, on looking through them edgeways, their wonderful transparency is perceived; we could see through one sixteen inches in width almost as plainly as we could through the air. Mr. Fitz said that he had paid $325 for one of these plates, sixteen inches square.

The circular pieces for the lenses are cut out by a very rude and simple instrument. It is formed by bending a strip of sheet iron into a hoop, brazing the ends together, and fastening it to a disk of wood. The plate of glass is laid upon a table, and the sheet iron hoop, being fastened upon the end of a shaft so as to give it a rapid rotation, is brought down upon the glass. A boy with a spoon feeds wet sand upon the plate, and as the iron revolves, it rubs the sand into the glass, slowly cutting it through.

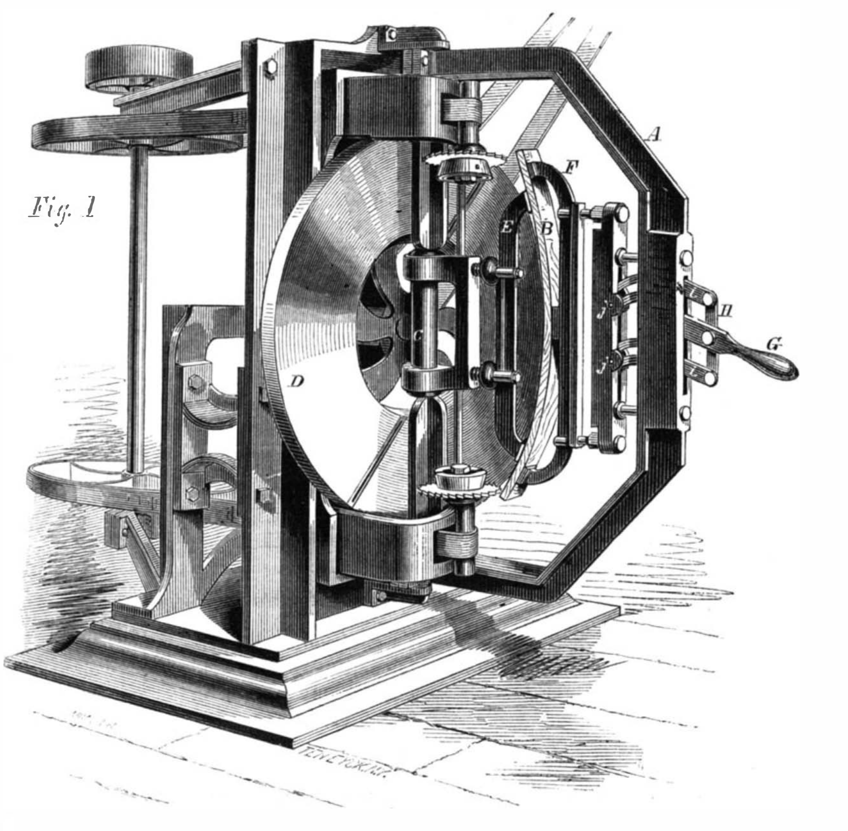
In grinding the lens, the first step is to make a cast iron bed of the proper form. This is done by a very simple process. A rod, of the length of the radius corresponding with the curve desired, is secured upon a table by a pivot at one end, when a cutting tool in the other end of the rod is swept across a plate of sheet iron, cutting it in two. This curved edge is then used as a guide for turning a pattern for casting the inner bed. This bed is then placed upon the top of a revolving shaft, and, being covered with wet sand, serves as a cutting surface for grinding down the lens into a corresponding form. As, however, the iron bed, as well as the glass, is ground away by the sand, it is necessary to provide some means for frequently restoring its proper form. For this purpose, a convex surface is cast to fit a concave one, and the two are ground together with emery between; then, whenever the form of one of the surfaces is altered, it can be restored by grinding it with its corresponding surface. After the lenses are reduced to the proper form, they are polished with oxyd of iron in molds of bell-metal, similar to those of iron employed in the grinding operation.

The great instrument just made by Mr. Fitz is what is called a "dialitic telescope," the object glass not being achromatic, but the corrector is placed half way down the tube. The corrector consists of a double convex lens of crown glass, fitting into one surface of a double concave lens of flint glass. This instrument, properly mounted, will be worth $10,000. Mr. Fitz has just sold a smaller telescope, to go to Allegheny City, Pa., for $7,000. In a future article, we may give some account of the most remarkable objects to be seen by the aid of this wonderful glass.

A LOCOMOTIVE has been altered at the machine shop of the Paris and Orleans Railway according to the plan of Mr. Mulholland, of the Reading (Pa.) Railroad, to fit it for burning anthracite coal. If found successful, this fuel will be introduced upon all the French railways. Such engines have been found very economical in America.

Improved Stave Machine.

The machine here illustrated for chiming and jointing staves for casks or barrels, has features of peculiar novelty and ingenuity, which would seem to secure a precision in its work unattainable by any other arrangement. The stave to be jointed is clamped in a swinging frame at a distance from the axis of the frame corresponding with the radius of the cask in the construction of which the stave is to be used; so that, as the frame swings on its axis, the stave describes the form of the cask. The cutters by which the edges of the stave are jointed revolve in a plane coincident with the axis of the swinging frame, thus cutting the edges of the stave always precisely in a plane which conforms with a vertical series of the radii of the cask.



BOWKER & BENSEL'S IMPROVED STAVE MACHINE.

The devices by which this desirable result is obtained are plainly shown in the engravings. The frame, A, in which the stave, B, is clamped, has its axle, C, passing directly through the diameter of the plane of the cutting cylinder, D; the axle, C, being bent into a recess in the center of the cylinder, and also bent outside of the periphery of the cylinder to bring its central line into coincidence with the plane of cylinder, D. The stave, B, being secured in place,

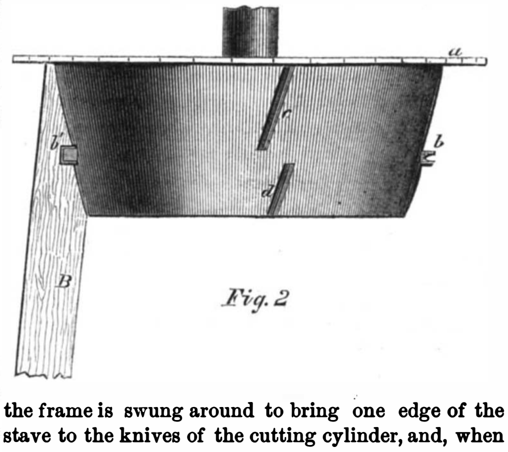


Fig. 2

the frame is swung around to bring one edge of the stave to the knives of the cutting cylinder, and, when this edge is jointed, the frame is swung in the opposite direction to joint the other edge.

As the stave is carried around by the swinging of the frame, its ends are sawed off, grooved for the reception of the heads, and finished by saws and cutters represented in Fig. 2. The circular saw, *a*, cuts off the end of the stave, the groove is formed by the revolving cutters, *b*, and the chamfers by the cutters, *c* and *d*.

The mode of clamping the stave into the swinging frame is shown in Fig. 1. To the middle portion of the axle, C, is secured the bar, E, which has its ends curved outward and properly fashioned to press against the inner side of the stave, and support it against the pressure of the bar, F. The bar, F, is forced powerfully against the outer side of the stave, bending it into the proper curve which it is to have in the cask. This forcing inward of the bar, F, is effected by means of the lever, G, which has its fulcrum at its inner end, and is connected by a pivot pin to the vertical bar, H. This bar is connected by pivots to the two horizontal levers, *i* and *i*, which have their fulcra in the middle, and their inner ends slotted to grasp the pins, *j* and *j*. Thus, it will be seen that, as the lever, G, is carried down, the bar, F, is pressed powerfully inward, bending the stave into its proper shape, and firmly clamping it in the frame, A.

From the plan of this machine, we should suppose that if it was well built, and the cutters were kept sharp, it would finish staves so perfectly that, when set up, the joints between them would be invisible, and the cask would be air tight.

The patent for this invention was granted, through the Scientific American Patent Agency, to Dan'l R. Bowker and William P. Bensel on Feb. 12, 1861; and further information in relation to it may be obtained by addressing Wm. P. Bensel, at No. 550 Washington-street, this city, where the machines may be seen in operation.

AMATEUR MECHANICS.—Among the men of wealth and leisure in England, there are many lovers of mechanical pursuits, some of whom have had machine shops and factories of the most complete kind, but on a small scale, fitted up for no other purpose than their own amusement. A very large proportion of the business of the firm of Holtzapfell & Son, one of whom was the author of the celebrated work on "Turning and Mechanical Manipulation," has, for two generations, consisted in the manufacture of lathes and other tools for these amateur mechanics. Some of their lathes, of small size, have been fitted with every kind of chuck and with every known appliance, and were capable of doing everything that could be done in a lathe, from the simplest hand turning to oval, eccentric and irregular work and engine turning. A thousand pounds sterling has been a common price for such lathes of small size, with all the necessary tools, and many have very far exceeded it. The Earl of Orkney—Sir Francis Shuckburgh—and the late John Taylor, a wealthy retired mining engineer, are among the most notable examples of these amateurs. The latter gentleman had, within two comparatively small apartments, every known variety of machine and tool used in working metals, the whole driven by a small steam engine; and to complete the whole, a small forge in his boiler room. One of his lathes, with the appliances added from time to time, was said to have cost three thousand pounds.

THE United States frigate *Niagara* having arrived in Japan, found that a large number of Dahlgren guns have been made by the Japanese from a model presented to them some years ago by Commodore Perry, in behalf of the United States government. Private letters have been received in this city from Mr. Harris, our Minister at Yeddo. He represents the feeling of the government and people of Japan to be in the highest degree favorable to this country, and differs essentially from the opinions of recent letter-writers from Japan, in regard to the prospective importance of the American trade. There is reason to believe we may expect large importations of teas and silks from there during the present year. The ambassadors who visited this country were loud and sincere in their acknowledgements for the honor and kindness shown them while in the United States.

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NEW YORK, SATURDAY, APRIL 6, 1861.

ENCYCLOPÆDIAS AND EXPLOSIONS.

The battles of science have frequently to be fought "over and over again." This is not always an agreeable, though it is sometimes a necessary task, because science is founded in truth, and the truth should generally be defended when plausibly assailed. At the same time we should never forget that what passes oftentimes for science, indorsed by high authority and common consent, is only "science falsely so called." The history of the past is full of instruction in reference to the veneration paid to mere notions—strings of falsehoods—which passed current for science during several centuries. A consideration of this fact, while it should lead us to keep our minds open to conviction and the reception of new truths, should also lead us to be very rigid in the examination of new theories and the evidence upon which they are based, so as to get the truth, and nothing but the truth. "Prove all things—hold fast that which is good," is a most excellent maxim for life and labor. This much we have said introductory to some remarks in the article on steam boiler explosions which has found a place in the late new edition of the "Encyclopædia Britannica." It relates to the new theory first published in the London *Engineer*, and subsequently in pamphlet form, and which was reviewed on page 345, Vol. II. (new series), Scientific American. We would not have recurred to it again but for its appearance in a work of such high authority. We will quote a favorite example from the work in question, and point out its unscientific character.

Suppose a "locomotive boiler, with 75 cubit feet of water space and 75 feet of steam space, the corresponding weight of water would be 4,650 lbs., while the steam at 140 lbs. pressure would only weigh 26 lbs. The temperature of this steam, and also of the water from which it is formed, is 361°, the water being 149° above the temperature at which it would produce steam in the open air, of atmospheric pressure. Water could only be heated to this temperature by being confined under a corresponding pressure, and if, when so heated, the pressure is removed, the water cannot remain in its original condition, as water merely, but a part of it becomes immediately converted into steam. 4,650 lbs. of water, heated to 361°, contains as much heat, or as many units of heat, over and above the heat at which it gives off steam of atmospheric pressure as are contained in 577 lbs. of steam of a total temperature of 1,200°. It is fair to presume, therefore, that upon the sudden liberation of the pressure under which 4,650 lbs. of water had been heated to 361°, about 577 lbs. of it would be immediately converted into steam. This quantity is more than twenty times greater than that of the steam originally contained in 75 cubic feet of space, and at a pressure of 140 lbs. per square inch."

We assert that such a result cannot take place, and that such a conclusion as 577lbs. of water being *immediately* converted into steam, under the above conditions, is opposed to science. It will be noticed that, according to the above example, steam of 2,800 lbs. pressure would be immediately generated in the boiler—a preposterous assumption. Steam is a compound of a certain quantity of latent and specific heat and water; every volume of it contains 1,200°. Now as each atom of the above 4,650 lbs. of water contains only 361° of heat, or 849 less than that of steam, it is impossible that the 577 lbs. of steam can be formed without a transfer of heat amounting to 149° from each of 4,073 lbs. of water disseminated over 66 cubic feet of space to rush in all directions, and combine with the wonderfully attractive 577 lbs. situated in some favorable position. There is no such law of heat-transfer known in the science of steam engineering.

In accounting for explosions by the theory referred to, it is requisite that the water in the boiler should be heated considerably above 212°, and that a rupture of the metal should precede the great eruption or explosion, by the 577 lbs. of water being immediately converted into steam. Safety valves, according to it, are the most dangerous devices ever invented for boilers. We know that if water be heated to 1,200° in a close strong vessel, and then released from pressure, it immediately flashes into steam, because it contains the requisite quantity of heat to produce such a result; but in no case whatever can water of 361° in a boiler be immediately formed into steam, according to the above theory of boiler explosions, which has been adopted in the "Encyclopædia Britannica" without due reflection.

THE NEW PATENT LAW.

The new law, as lately published in the Scientific American, has been eagerly sought for and read with the deepest attention, by thousands of our citizens; and from every quarter we are receiving the most unqualified expressions of approval concerning its general provisions.

In a recent discussion in the United States Senate, relative to the propriety of printing extra copies of the bill, one of the Senators stated that there had been more applications for copies than for any other bill before Congress; 2,000 extra copies were ordered. More than 25,000 copies have been printed and circulated from our office alone.

In many respects, the law is a noble one. All persons, without distinction of nationality, except Canadians, may now file applications for full patents on payment of the small government fee of $15. The fee heretofore required was $30.

This reduction removes an obstacle that has prevented thousands of ingenious people from coming forward with their new discoveries. Already we observe the most flattering indications of an increase in the number of applications for patents.

The new law for *design patents* also opens a most extensive and profitable field for persons of an inventive turn of mind. They are no longer confined to the dry details of machines and mechanics. The law seeks to encourage improvements in matters of fancy, taste, form and artistic skill. *Any new form, picture, painting, pattern, cut, ornament or design for any article may now be patented.*

This includes all kinds of wearing apparel, bonnets, dresses, ribbons, ornaments for the person, embroidery, laces, edgings, &c. The law, therefore, opens a new and broad field for the encouragement and reward of women, in the exercise and development of improved taste, and in the production of things which pertain to their peculiar sphere. We presume that they will not be backward to improve these opportunities. The contrivance of almost any new article or form of dress, which should happen to "take" with the public, would be likely to bring in a young fortune to the holder of the patent.

The terms upon which these design patents are issued are quite liberal:—

For a patent of 3½ years	$10
For a patent of 7 years	$15
For a patent of 20 years	$20

To these costs, a small sum for agency fees, for preparing the drawings and specification, must be added. The proceedings are all of a very simple nature.

We hope that our brethren of the press will take pains to post their fair readers in regard to the important facilities and "rights" now extended to them by the new Patent Law.

THE LUMBER TRADE—SAWING OPERATIONS.

The lumber trade of America is vast in its proportions. It is estimated that about 300,000,000 feet of lumber come into Albany, N. Y., annually; about the same quantity arrives at Chicago, Ill.; 250,000,000 at Bangor, Maine; and 150,000,000 at Baltimore, Md. These statistics will give some general idea of the American lumber business at a few of our leading ports. The annual exports of timber from our forests are valued at $12,000,000, and the home consumption of lumber cannot be much under $60,000,000. At one period, not very remote, an almost unbroken forest extended from the Atlantic Ocean to the Mississippi river; but a great change has passed over the face of the land, especially during the past twenty-five years—our railroad era. The great forests have disappeared from regions near our seaboard and navigable rivers. The growing scarcity of valuable timber, and the increased cost of carrying it from great distances to market, have been exciting causes for inventing and introducing improvements in the sawing operations. These principally consist in what is called "resawing;" also, the employment of much thinner saws than were formerly used. Immense quantities of thin boards, varying from one-fourth up to five-eighths of an inch in thickness, are required for making furniture, boxes, &c. Formerly these were cut out at the backwoods mills, direct from logs, and were subject to great damage from frequent handling while being carried to market. Beside this, thin boards were produced at a considerable cost by waste of material, as the same thick saws were used to cut them out as were employed to saw plank and scantling. Thin boards of half an inch in thickness used to be sold for the very same prices as inch boards; this was found necessary to remunerate the lumbermen, who usually had a great number of the former split in transporting them. It was to obviate these evils that resawing was invented and introduced, about twenty years ago, by Gen. Pearson Crosby, now of this city, but formerly of Crosbyville, N. Y. Having been engaged practically in the lumber business all his life, he was well acquainted with its defects; and the remedy which he devised was mechanism to resaw thick boards and planks which had been sent from distant mills where they had been cut from the logs. Boards, for example, one inch in thickness are strong, and not subject to injury in handling and carriage; such is the lumber now cut from logs and sent to cities for resawing. Such boards are fed in between vertical rollers to a properly adjusted thin saw, and reduced with the utmost precision and very little waste from sawdust.

General Crosby has been very successful with his patented improvements in substituting thin for thick saws, and two important beneficial results have thereby been secured. One is the saving of timber by a thinner cut, and the other is a saving of power in operating the saws. A saw of one-eighth of an inch in thickness removes twice as much timber—converting it into sawdust—in cutting, as one that is only one-sixteenth of an inch in thickness; and it also takes about double the power to drive it. Great difficulty was first experienced in operating thin saws, as they were liable to twist and follow the fiber. These difficulties, however, have been overcome by separate inventions for straining, setting and gaging, so that No. 16 can now be used in place of No. 11 saws, either singly or in gangs, and a saving of about from 8 to 10 per cent effected in the lumber. These improvements in sawing, by economizing lumber and power, increase the products of the country, and are a benefit to the entire community.

BANK CAPITAL CONSISTS OF MERCHANDISE.

If you are appointed a commissioner with authority to examine the condition of a bank, when you call on the cashier for the assets he will bring you some bundles of little slips of paper with something written on them. These little bits of paper form the whole property of the bank, and they are consequently kept very carefully locked up in stone or iron safes. On examining them, you will find that they are notes, acceptances, drafts, &c., some form of promises to pay money; bills receivable, or receivables, they are called. Now, why is it that these pieces of paper have such great value? It is because the men who have signed the promises to pay are the owners of property. If one of these men is a manufacturer, his property consists of his manufactory, machinery, raw material, supplies, &c.; if a shipper, of his ships, stores, &c.; if a merchant, of his merchandise. Banks do not give men large amounts of money on the promise to repay it with interest unless they are satisfied that the men are able to fulfill these promises, and this ability depends on the possession of property; not of money—

the debtors of our banks are in possession of money to the extent of only a very small fraction of the amount of their indebtedness ; but they are in possession of personal property equal or nearly equal to the whole amount. We say *personal* property, for long experience has taught bankers that for their purposes—to meet their liabilities to their depositors and the holders of their notes—real estate is not the kind of property that they want pledged to them ; they prefer personal property, and especially that which is in the warehouses and stores of traders. This experience has led to the adoption of certain sound maxims of banking which have resulted in causing the property of banks to be lo aned principally to men who have in their hands me rchandise sufficient to pay their debts ; or if the merchandise has been passed to another, the debtor of a bank holds the promise of that third party to pay.

Now, these promises to pay the bank may be regarded as a transfer of ownership of the merchandise to the bank. If the merchandise is burned up, the note in the bank vault becomes worthless—the vault may remain securely locked, the note as finely engraved and as fairly signed as before—but the *value* that was in it has gone to ashes. In these articles we deal with no theories, but with actual facts as they really exist ; in the great fire of 1835, many thousands of dollars of bank capital disappeared in this way in one night.

We have said that *all* bank capital consists of merchandise. This is almost literally true ; for the specie in the bank vaults really belongs to depositors who have left it with the bank for safe keeping ; and the State stocks that are deposited with the bank commissioner as security for the circulation, belong to the holders of the bills. The real estate, however, if the bank owns any, is a part of its capital.

As we came down to our office this morning, we noticed a bale of sheetings in front of a certain jobber's store, and happening to know in what bank he kept his principal account, and that a certain old maid in New England owns part of the stock of that bank, it occurred to us as a very striking instance of the complex relations of civilized life, that a portion of those sheetings really belonged to that distant old maid !

Grooming a Horse.

The following, from the *American Agriculturist*, will be found very useful to a large number of our readers :—

"What do you give your horses to keep them in such fine condition?" asked a young farmer of his neighbor, whose team of bays were the pride of their owner, and the admiration of the village. "Oats, carrots, and plenty of *brush*," was the reply. There is little need of insisting on the necessity of good food, and plenty of it, to have a horse remain vigorous. Every one knows that bone, and sinew and muscle are manufactured from hay, oats, corn, &c., and that the raw material must be supplied to produce the strong limb, elastic step, noble spirit, which makes a fine horse the universal favorite he is. But the important part which the skin bears in the animal economy, and the necessity of properly cleansing and keeping it in healthy condition, are not fully appreciated. Rough staring coats, "grease" or "scratches," inflammations, and a whole catalogue of diseases, find their origin in neglect of proper grooming.

The skin of the horse, like that of other animals, not only affords protection to the parts within, but by the pores affords an outlet to a large part of the waste of the body. In out-door life, the natural state of the horse, this membrane becomes thickened and tough, capable of resisting changes of temperature ; and by continual exercise, the pores are kept open, giving free exit to all the exhalations. But this alone will not give the smooth glossy coat which adds so greatly to the animal's beauty. Confining the horse to the stable, as is generally done for at least part of the year, renders his skin tender, especially when he is kept warmly blanketed. Expose him now to great change of temperature; take him out and drive him until heated, return him to the stable, and let him stand uncared for over night, even for an hour, the sensitive skin is rapidly chilled by the evaporation or the sweat, the pores are suddenly closed, and often a cold, a rheumatic stiffness, or other disorder, results. Proper grooming prevents this, by toughening the skin, keeping it in healthy action, equalizing the circulation, removing obstruction from the pores, and what is of great importance, by rousing the action of the muscles at the surface, in some measure, compensates for the want of exercise, consequent upon stable life.

Currying and brushing should not be done in the stable ; the dust and scruf will be scattered in the manger to mix with the horse feed, beside keeping the stable uncleanly. Take the animal into the open air, tie him securely, and handle him so gently that he will enjoy, rather than dread, the application of the comb and brush. A sharp curry-comb, roughly scraped over the tender skin, is anything but pleasant, as the shrinking and resisting animal will soon show. Apply this instrument lightly, and depend mainly on the free use of the brush. Begin at the head, and pass the comb lightly up and down, until the dandruff is all loosened, and remove it with the brush. Be particular around the edges of the foretop, and the mane. It is a good plan to sponge off the head and ears, using but little water, smoothing the hair down to its natural position. In going over the back, quarters, loins, &c., use the comb in one hand and the brush in the other, working lightly and quickly. Take much pains where the skin lies in folds, as at the union of the legs with the body—let every part be made thoroughly free from dust and dandruff. Finish by rubbing down vigorously with wisps of straw, until the hair "shines like a bottle"—an extra smoothing touch may be put on with a woolen cloth. Do not fear all this trouble ; it will be more than repaid in the extra looks and spirit of the horse.

United States Census for 1860.

Hunt's *Merchant's Magazine* compiles the following table of the population of the several States from the returns furnished by the Census Bureau to the governors of States for the purpose of apportioning members of Congress :—

NORTHERN STATES.

	Population 1850.	Population 1860.	Apportionment. New.	Apportionment. Old.
Maine	583,169	619,958	5	6
New Hampshire	317,976	326,072	3	3
Vermont	314,129	315,827	3	3
Massachusetts	994,514	1,231,494	10	11
Rhode Island	147,545	174,621	1	2
Connecticut	370,792	460,670	4	4
New York	3,097,394	3,851,563	30	33
Pen nsylvania	2,311,786	2,916,018	23	25
New Jersey	489,555	676,034	5	5
Ohio	1,980,427	2,377,917	19	21
Indiana	988,416	1,350,802	11	11
Illinois	851,470	1,691,233	13	9
Michigan	397,654	754,291	6	4
Wisconsin	305,391	768,485	6	4
Iowa	192,214	682,000	5	2
Minnesota	6,077	172,793	1	2
Oregon	13,294	52,566	1	1
California	92,597	384,770	3	2
Kansas	......	143,645	1	1
Total	13,454,169	18,950,759	150	149

SOUTHERN STATES.

	Population in 1850. Free.	Slave.	Total.	Apportionment. New.
Delaware	89,242	2,290	91,532	1
Maryland	492,666	90,368	583,034	6
Virginia	949,133	472,528	1,421,661	11
North Carolina	580,491	288,548	869,039	7
South Carolina	283,523	384,984	668,507	4
Georgia	524,503	381,682	906,185	7
Florida	48,135	39,309	87,445	1
Alabama	428.779	342,892	771,623	6
Mississippi	296,648	309,878	606,526	5
Louisiana	272,953	244,809	517,762	4
Arkansas	162,797	47,100	209,897	3
Texas	154,431	58,161	212,592	4
Tennessee	763,154	239,460	1,002,717	8
Kentucky	771,424	210,981	982,405	8
Missouri	594,622	87,422	682,044	9
Dist. of Columbia	48,000	3,687	51,687	.
Total	6,470,503	3,204,099	9,664,650	84

	Population in 1860. Free.	Slave.	Total.	Apportionment. Old.
Delaware	110,548	1,085	112,353	1
Maryland	646,183	85,382	731,565	6
Virginia	1,097,373	495,826	1,593,199	13
North Carolina	679,965	328,377	1,008,342	8
South Carolina	308,186	407,185	715,371	6
Georgia	615,336	467,400	1,082,736	8
Florida	81,885	63,800	145,685	1
Alabama	520,444	435,473	955,917	7
Mississippi	407,051	479,607	886,658	4
Louisiana	354,245	312,186	666,431	4
Arkansas	331,710	109,065	440,775	2
Texas	416,000	184,956	600,956	2
Tennessee	859,528	287,112	1,146,640	10
Kentucky	920,077	225,490	1,201,214	10
Missouri	1,085,595	115,619	1,145,567	7
Dist. of Columbia	....	....	75,321	.
Total	8,434,126	3,999,283	12,508,730	89

TERRITORIES.

Nebraska	....	28,893
New Mexico	61,547	93,024
Utah	11,354	50,000
Dacotah	....	4,839
Washington	....	11,624
Total Territories	72,901	188,370
Total United States	23,191,876	31,647,859

It will be seen that the population of the seven seceded States is—Free, 2,703,147 ; slave, 2,350,607 : total, 5,053,754. The seven seceded States contain 2,350,607 slaves, and the eight remaining slave States contain 1,648,676 slaves. South Carolina and Mississippi are the only two States in which the slaves outnumber the free.

Heavy Ordnance and Seacoast Defenses.

At this time public attention is considerably interested in all that relates to the art of war. We have kept our readers pretty well supplied with intellectual munitions of this sort, and we believe many of them will be much interested in the following report of a lecture recently delivered in this city by Capt. Mansfield Lovell, late of the City Guard, on "Heavy Ordnance and Seacoast Defenses."

Captain Lovell commenced by remarking that it was impossible to go much into the details of his subject in the brief time proper for a lecture ; but he intended to avoid technical terms, and, in plain talk, to give some general ideas, leaving particulars to be sought in books by those who wanted the facts. Heavy ordnance comprised four kinds of destructive means: guns, howitzers, columbiads and mortars. Their respective spheres of service were: seacoast, field, garrison and battery. "Caliber" meant the diameter of the bore of a gun, and not the weight. A 10-inch mortar, charged with 3½ lbs. of powder, would throw a shell 1 mile in about 19 seconds. There was a great deal of uncertainty about the fuses, however, especially in water, and much attention was devoted by experienced gunners to insure the burning of the fuse, so that it could be relied on in calculations of time and distance. Ricochetting shots were thrown at a slight elevation, and intended, by their irregular and bounding course, to break away opposing obstacles of the enemy. Columbiads were the guns of the present day, and were used both for solid shot and shell. The various patterns and forces of this gun were described. Mortars were used for reaching out-of-the-way places. At the siege of Monterey, the Mexicans gathered within the city in the plaza, and one shell thrown among them killed 26 men. The effective range of 22-pound guns was about a mile. The capacity of a gun to impel a projectile 3 or 4 miles did not make it serviceable at that distance. A mile was about the longest range for destruction.

The Captain gave accounts of attempts to cast very large guns. The difficulty was in casting the iron. Captains Rodman and Dahlgren, the very best American gunners, were experimenting upon the plan of cooling the inside part of the cannon first, which was done by casting it with a core and letting water wash through the opening, keeping the outside hot meanwhile. The old mode, and which is yet followed, is to cast the cannon solid and bore it after cooling. In casting very large guns in this way, too much expansion was given to the iron in cooling to make them strong in proportion to the size. At Fort Monroe, successful experiments were being made with a gun 16 feet long, and weighing 25 tuns. It was designed to carry a ball of from 305 to 401 lbs., requiring a charge of 35 to 40 lbs. of powder. It was found that such a quantity of powder was too powerful for the iron, but very large grained and easily compressed powder, which would create gas less instantaneously than the fine material, acted satisfactorily. By this means, the projectile was moved and helped on its journey through the bore, instead of the shock being all expended in one prodigious blast, that would tear away whatever opposed it, and was not strong enough to resist its stupendous power.

He gave an idea of the caliber of shells by stating that a 20-inch one would weigh 1,000 lbs., and a 30-inch one 3,000 or 4,000 lbs., or sufficiently large to crush a large ship so badly as to sink her at once. After referring to the power of the Armstrong gun, he interested the audience a good deal by describing the effect of shot. A shot did not make a hole of its own size right through wood, but indented it, the fibers springing back after the shock. Generally the course of shot could only be traced by a wire, sometimes by a hole as large as a man's finger. The damage most often happened in the inside of a vessel, in splintering and breaking the wood, after the main force of the shot was spent. Forts Hamilton and Richmond, which are about a mile apart, with a vessel lying between them, could not, with their guns, send shot through two feet of its timber. There was rarely an instance where a ship was sunk by solid shot. Hot shot and shells did the mischief ; the latter would sometimes make apertures of several feet in extent, through the sides of vessels. He mentioned several instances where vessels had gone through hours of cannonade and came off unsunk. The latest was that of the *Agamemnon*, which was under the fire of a Russian battery, at the distance of 800 yards, for five hours, without being sunk or having her engines or her batteries damaged, and lost only 29 men, although an enormous quantity of shot was thrown into her. The Emperor Napoleon had built a war vessel with sides covered with steel five inches thick. The speaker believed this vessel would prove to be invulnerable to the present class of guns, as Armstrong, whose guns had carried shot 5½ miles, had been unable to drive a shot through the steel coating at a greater distance than 200 yards. He thought that against such vessels the guns about our harbor could play away without effective damage. The Fort Monroe big gun, however, might crush the steel all up.

He then gave considerable attention to the weakness of the American service in respect to artillerists. The remedy rested with the people. In New York, men could readily be found to go into the forts for service, in case of an emergency; but while they would be getting ready to fire, the enemy's vessels would get beyond reach of the guns. Raw men at the guns would take as long to fire once as practiced gunners would to fire 40 times. He said the City Guard and the Ninth and Fifth Regiments had commenced the practice of gunnery, but it was found to be pretty expensive to go to the forts to practice with great guns. The General Government had signified a willingness to make Castle Garden a practice school, with instructors, if the State would give it up for that use, but it had been found preferable to make it an emigrant depot.

THE POLYTECHNIC ASSOCIATION OF THE AMERICAN INSTITUTE.

[Reported for the Scientific American.]

The usual weekly meeting of the Polytechnic Association of the American Institute was held, at their room, in the Cooper Building, this city, on Thursday evening, March 21, 1861—William Lawton in the chair.

TRANSVERSE HARROW, SEED SOWER AND ROLLER COMBINED.

Edward Badlam exhibited and explained a beautiful model of a new agricultural implement with the above title. It has a single wheel in front and a large roller in the rear. It is drawn by two horses. A transverse box or trough in front contains the seed. (Another similar one in the middle may contain grass seed.) Just behind the front seed box is suspended near the ground a case of harrow teeth, and, as the machine moves, the teeth operate transversely in the soil. There are six rows of teeth, and they may operate all together, or one half of them in an opposite direction to the other half. The harrow being suspended at four corners, it yields to obstacles and unevenness of surface. The teeth keep themselves clear, and pulverize more thoroughly, it is claimed, than the common harrow. A boulder causes no breaking of the teeth, because they yield. The driver can throw the harrow out of gear. The machine has been tried in Ogdensburg. The inventor thinks the draft is fully as easy as the common harrow. It was patented only last Fall. There is no other machine combining the harrow, seed sower and roller. It is said to do three days' work in one. It will be retailed at about $100. The working machine is 4 or 4½ feet wide, and weighs from 700 to 800 pounds. The roller may be made in two sections. No part is liable to get out of order. The model exhibited is a quarter size, and was made by the inventor. (A member pronounced it the best model he had seen exhibited before the Society.)

The Chairman remarked that it was very important to submit such machines to scientific institutions, from the fact that the farmers who invented them were frequently deficient in mechanical knowledge, and a few practical hints might save them great expense and loss.

CLOTH-WRINGER.

Mr. Stetson.—There have been a great many efforts to invent machines for wringing cloths. Some hundred patents have been granted for washing machines. The wringing machine is a later invention. The English wringer consists of rollers of wood, with no yield except from an elastic bearing. But in the passage of a bunch of clothes, while the thicker portion would be pretty well squeezed, the thinner portion would remain dripping wet. Mr. S. then exhibited an American invention, which, he said, was practically uniform in its operation, and introduced as the inventor—

E. Dickerman, of Middlefield, Conn., who explained the operation. The machine may be screwed to a wash tub. The two rollers through which the clothes are passed are of india-rubber, with an axis of iron. An iron axis three-quarters of an inch thick is driven through a hole half an inch in diameter in the india-rubber roller, and cemented therein with dissolved rubber. Once passing through is sufficient to expel the water from every part of the cloth, thick or thin. The inventor says that he can wring out a sheet before a washwoman can get it ready for wringing. No guiding is required. A girl of 10 years can turn the crank and wring out a washing. It has only been perfected a short time, and it has sold rapidly. In almost every instance where they were left on trial in Middletown they were afterwards purchased. The inventor does not claim the rubber rollers as new, but what he does claim is the use of wooden rollers outside, or above and below the rubber rollers; and he has also a claim pending for the clamping process. The wooden rollers press against the rubber rollers above and below, and have a sliding block for the bearing; also a spring that allows the rubber rollers to yield. The price of the largest size machine is $10, intended for hotel use; the next size below, $8; and a small size will be made for $5.

Mr. Seely—I think this a very admirable machine, and suggest that it may be useful for other purposes than wringing. I think it would be good for copying letters; also for mounting pictures upon cards. There is a great deal of such work done by photographers. It might also make a very good washing machine, by immersing it in a tub of soap suds and passing the clothes back and forth through the rollers. Successful washing consists in getting soap suds in and soap suds out of the cloth. But rubber will not stand soap or grease; and even hot water will injure it. Again, I think this machine would be specially applicable to washing photographs. The chemical substances must be removed from photographs or they will fade. Their durability depends upon the extent of the removal of those substances. They are usually washed twelve hours. With this machine they could be as thoroughly cleaned in ten minutes. By passing the photograph through once, you will remove nine-tenths of the noxious material; by repeating it, you will remove ninety-nine-hundredths; and so on.

Mr. Dickerman—I have experimented on the machine as a washing machine, and have found it successful, washing the clothes entirely clean without rubbing.

Mr. Johnson—My experience has been that nothing short of rubbing will answer in washing; the machine here exhibited is a rubbing, washing machine.

Mr. Seely—The trouble with machines is that they do not dislodge the fluid on the inside.

Mr. Stetson stated in the four most popular washing machines—the Metropolitan, the Cataract, the Union and the Conical—the clothes are not rubbed together.

Mr. Dickerman—There have been no clothes rubbed in my house since November.

PROJECTILES.

Mr. Stetson—Several years ago it was my privilege to show a projectile which has done the best execution, viz.: B. B. Hotchkiss' patent ball. The ball is in two pieces, united by lead, flush with the surface. When discharged, the first effect of the powder is to drive forth the back portion and to force out the lead at the sides against the internal surface of the cannon. The back portion shuts over the front portion, and the lead between is only half an inch thick. The print of the internal surface of the cannon is shown in this ball (exhibited, weighing about 15 lbs.), which was fired into a soft substance. On the 19th of February, a target nine feet high and six feet wide was fired at a distance of 1,000 yards—a good fair distance for rifled cannon practice, and here is a diagram showing the result. Out of seven shots six struck the target, the seventh just clearing the edge; and three of the shots hit within a space 16 inches square in the center. The cannon was of iron, weighing 650 lbs.; elevation, 3½°; weight of ball, 5¼ lbs.; quantity of powder, 5½ ounces.

Numerous other diagrams were exhibited of the results of other trials.

ALCOHOL.

The Chairman wished to call the attention of the association to the consideration of alcohol in connection with the agricultural interests of the country (alcohol being one of the subjects in regular order for discussion). There is a vast deal of grape culture for producing wines, and from wine brandy is distilled. He wished to have some light upon the question of the effects of alcohol upon the human system—particularly whether there is any difference when taken in the form of brandy and when taken in the form of wine, and combined with the vegetable product; and whether, in the latter form, or in any form, it is healthful or otherwise. It is maintained by many that brandy made from the grape is no better than other alcohol, and that its peculiar flavor is due to the ingenuity of dealers. He was unwilling to believe that the world had been thus far cheated into paying from $4 to $6 a gallon for such an article. It is true that brandy, when taken into the stomach, acts like carbon, and suspends hunger and vitality without being digested. Is that the effect of poison? Is alcohol absolutely a poison? And what difference is there in its effects when combined with vegetable products in the form of wine?

Enos Stevens, upon the introduction of Mr. Serrill, read a paper bearing upon this question, being the result of certain investigations by himself while employed as clerk for the Massachusetts Commissioners on Sanitary Survey, more particularly as to getting up an institution for feeble-minded persons. Among other conclusions arrived at were these: that alcohol is not a producer or furnisher of nervous stimulus, but an irritator; that it is the most virulent poison in nature, and never tends to cure; that the use of one gill a day of commercial proof liquor, whether drugged or not, wastes about ten per cent of the strength and activity for to-morrow.

Mr. Koch stated that it was found in Russia, where he had lived many years, that alcohol was absolutely necessary for the sustenance of life.

Mr. Stevens, in reply, cited the fact that the Esquimeaux had not the means of distilling alcohol. He also stated that one quarter of all the idiots in Massachusetts were the offspring of very intemperate parents one or two years before the transmission of the germ.

Dr. Reuben maintained that alcohol was alcohol, no matter how combined with other ingredients. Alcohol in wine will produce the same effect as pure alcohol, diluted or otherwise, except so far as it is modified by the presence of some other substances. Strong coffee will neutralize, to some extent, the effects of alcohol. So will certain vegetable acids. To his own mind it was not proven that alcohol is always injurious, though its general effect is to contract animal tissue. This could be shown by putting a piece of flesh in alcohol; and in post mortem examinations, the effect of alcohol on the brain was seen in the diminution of its size, and in some cases the filling of the enlarged cavities with that fluid.

NEW SUBJECT.

The subject selected for the next meeting is "Iron Cased Ships."

On motion, the Association adjourned.

Recent American Inventions.

The following inventions are among the most useful improvements lately patented:—

MACHINE FOR MANUFACTURING SHIRRED GOODS.

This invention relates to a new and improved machine for placing india-rubber cords between two laminæ of cloth and then crimping the latter, so that a certain degree of elasticity will be allowed it. Goods thus formed are commonly termed shirred goods, and have hitherto been manufactured by two distinct machines, one being employed for cording the fabric, and the other for crimping it. This double operation is attended with some difficulties—the fabric is more or less soiled by repeated handling, and the colored portion of the cloth frequently stains and disfigures the white inner cloth or lining—in consequence of being wound on a roller, under a requisite degree of tension, as it passes from between the cording rollers. During the secondary or crimping operation, the rubber cords are liable to be cut, and the goods are frequently so much injured as to materially damage them in a commercial point of view. The object of this invention is to obviate these difficulties, and to this end a roller is employed, provided with circumferential and longitudinal grooves, and used in connection with a roller having a yielding surface or periphery, the parts being so arranged that the india-rubber cords are placed and secured longitudinally between the two layers or laminæ of cloth, and the latter crimped or corrugated transversely, the whole being done at one operation, and without injuring the fabric. Richard Solis, of New Brunswick, N. J., is the patentee of this invention.

IMPROVEMENT IN DESICCATING AND TORREFYING FARINACEOUS SUBSTANCES.

The object of this invention is to expel moisture from farinaceous and other substances by artificial heat applied through such a means which will give the operator or attendant better control than hitherto over the heat employed for the purpose; and also to stir the substance while within the retort, so that it will be equally heated throughout, and not liable to be burned. The usual plan in desiccating and torrefying substances is to withdraw the pans from the retort occasionally, for the purpose of stirring the contents. This cools the substance, and consequently prolongs the process, and increases the consumption of fuel. This invention consists in heating the substance to be desiccated or torrefied through the medium of animal oil and employing stirrers arranged within the retort, so that they may be operated from the outer side, and by such a means as to act in a very efficient manner. Francis Huckins and E. C. R. Walker, both of Boston, Mass., are the inventors.

IMPROVEMENT IN CARTRIDGE BOXES.

Among the patents granted last week, it gives us pleasure to notice the claims of J. S. Smith, of Brooklyn, N. Y., for an improvement in cartridge boxes. The object of this invention is to facilitate the operation of picking the cartridge out. Ordinary cartridge boxes are provided with a regular tin case, in which the cartridges are placed in a horizontal position, so that it is very difficult to get hold of a single cartridge, especially with gloved or numbed hands. Instead of this regular box, Mr. Smith uses a series of tubes, constructed in a very ingenious, cheap and simple manner, and so arranged that each tube is capable of holding two cartridges, one above the other, in a vertical position and that each cartridge can be picked out with the greatest facility.

IMPROVED PRESSURE GAGE.

The principal object of this invention is to connect the pressure gage with the safety-valve of a hydraulic press or of a steam-boiler in such a manner that whenever the pressure reaches a certain point, the safety-valve is raised by the action of the pressure gage, and damage to the press or to the boiler is prevented. The gage, which forms the subject of this invention, is particularly adapted for the purpose, and it has been tried by long experience. It never fails to lift the safety valve at the desired point. The credit of this invention is due to John Leavens, of Brooklyn, N. Y., and he has secured it by Letters Patent in the United States and in Europe, through the Scientific American Patent Agency.

EXTRACTING OIL FROM FISH.

The usual method of extracting the oil from fish is to cut it in small pieces, and to boil it in water for a period of several days, and to scoop off the oil which accumulates on the surface of the water. The largest portion of the oil, which remains in the body or in the flesh of the fish, has to be obtained by pressing. This entire operation requires much labor and a large quantity of fuel and machinery, and, after all, the oil thus obtained is mixed with a great many impurities, its color is dark and its smell very offensive. The object of the present invention is to extract the oil in a cheap, simple and efficient manner, and to remove or precipitate at the same time the largest portion of the impurities, and this object is effected by treating the fish with dilute sulphuric acid, in a manner which produces a pure oil at a larger percentage than the ordinary method. A. M. Millochau, of this city, is the inventor.

GAS NAPHTHALIZING APPARATUS.

In the use of the various apparatus heretofore invented for furnishing a supply of vapor of naphtha or other liquid hydrocarbon to mingle with illuminating gas near the burners, for the increase of its illuminating power, much difficulty has been experienced from the varying volatility and character of the different hydrocarbon liquids used, and from the effects of variations in the temperature of the atmosphere. This invention consists in a certain construction of the apparatus, whereby the supply of vapor is enabled to be so regulated as to obviate all difficulty from the above causes. E. Dwight Kendall, of this city, is the inventor of this device.

CHANGING IRON INTO GOLD.—Noble's photometer, illustrated on another page, was originally invented by Dr. Draper, of this city. He was led to the discovery of its principles by experiments undertaken in the effort to effect the transmutation of metals—one of the dreams of the old alchemists.

BEFORE the publication of Lieutenant Maury's "Wind and Current Charts," the average length of a voyage by a sailing ship between England and Australia was 124 days. The average is now ninety-seven days, the passage having once been made in sixty-three days.

THE ODOR OF MUSK.—When Justinian, in 558, rebuilt what is now the mosque of St. Sophia, the mortar was charged with musk, and to this very day the odor is given off.

ISSUED FROM THE UNITED STATES PATENT OFFICE

FOR THE WEEK ENDING MARCH 19, 1861.

Reported Officially for the Scientific American.

*** Pamphlets giving full particulars of the mode of applying for patents, under the new law which went into force March 4, 1861, specifying size of model required, and much other information useful to inventors, may be had gratis by addressing MUNN & CO., Publishers of the SCIENTIFIC AMERICAN, New York.

691.—Ethan Allen, of Worcester, Mass., for an Improved Machine for the Manufacture of Metallic Cartridges:

I claim the combination of rollers, h h, knives, k k, levers, i i i i, inclines, m m m m, with jaw, N, inclined plane, 4, spindle, I, and arm, Z, substantially as specified and for the purpose set forth.

692.—Wm. Blake, of Boston, Mass., for an Improved Furnace for Galvanizing Iron:

I claim my improved zincing bath, as constructed of a long bent tube (or its equivalent), arranged in one or more furnaces or heating chambers, and so as to operate substantially as described.

693.—Joseph Brakely, of New York City, for an Improvement in Machines for Planing Bark:

I claim the combination with each other and with the feed rollers, G G, of the adjustable beds, D F, and cutting cylinders, C E, in the manner and for the purposes substantially as shown and described.

I also claim in bark mills, having the bed or beds on which the bark is placed concentrically adjustable in respect to the periphery of the cutting cylinder, substantially as shown and described.

[This invention consists in the employment or use of rotary cutting cylinders in connection with adjustable bed pieces and pressure rollers, whereby the bark may be expeditiously cut, and reduced to the required degree of fineness for tanners' use, and the loss or external worthless portion discharged from the machine at a separate point from the two valuable portions which are also discharged at separate points, so that the several parts are not mixed.]

694.—T. L. Braynard, of New York City, for an Improved Rein Holder:

I claim the arrangement and combination of the two eccentrics, A and B, substantially as described for the purpose of holding or fastening reins, straps, &c., by the action and revolution of such eccentrics toward each other.

695.—Hiram Clark, of Rochester, N. Y., for an Improvement in Skates:

I claim the employment in skates of a thimble, or its equivalent, encircling the posts or studs, between the foot piece and the runner, for the purposes set forth.

696.—John Cooley, of Tafton, Wis., for an Improvement in Corn Planters:

I claim the cam projections M, and recesses, O, of the seed-distributing cylinder, B, in combination with the crank shaft, Z U F, of the seed valves, E, the rock shaft, G, the hinged pressure rollers, H', and the levers, T S, operating the hinged shoes, K, substantially as and for the purposes set forth.

697.—Nathan Cope and William Hodgson, of Cincinnati, Ohio, for an Improved Valve:

We claim, first, The employment of a valve which is the central section of a sphere adapted to and used in connection with a valve seat, which is the corresponding section of a concentric or hollow sphere, substantially as and for the purpose specified.

Second, The employment of the valve case, constructed in two parts and provided with metallic packing and valve seat, as and for the purpose set forth.

698.—John Cox and J. A. Thorp, of Three Rivers, Mich., for an Improvement in Cultivators:

We claim, first, The combination with the oblique side bars, A A, and swinging shovel stocks of feet, F' F' of a V-shaped frame of three-sided metallic blocks, G G, the blocks being constructed with heir inner face to be parallel with the line of draft and in contact with the upper ends of the shovel stocks, and their outer face parallel with the oblique bars, each block being let in the sides of the bars and confined by a single bolt, H, substantially as and for the purposes set forth.

Second, The combination with the oblique side bars, A A, of metallic ears, I I, wooden pins, L L, swivelling connecting links, K K, shovel stocks, F' F', and pivoted screw bolts, H H, substantially as and for the purposes set forth.

Third, The arrangement of the V-shaped frame, A A B, crank axle C, supporting wheels, C' C', arch-shaped bar, E, adjusting lever, F f, three-sided blocks, G G, shovel stocks, F' F', screw bolts, H H, metallic ears, I I, swivelling connecting links, K K, and wooden pins, L L, substantially as and for the purposes set forth.

699.—M. C. Cronk, of Auburn, N. Y., for an Improvement in Bottle Stoppers:

I claim the combination of the stopper, constructed as set forth, with the wire rod, H, the hasp I, and the loops, F F, when used as and for the purpose specified.

700.—John Dunham, of Detroit, Mich., for an Improvement in Steam Boilers:

I claim conducting the air in through the water vessel, in combination with the several parts, when constructed in the manner and for the purposes set forth.

701.—Rufus Dutton, of Dayton, Ohio, for an Improvement in Mowing Machines:

I claim the casing box, E, its projecting center forming a bearing for the end of the counter shaft, and having a projection, u', for the reception of the bevel pinion of the pitman shaft, in combination with the outer side plate, D, provided with the bearing, f, substantially as described.

I also claim raising the outer end of the finger bar at the same time that the draught shoe is raised by means of the bent lever, P, resting on the hinge piece, i, and coming in contact with the friction roller, c, or its equivalent, on the projecting end of the tongue, substantially as set forth.

I also claim the conical skeleton track clearer, Q, formed of spiral rods or wires, when connected at their outer ends by the weight clamps, b' b', substantially as described.

I claim the guard finger, R, made in a single connected piece covering the sickle bar, and having opening, t' t', in the bottom thereof, for the escape of grass or other substance entering with the sickle, when said guard finger is provided with a bearing surface, r', connecting the upper and lower portions of said guard finger, and resting against the edge of the finger bar, and is braced and sustained against lateral strain, as set forth.

702.—Bernard Fagan, of New Britain, Conn., for an Improved Quilting Frame, Table and Clothes' Dryer Combined.

I claim the combination of a table, a quilt frame, and clothes frame in one, substantially as and for the purposes described.

703.—L. O. Fairbanks, of Nashua, N. H., for an Improved Bevel Attachment for Bench Planes:

I claim the attaching of an adjustable guide to the stocks of bench planes, substantially in the manner and for the purpose set forth.

704.—Thaddeus Fowler, of Seymour, Conn., for an Improved Device for Coating Pins:

I claim the method specified of separating pins and other articles, so soon as thoroughly covered with the coating metal, by the use of a series of riddles, wires or rods to which a vibration or motion is communicated, to produce a series of blows or concussions upon the articles as they fall from the successive riddles, wires or rods, and thereby ensure the entire separation of the articles while the coating metal is in a melted state, as set forth.

705.—L. F. Frazee, of Tottenville, N. Y., for an Improvement in Ash-sifters:

I claim the arrangement of the sieve, 6, box, 7, frame, 9, links, 10 10, and supporting pivots, 11 11 13 13, in the manner described, the fixed point of support for the links being below the points or pivots which connect them to the sieve frame, substantially as and for the purpose set forth.

706.—Charles Gardner, of Hoosick, N. Y., for an Improvement in Cultivators:

I claim the parallel bars, A A, jointed handle brace, D, wings, F, provided with sliding or extension plates, G, and the V-shaped cross pieces, B B, all combined and arranged for joint operation, as and for the purpose set forth.

[The object of this invention is to obtain a machine of simple construction, which will admit of being adjusted laterally for the purpose of placing its shares at a greater or less distance apart, as may be required, and a machine which will admit of being drawn over the rows of plants without injuring the same.]

707.—W. E. Gaunt and B. B. Hinman, of Keokuk, Iowa, for an Improvement in Grain Separators:

I claim the arrangement and use of the adjustable screen, E, in combination with the adjustable sieve, B, and stationary screen, G, when arranged and operating substantially as set forth.

708.—Loure Green, of Great Bend, Pa., for an Improvement in Plows:

I claim the combination and arrangement of the share, N, landside, L, standard, S, moldboard, P, friction rollers, R R R, and box plate, H', the whole constructed as and for the purpose described.

709.—E. J. Hale, of Foxcroft, Maine, for an Improvement in Lanterns:

I claim the foraminous conical cap, r, made with its holes, in conical frusta, a nged so as to project from the other surface of the cap, as described, in combination with the coal oil lamp, its chimney and the lantern case, arranged together substantially as described.

I also claim the application of the parts, o l, to and their arrangement with the chimney supporter, n, when separate from and supported by the deflector supporter, substantially as described.

710.—James Hale and J. S. Atterbury, of Pittsburgh, Pa., for an Improvement in Lanterns:

We claim (for use with a lantern and lamp, constructed substantially as described,) a lantern glass with an outer flange, I, blown or formed round its base, in combination with a horizontal extension or flange, F, of the burner cap, E, substantially as set forth.

711.—William Hamilton, of St. Catharine, Mo., for an Improved Churn:

I claim the use of reticulated dasher cylinder or inner case, so perforated as that a constant communication is established through the meshes of the inner cylinder between the inner and outer cylinders both above and below the dasher in the double movement of the latter, essentially as set forth.

712.—S. T. Harvey, of Baltimore, Md., for an Improvement in Stoves:

I claim the combination of the water chamber, air chamber, stove and register, when the several parts are constructed and arranged in the manner and for the purposes specified.

713.—Alexander Hay, of Philadelphia, Pa., for an Improvement in Railroads:

I claim the construction of street railroads by using the paved surface of the street as the bed of the railroad, and interposing between the pavement and the broad flanges of the rails a plank or line of planking, or other material having more elasticity than the pavement or the iron rail, and thus avoid the digging up of the street, substantially as described.

I also claim, in combination with the street rails that are pported upon timber, plank or other elastic material laid upon the paved surface of the street, the stre gthening of the joints of the rails by one or more tongues which slip into and are caught and held in one or more folds or loops formed in the end of the adjacent rail, and without the use of keys, bolts, rivets, or any other fastening than that afforded by the shape of the ends of the rails themselves, as described.

714.—Luther Humiston, of New Haven, Conn., for an Improved Mode of Attaching Traces to Whiffletrees:

I claim the use of the socket, A, with its projecting stud, B, and hook or cock-eye, C, in combination with the elbow-shaded lever, D, when the whole is constructed and fitted for use, substantially as described.

715.—E. L. Jinnett, of Vermillion county, Ill., for an Improvement in Beehives:

I claim the combination and arrangement of the beehive, constructed substantially as described, with a moth hive and trap beneath attached, provided with the devices described, or their equivalents, of similar construction.

I further claim the glass tube, B, attached to the bee hive, arranged in the manner and for the purposes described,

716.—E. D. Kendall, of New York City, for an Improved Apparatus for Naphthalizing Gas:

I claim the combination of the reservoir, E, cylinders, B and D, or their equivalents, wick, h, and slide, E, the whole applied, substantially as described, in relation to each other and to the inlet, a, from the supply or service pipe, and the outlet, b, to the burner or burners, substantially as and for the purpose specified.

717.—John Leavens, of Brooklyn, N. Y., for an Improved Pressure Gage:

I claim supporting the spring, D, and lever, E, within the indicating ring, B, between the upper point of the valve, C, and the adjuster, b, when all of said parts are mounted upon the steampipe, A, and otherwise constructed, as shown and described, for the purposes set forth.

718.—J. J. E. Lenoir, of Paris, France, for an Improved Air Engine:

I claim the arrangement in an air engine, substantially as described, of the parts for the admission to the cylinder successively of air and inflammable vapor or gas in such requisite quantities and proportions as that the former shall act upon the piston by expansion on being heated by the ignition of the latter, as described, in combination with a device for igniting said vapor or gas by electricity at each end of the cylinder, essentially as set forth.

719.—Jacob Lighter, of Clay Village, Ky., for an Improvement in Medical Compounds to Cure Hog Cholera:

I claim the use of the compound described to be administered to to swine for the cure of the disease known as hog cholera.

720.—S. H. Lyon and W. E. Doubleday, of Brooklyn, N. Y., for an Improvement in Bonnets:

We claim, as a new article of manufacture, the bonnet or hat formed of cotton cloth known as pique, or marseilles, upon buckram or stiffening material and pressed into form between heated dies, as set forth.

721.—John Markel, of Monticelli, Ill., for an Improvement in Cultivators:

I claim, first, The combination of devices, G b H h I, for permanently or temporarily adjusting the working width of the cultivator shovels, constructed, operated and operating in the manner substantially as set forth.

Second, In combination with the above, the reversible dished wheels, C, as fully described for the purpose set forth.

722.—Ferdinand Martin, of Marseilles, France, for an Improved Anchor. Patented in England Aug. 27, 1859:

I claim, as an improved article of manufacture, an anchor provided with a curved steadying bar sword-shaped flukes, grappling head or third fluke, and otherwise constructed as shown and described.

723.—J. F. McClure, of Boston, Mass., for an Improved Hair Brush:

I claim the perforated plate, C, or its equivalent, applied to a brush, substantially as and for the purpose specified.

724.—J. H. Sears, of Boston, Mass., and Benjamin Merritt, of Chelsea, Mass., for an Improvement in Brick Elevators:

We claim the combination of the swivelling hods, G, latch, m, and pins, 7, with the endless chain, D, the whole arranged and operating as described, for the purpose set forth.

We also claim the arrangement of the pins, 5 and 7, in triangular positions, for the purpose of giving the greatest amount of lateral throw to the hod, G, as and for the purpose described.

725.—Christopher Meyer, of New Brunswick, N. Y., for an Improvement in Methods of Applying Caoutchouc to Cloths, &c.:

I claim causing cloth or other fibrous material and india-rubber, or gutta-percha, to adhere in any desirable forms by means of plain pressure rollers and loose patterns, substantially in the manner set forth.

726.—Christopher Meyer, of New Brunswick, N. J., for an Improvement in India-rubber Shoes:

I claim, as a new article of manufacture, consisting of a shoe having a rubber sole and its upper composed of cloth, felt, or other equivalent substance, coated with rubber near the sole and also at its binding edge, substantially in the manner shown, but being elsewhere permeable to moisture, the whole being construeted substantially as set forth.

727.—Samuel Miller, of Winchester, Ohio, for an Improvement in Harrows:

I claim the employment of pieces, A B C D and E, for operating conjointly, when constructed and arranged in the manner and for the purpose set forth.

728.—Roswell Northrop, of New Millford, Conn., for an Improvement in Machines for Felting Hat Bodies:

I claim the fluted cam roller, I, in combination with the rollers, J J, for the purposes set forth.

729.—J. H. Noyes, of Abington, Mass., for an Improved Last for Boots and Shoes:

In a last formed in two parts by cutting it transversely at or near the shank, I claim the dovetailed groove and tenon joint, as described, in combination with the slotted sliding plate and set screws on the one section and the lip fixed upon the other section of the last, the whole being constructed and arranged so as to operate substantially in the manner set forth, whereby, while the parts may be disunited at pleasure, all lateral play is prevented when united.

730.—B. M. Nyce, of Kingston, Ind., for an Improvement in Buildings for Preserving Fruit:

I claim, first, The construction of a preserving house whose lower chamber, to contain provisions, is separated from its upper or ice chamber by an air-tight metallic floor, M, supported on metallic joists, L, whose upper surfaces consist of a series of thin edges or points, substantially as and for the objects set forth.

Second, The cover, O P, consisting of a frame, O, which fits the interior of the ice reservoir, and is open at its center and supports the skirts of an impervious and flexible diaphragm, P, as and for the objects explained.

Third, The described combination of the insulated cooled and dried vestibule, W, furnished, as described, with the main preserving chamber, all constructed as set forth.

Fourth, In combination with the chambers for preserving fruit, as described, I claim the use of inclined desiccating troughs, U, and hygrometer attachment, 3, 4, 5, 6, 7, substantially as set forth.

731.—J. S. Palmer, of Providence, R. I., for an Improvement in Constructing Bracelets, &c.:

I claim the combination of the lips, e e, of the foundation plate with the ornamental metal plates, or their equivalent, constructed in the manner substantially as described, for the purpose specified.

732.—Enoch Piper, of Camden, Maine, for an Improvement in the Method of Preserving Fish:

I claim preserving fish or other articles in a close chamber, by means of a freezing mixture, having no contact with the atmosphere of the preserving chamber, substantially as set forth.

733.—Daniel Pohlmann, of Baltimore, Md., for an Improvement in Railroad Safety Brakes:

I claim the shoe frames, B, in combination with the sliding rod, c, having supporting projections, d d′, and truck frames, A, the whole constructed, arranged and operating substantially as and for the purposes set forth.

734.—W. F. Quinby, of Stanton, Del., for an Improvement in Cultivators:

I claim the employment of two or more rotary cylinders, A D′, armed with suitable teeth secured to their peripheries, and so combined that the revolution of the foremost cylinder shall give a greater relative speed to the rear cylinder or cylinders, said cylinders having their bearings in a suitable frame which is mounted in a carriage consisting of frame, E E, wheels, F F, jointed frame, H H, and front wheel, I, cords or chains, J J, pulleys, m m, and roller, G, or their equivalents, all combined and operating substantially as and for the purposes set forth.

[The nature of this invention consists in combining two or more cylinders or rollers, of a suitable size, by cogs, belts or chains, in such a manner that the revolution of the foremost cylinder shall give a greater relative speed to the rear cylinder or cylinders; and, in arranging the peripheries of said cylinders, a suitable number of spurs, spikes, knives or cutting teeth, of any desired description, said cylinders being so arranged within a framework, which is mounted on a jointed carriage frame, that the driving cylinder can be raised or depressed at pleasure, and the teeth on this cylinder withdrawn entirely or partially from the ground.]

735.—James Reed, of Newville, Ohio, for an Improvement in Water Wheels:

I claim, first, A plano-convex spiral bucket for water wheels, as set forth and substantially as described.

Second, I claim a bucket for water wheels, of the character above stated, in combination with a circular chamber, for the purpose set forth and substantially as described.

736.—G. N. Relyea, of Veteran, N. Y., and John Relyea, of Horse Heads, N. Y., for an Improvement in Straw Cutters:

We claim, first, The peculiarly-shaped cutters, C C, pointed and cutting with both edges, arranged and operated substantially as set forth.

Second, In combination with the lever, G, constructed and operated as described, the pawls and racks, I I′, and pinions, P, for operating the feed rollers, substantially in the manner set forth.

Third, In combination with a straw-cutting machine, constructed as described, the shaft, B, arm, H, lever, G, and lever, A, arranged for conjoint operation, as specified.

737.—Wm. C. Reutgen, of Keokuk, Iowa, for an Improvement in Hand Trucks:

I claim the arrangement of auxilliary wheels, b b, in the rear ends of the truck frame, relatively to the main wheels, B B, and the curved adjustable holding and stop bar, D, substantially as and for the purposes set forth.

738.—Wm. S. Riggs, of Hightstown, N. J., for an Improvement in Cultivators:

I claim the arrangement, substantially as set forth, of the standards, B B′, and shares, a a, and frame, A, the whole operating as and for the purposes set forth and described.

739.—J. R. Robinson, of Boston, Mass., for an Improvement in Steam Boiler Furnaces:

I claim the construction and arrangement of the gas-mixing chamber, D, directly over the fire chamber, with openings, e e, at the sides thereof, substantially as described.

And I further claim, in combination with the so constructed and arranged gas-mixing chamber and its side openings, e e, the opening, g, at the crown of the arch, E, or its equivalent, communicating with the highest part of the fire chamber, and fitted with a valve or damper, h, substantially as and for the purpose specified.

740.—T. J. R. Robinson, of Boston, Mass., for an Improvement in Dampers for Multitubular Steam Boilers:

I claim the damper constructed of one or more parts hinged together, and arranged relatively to the tubes of the boiler substantially as described, and combined by such a system of connections as will make the lower parts capable of opening before or independently of the upper ones, substantially as and for the purpose described.

741.—E. P. Russell, of Manlius, N. Y., for an Improvement in Fingers for Harvesters:

I claim the combination of the elastic steel face plate, c, with the concave face of the finger, A, by means of the cap, B, and the single bolt or screw, c, whereby said plate is drawn down upon the finger in the manner described, for the purposes set forth.

742.—J. A. Safford, of Boston, Mass., for an Improved Machine for Splitting Leather. Ante-dated Nov. 19, 1860:

I claim combining with the gage roll, J, whose ends are simultaneously adjusted by one operation, a feed roll, G, so mounted on springs, d, that either end may be depressed to a distance sufficient to compensate for such inequalities in the leather being skived as are not sufficient to choke the machine, when such arrangement is combined with a rod, L, or its equivalent, connecting links, M, and treadle, N, for the purpose of depressing both ends of the feed roll simultaneously to free the machine when choked, the whole being arranged, constructed and operated in the manner substantially as described.

743.—Suspended.

744.—J. H. Simonds, of New York City, for an Improved Hot Air Register:

I claim having the open face plate, B, of a hot air or venti-duct register, of curved or arched form, so as to project outward from the duct, C, and form a space or chamber, d, which, in connection with box, A, serves to admit of the operating of the slats or valves, without interfering with or obstructing the duct, as set forth.

[The object of this invention is to obtain a register which may be economically constructed, readily adjusted, and one that will not be liable to get out of repair or rendered inoperative by use.]

745.—D. W. Smith, of Dooly county, Ga., for an Improvement in Plows:

I claim the adjustable standard and brace, B C, connected together, and arranged in relation with and attached to the beam, A, as shown, in connection with the landside, E, block, H, and adjustable arm, F, all arranged for joint operation substantially as and for the purposes set forth.

[The object of this invention is to obtain a plow of simple construction, which will admit of being readily adjusted to plow a furrow of greater or less depth, as may be required, and also admit of being readily manipulated or managed by the attendant, and be of light or easy draft.]

746.—Richard Solis, of New Brunswick, N. J., for an Improved Fastening for Gaiter Shoes:

I claim the gaiter fastening, composed of the pivoted plates, b b′, and spring latch, g g′, when constructed, applied and operating together, and with the gaiter, A, in the manner shown and described.

747.—M. B. Stafford, of New York City, for an Improvement in Stoves:

I claim the construction of the jacket in two parts, one of which, H, is perforated so as to form a protractor and radiating chamber, while the other part, E, forms a hot air chamber, when the said parts are arranged together, and the stove and air chamber, and the whole is made in the manner shown and described.

748.—I. A. Stafford, of Essex, N. Y., for an Improvement in Seeding Machines:

I claim the arrangement and combination of the hopper, G, the vibrating rack, g, the sliding bottom, h, and the distributing box, H, substantially in the manner as specified and for the purposes set forth.

749.—Frederick Stamm, of Lancaster, Pa., for an Improvement in Cultivators:

I claim the arrangement of the draft beam, B, side beam, A, stays, D, hinge, C, and curved shovel, E, with its head, Z, the whole being constructed, operated and operating in the manner and for the purpose set forth.

750.—C. W. Taylor, of Pittsburgh, Pa., for an Improvement in Alarm Trunks:

I claim the clock alarm, in combination with the lever, F, board, G′, rod, f, spring, h, and rod, J, the whole being constructed and operated substantially in the manner and for the purpose set forth.

[This invention consists in arranging, in a suitable place on the inside of the lid of a trunk, an ordinary clock alarm, having a bell which will give a full, loud sound, and in so combining with the hammer rod of the alarm a sliding rod and spring that when the wheel work of the alarm is wound up, the hammer rod will be prevented from operating unless the trunk or the lid thereof is raised.]

751.—Horace Tupper, of Ruffalo, N. Y., for an Improvement in Boxes for Railroad Cars, &c.:

I claim, first, Constructing the upper portions of the box, A, with openings, C C C′, with inclined sides, D D, windows, K K, and revolving transparent partitioned wheel, E, arranged as and for the purpose specified.

Second, In combination with the partitioned wheel, E, I claim the drawer, G, the same being used substantially as and for the purpose set forth.

752.—M. D. Wells, of Morgantown, Va., for an Improved Churn Dasher:

I claim the oblique box dasher, D, construc d and operating substantially as set forth, that is to say, with two flat sides, two curved sides, and two open sides, and turned in the same direction for churning and for gathering the butter, but at variable velocities, as mentioned.

753.—C. H. Wilcox, of New York City, for an Improvement in Sewing Machine Needles:

I claim a sewing machine needle, the same forming a new article of manufacture, having combined with its round shank a slot or groove, substantially as and for the purpose or purposes set forth.

754.—P. G. Woodard, of Waterford, Pa., for an Improved Butter-worker:

I claim the combination and arrangement of the fluted roller, E, and the butter board or table, H, provided with sides or projections, p p, so as to produce an automatic shifting of the roller upon the butter at every turn of its movement, substantially as and for the purpose specified.

I also claim the adjustable head blocks, B B B B, arranged and operating, in connection with the other parts of the machine, so as to adjust the roller, E, to any desired hight above the butter board or table, H, substantially as set forth.

755.—William Woodbury, of Gloucester, Mass., for an Improved Spring Tackle for the Sheets of Fore-and-aft Rigged Vessels:

I claim the springs, b, in combination with the traveler, C, and sheet, E, operating substantially as described, for the purpose specified.

756.—A. S. Adams, of Chelsea, Mass., assignor to himself and Jos. Watson, of Brooklyn, N. Y., for an Improvement in Printing Presses:

I claim, first, The dog, h, on the tympan, and stationary cam, i, for the purpose of automatically depressing the tympan before it reaches the impression roll, whereby the tympan can be operated on by said roll, when the former comes under from either direction, as described.

Second, I claim the combination of the spring, r, with the picket, T, and tympan, K, the whole arranged and operating as specified, for the purpose set forth.

Third, I claim the inking roll, R, carried by the bent or U-shaped bar, M, substantially as described.

757.—G. W. Depew (assignor to Horton, Depew & Sons), of Peekskill, N. Y., for an Improvement in Plows:

I claim a clevis, B, provided with arms, h h, which have pins, i i, projecting therefrom, in connection with a plow beam, A, having flanches, a a, at its upper and lower edges, and provided with an inclined front end, a′, and notches, e e, all arranged as and for the purpose set forth.

[The object of this invention is to obtain a clevis that may be very readily adjusted on the end of the plow beam, so that the plow may have more or less pitch, to plow deep or shallow, as may be required, and the draft attachment permitted to be so connected to the clevis as to give the plow more or less land, as desired; the clevis, at the same time, being attached or connected to the plow beam in such a manner as to preclude the possibility of its casual detachment.]

758.—W. H. Hope, of Washington, D. C., assignor to T. B. Florence, of Philadelphia, Pa., for an Improvement in Machines for Sweeping Streets:

I claim, first, The arrangement of a cylindrical brush in street sweepers, revolving in a metallic or other adjustable casing, as described, whereby dirt and other substances are gathered without any other mode of conveyance, into the box or body of the machine, as set forth and described.

Second, The arrangement of lever, L, in combination with the bar R, connecting rods, r r, and axle, A, which are attached to box or body b, for the purpose of ungearing brush, B, as set forth and described.

759.—F. Huckins and E. C. R. Walker (assignors to Francis Huckins), of Roxbury, Mass., for an Improvement in Apparatuses for Desiccating and Torrefying Farinaceous Substances:

We claim the emplo ment, in connection with the arms, F, and retort, C, of the self-adjusting or spring scrapers, j, constructed and operating as shown and described.

760.—Lewis Miller (assignor to C. Aultman & Co.), of Canton, Ohio, for an Improved Gearing for Threshing Machines:

I claim supporting the shaft of a threshing cylinder in bearings arranged outside of, and beyond the main frame of the machine, when used in connection with driving gearing placed between said bearings and the main frame, for the purpose of using small journals and applying the power that is to drive the threshing mechanism, to the heavier and stronger part of the shaft, substantially as and for the purpose set forth.

761.—A. M. Millochau, of New York City, assignor to Henry Levrat, for an Improvement in Methods of Extracting Oil from Fish:

I claim the described process substantially of obtaining oil directly from fish by means of a bath of dilute sulphuric acid, and without forcible separation by pressing.

762.—J. L. Rowe (assignor to himself and T. Rudderforth) of New York City, for an Improved Ice Crusher:

I claim the adjustable side, d, grooved vertically as specified, in combination with the roller, a, to crack and break ice in the manner specified.

763.—Albion Ransom and R. D. Granger (assignors to S. H. Ransom & Co.), of Albany, N. Y., for an Improvement in Tea Kettles:

We claim connecting the lid or cover to the breast of the kettle by studs or projections constructed substantially as described, whereby the lid will be held to the body at all times and be in the erect or nearly erect position when thrown up or out, and the bail be held off from the breast of the kettle, as recited.

764.—W. H. Sullenberger (assignor to himself, Henry Sierer and John Tolbert), of Chambersburgh, Pa., for an Improved Method of Hanging Band Saws:

I claim the employment in the manner substantially as shown and described, of a spring balance, f, to strain the saw; as the saw expands by heating, the straining pressure of the spring will decrease, all as set forth.

The particular arrangement of the joint frame, D D′, and arm, b, and slide, A2, with the oscillating adjusting screw, J, in the manner and for the purposes shown and described.

The construction of the guide wheel, I, with separately-adjustable flanges and shanks and intermediate washer, substantially in the manner and for the purposes shown and described.

The arrangement of the peculiarly-constructed guide wheel, I, with the saw, K, and adjustable slotted arm, H′, in the manner and for the purpose shown and described.

[This invention and improvement in saws known as "belt saws" relates to a novel manner of hanging the saw, so as to compensate for its expansion and contraction under different degrees of temperature, and thus to keep up a proper degree of tension on the saw for driving it through its work with ease, whether the saw be cool or heated. The invention also relates to a novel manner of hanging the upper belt wheel, in combination with a movable slide in the table, whereby the saw may be adjusted and set to saw any irregular or straight bevel. It also relates to a novel means for preventing injury to the saw teeth in consequence of their running on the peripheries of belt wheels. It further relates to the application of a yielding, gutta-percha slieve to the toothed edge of the saw, under the table, for the purpose of preventing the saw from being worked off the belt wheels when the work is drawn backward from the saw. It also relates to a novel guide wheel which prevents the saw from twisting and serves as a back rest for the saw in sawing, and which is so constructed that it can be wel adapted to saws of different widths.]

RE-ISSUES.

46.—Henry Hewitt, of San Francisco, Cal., assignor to W. A. Sanford, of Potsdam, N. Y., for an Improvement in Seeding Harrows. Patented March 27, 1860:

I claim the arrangement of the sowing apparatus and the cylindrical harrow described—all the various parts being constructed for operation conjointly, in the manner and for the purposes described.

47.—Bernard Hufnagel, of New York City, for an Improvement in Photographic Bath. Patented October 5, 1858. Re-issued Nov. 13, 1860:

I claim, first, the arrangement and use of a frame or box of wood or any other suitable material, to hold together and support two plates of glass with packing between, for the purpose of forming a silver bath for photographic and ambrotype use.

Second, I claim the application and use of india-rubber packing between the two plates of glass, for the purpose of making a tight joint between the plates at the sides and bottom as well as to protect the framework from the action of the solution.

Third, I claim the construction of the outer box or case, and the manner of fastening the same together by the screws, S, for the purpose and in the manner set forth.

Fourth, I claim the arrangement and use of doors or panels, D D', on opposite sides of the outer box or casing for the purpose substantially as described.

48.—C. C. Lloyd, of Philadelphia, Pa., for an Improvement in Gas Meters. Patented June 20, 1854:

I claim the application and mode of operation described, when the double purpose is effected of equalizing and regulating the pressure of gas within the meter and of shutting off the gas when the water gets too low, by combining the valve with one and the same float, all within the meter, substantially as and for the purposes set forth.

I also claim the float, K, in combination with any suitable inlet valve, when the said float operates in a chamber, L, so placed in the front of the meter as to be isolated from the inlet pressure, and the said chamber being so situated or so constructed that its interior may communicate with the inlet pressure at a point between the water line and the top of the center opening of the drum, when the water gets too low, as set forth.

49.—Elias Howe, Jr., of Brooklyn, N. Y., for an Improvemeet in Sewing Machines. Patented Sept. 10, 1846, and Extended:

I claim, first, A sewing machine constructed and operating to form a seam substantially as described.

Second, The combination of a needle and a shuttle, or equivalent, and holding surfaces, constructed and operating substantially as described.

Third, The combination of holding surfaces with a baster plate, or equivalent, constructed and operating substantially as described.

Fourth, A lifting rod, a clipping lever, and a receiving pin, respectively, each constructed and operated to control the threads, substantially as described.

Fifth, A baster plate constructed and operating substantially as described.

Sixth, Holding surfaces constructed and operating substantially as described.

Seventh, A grooved and eye-pointed needle constructed and adapted for rapid machine sewing, substantially as described.

Eighth, A side-pointed shuttle constructed and operating substantially as described.

50.—Cæsar Neumann, of New York City, for an Improved Machine for Making Hooped Skirts. Patented Aug. 16, 1859:

I claim the combination of a series of twisting apparatus for the purpose of forming a hoop skirt, substantially as and for the purposes set forth.

I also claim, in combination with the twisting apparatus, the elevating screw and its appendages, and the mode of operating the same, as described.

I also claim the guide rod, i, for guiding the twisting apparatus and determining the size and shape of the skirt, as set forth.

I also claim collapsing the guides to form different-sized skirts and to deliver the same, as specified.

I also claim moving the guides up and down, to determine the position of the twisting apparatus.

I also claim simultaneously twisting a series of cords for the purpose of forming a hoop skirt, substantially as described.

EXTENSION.

Charles Wilson, of Springfield, Mass., for an Improvement in Cutting Stone. Patented March 13, 1847. Re-issued March 4, 1851:

I claim the method substantially as described, of dressing, facing or reducing stone and other like materials by means of a rolling edge or edges acting against the face or surface of the material to be worked, substantially as described.

DESIGNS.

E. C. Brewster, of Bristol, Conn., for a Design for a Clock Case.

James Horton and John Martino (assignors to D. Stuart and R. Peterson), of Philadelphia, Pa., for a Design for Stoves.

Elias Ingraham, of Bristol, Conn., for a Design for a Clock Case Front.

E. J. Ney, of Lowell, Mass., assignor to the Lowell Manufacturing Company, for a Design for Carpets.

Notes & Queries

S. C. C., of Iowa.—We have covers only for the new series. It would do better to employ a bookbinder to put on the covers, as he could do it better than a green hand.

D. G. BARNARD, of Winslow, Camden county, N. J., wishes to correspond with manufacturers of threshing machines and cleaners combined.

J. O. C., of N. Y.—We cannot answer your inquiries about Russia. We would recommend you to correspond with the Russian Minister resident at Washington. Doubtless he would cheerfully give you all the information you seek.

J. K., of N. Y.—Your plan of escaping from burning buildings by breaking through the back of a fireplace into the adjoining house, we apprehend would take too much time. The suggestion to take a towel in the hands in grasping a rope is a good one.

R. B. P., of Conn.—We know no reason why you should not get a good draft by carrying a horizontal flue from your furnaces to the tall chimney 160 feet distant.

M. C., of Ohio.—Your plan for preventing the counterfeiting of bank notes, by having an impression of the president's hand on each note, would not be effectual. Engravers would find no difficulty in reproducing the meshwork of lines in the palm of a man's hand.

J. T., of Ky.—The power that forces the water up one limb of a siphon is the weight of the air resting on the external surface of the water; and as a column of the atmosphere is equal in weight to a column of water only about 32 feet high, a siphon will not operate if it exceeds this hight. The falling water in the discharging limb merely removes the pressure of air from the surface of the water in the long limb, and your pump would perform the same service, but the water would rise only 32 feet above the level of the water in the river.

L. M. R. B., of S. C.—We suspect that the softness or hardness of rifle barrels has nothing more to do with accurate shooting than in obtaining a close, smooth surface, and a true bore. A series of accurate experiments is wanted to throw light on this subject.

A. S., of Mass.—You desire to obain a waterproof cement which will be equally good above as under water, or, in other words, one which possesses the double property of a dry and a wet cement. We do not know where you can obtain such, but some of our readers may be able to supply the information. Asphalt mixed with air-slacked lime, and applied hot, we believe would answer your purpose. This cement, however, would only answer when laid upon the top of concrete made with hydraulic cement, and it may therefore be rather expensive for common use, as making dams, &c.

F. P., of N. Y.—On page 387, Vol. II, present series of the SCIENTIFIC AMERICAN, you will find subterranean railroads for New York advocated. They were proposed about fourteen years ago, and the mode of construction then described has been before the public several times.

E. A. H., of Ill.—Your arrangement of the plates, and mode of working Daniels' battery, are new to us, and we believe are patentable. You can determine by experiment how much more economical it is than the common battery. We cannot give you the information required respecting Vergne's electro-magnetic engine. We have seen no lamp for burning coal oil without a chimney, which could compare with a chimney lamp for giving a bright light. The burner to which you refer is very expensive.

N. C., of N. Y.—We should really like to know how to render aniline colors proof against the action of solar light. The discovery to which you refer, should it accomplish this object, is one of vast importance to dyers.

J. J. D., of Pa.—We prefer a priming of oil for hand railing to glue or any kind of sizing. If you employ any varnish at all for outside work, clear copal is the best, because it contains so much linseed oil.

D. B. A., of N. Y.—It is generally believed that it becomes perceptibly darker just before daybreak, but so far as our observation has extended, we have come to the conclusion that the idea is erroneous. It is just the same as regards the common opinion that a saw mill runs faster during the night than in the daytime. On page 207, Vol. II, present series of our journal, you will find an account of a series of experiments made to test this question, in which it was demonstrated that there was a slight difference in favor of wheels running during the day.

W. S. C., of Pa.—We are not acquainted with any method of making lead adhere to iron, without first giving the latter a coating of tin. Lead forms an alloy with tin in various proportions, but not a true alloy with iron, so far as we know. By washing the surface of clean cast iron with a solution of the stannate of soda, and then dipping it into molten lead, the latter may be made to adhere tenaciously to the iron. We suggest this to you as an experiment, as we have not tried it ourselves.

M. M. G., of Maine.—We know of no process for hardening leather so that it will be suitable for pickers. As it would be more expensive than raw hide, what would be the advantage?

A. H., of Ill.—Telegraph cables, in some instances, have been laid back and forth in 8-form, to prevent them from twisting while being paid out.

S. D., of Ohio.—It is impossible to determine positively what the mineral is which you send us, without tests, which will cost money. A larger specimen, too, would be required.

J. M. B., of Mo.—By steeping old files for about one hour in a mixture of one pint of vitriol to six of water, then washing them well in hot water, they will be "restored," but not to equal recut files. We do not know whether the process pays for the trouble, as the burs of the files thus made sharp soon become dull.

L. J. O., of Wis.—A mixture of red and white lead is better than either one of those substances singly for making steam joints. The red lead furnishes oxygen to the white, and hardens it.

Money Received

At the Scientific American Office on account of Patent Office business, for the week ending Saturday, March 23, 1861:—

P. & B., of N. Y., $10; D. R. P., of N. Y., $100; J. S., Ohio, $30; M. L. B., of N. Y., $10; I. J. F., of Mass., $15; J. K. H., of Ind., $30; D. K., of Mich., $30; W. R., of Cal., $30; G. W. R., of Ill., $55; T. & G., of Mich., $30; R. W. & D. D., of N. Y., $40; J. G., of Mass., $5; B. S., of N. Y., $15; J. J. H., of Ky., $55; S. F., of Ohio, $15; G. & C. B., of Conn., $10; W. D. B., of Mass., $15; G. S. R., of Vt., $30; B. C., of Pa., $10; F. H., of N. Y., $15; G. W. R., of N. Y., $45; J. T., of Conn., $15; C. & B., of Mass., $30; H. L. B., of Conn., $15; J. McD., of N. Y., $30; P. D. B., of Mich., $30; W. N. M., of Mass., $10; G. W. S., of Maine, $10; J. D., of Ill., $50; J. A. R., of Pa., $5; J. M. W., of N. Y., $15; J. A. W., of N. Y., $15; C. & P., of Ill., $30; W. & H., of Ohio, $15; J. N. W., of Pa., $15; E. S. H., of Mass., $10; J. T. W., of N. Y., $15; J. H., of N. Y., $10; C. B., of Ohio, $25; H. S., Jr., of N. Y., $135; L. S. B., of N. Y., $15; E. D. S., of Conn., $20; C. M. J., of Ill., $30; H. A. H., of Mass., $15; A. H. C., of Wis., $25; W. F. B., of Ill., $10; S. & M. P., of Pa., $30; J. L., of Mass., $15; J. L., of N. Y., $100; C. J. E. T., of R. I., $15; G. W. D., of Ohio, $15; J. A., of Mich., $15; J. J. K., of Ill., $15; J. G. D., of Mich., $10; D. H., of Md., $25; L. H. A., of Mass., $25; W. C. & J. D., of N. Y., $15; F. W. L., of N. Y., $15; J. R. R., of Mass., $80; N. C. S., of Conn., $15; J. N. B. B., of N. Y., $40; E. L., of N. Y., $12; E. G. K., of N. Y., $15; P. P., of N. Y., $20; G. R. B., of Ill., $15; C. R., of Ill., $15; S. S. H., of Maine, $15.

Specifications, drawings and models belonging to parties with the following initials have been forwarded to the Patent Office during the week ending March 23, 1861:—

[The patents on these cases, when issued, will be granted for seventeen years under the new Patent Law.]

L. A. B., of N. Y.; B. C., of Pa.; M. L. B., of N. Y.; G. & C. B., of Conn.; G. S. R., of Vt.; C. & D., of N. J.; A. A. C., of Wis.; G. W. S., of Maine; W. N. M., of Mass.; J. D., of Ill. (2 cases); W. F. B., of Ill.; C. B., of Ohio; J. R., of N. Y.; F. C., of N. Y.; C. M., of N. Y.; L. H. A., of Mass.; J. G. D., of Mich.; D. H., of Md.; G. L. T., of N. Y.; E. L., of N. Y.; J. N. B. B., of N. Y.; C. C., of Pa.; E. D. S., of Conn.; A. R., of Va.; O. P. C., of Maine.

New Books and Periodicals Received.

THE ATLANTIC MONTHLY. Published by Ticknor & Felds, Boston.

The April number has the conclusion of the "Professor's Story." It is very inferior to the other series of articles by Holmes.

Important Hints to Our Readers.

BACK NUMBERS AND VOLUMES OF THE SCIENTIFIC AMERICAN.—Volumes I., II. and III. (bound or unbound) may be had at this office and from all periodical dealers. Price, bound, $1.50 per volume by mail, $2—which includes postage. Price in sheets, $1. Every mechanic, inventor or artisan in the United States should have a complete set of this publication for reference. Subscribers should not fail to preserve their numbers for binding.

PATENT CLAIMS.—Persons desiring the claim of any invention which has been patented within thirty years, can obtain a copy by addressing a note to this office, stating the name of the patentee and date of patent, when known, and inclosing $1 as fee for copying. We can also furnish a sketch of any patented machine issued since 1853, to accompany the claim, on receipt of $2. Address MUNN & CO., Patent Solicitors, No. 37 Park Row, New York.

BINDING.—We are prepared to bind volumes, in handsome covers, with illuminated sides, and to furnish covers for other binders. Price for binding, 50 cents. Price for covers, by mail, 50 cents; by express or delivered at the office, 40 cents.

RATES OF ADVERTISING.

Thirty Cents per line for each and every insertion, payable in advance. To enable all to understand how to calculate the amount they must send when they wish advertisements published, we will explain that ten words average one line. Engravings will not be admitted into our advertising columns; and, as heretofore, the publishers reserve to themselves the right to reject any advertisement sent for publication.

CHANGE IN THE PATENT LAWS.

NEW ARRANGEMENTS—PATENTS GRANTED FOR SEVENTEEN YEARS.

The new Patent Laws, recently enacted by Congress, are now in full force, and promise to be of great benefit to all parties who are concerned in new inventions.

The duration of patents granted under the new act is prolonged to SEVENTEEN years, and the government fee required on filing an application for a patent is reduced from **$30** down to **$15**. Other changes in the fees are also made as follows:—

On filing each Caveat	$10
On filing each application for a Patent, except for a design	$15
On issuing each original Patent	$20
On appeal to Commissioner of Patents	$20
On application for Re-issue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing Disclaimer	$10
On filing application for Design, three and a half years	$10
On filing application for Design, seven years	$15
On filing application for Design, fourteen years	$30

The law abolishes discrimination in fees required of foreigners, except in reference to such countries as discriminate against citizens of the United States—thus allowing English, French, Belgian, Austrian, Russian, Spanish, and all other foreigners except the Canadians, to enjoy all the privileges of our patent system (except in cases of designs) on the above terms.

During the last sixteen years, the business of procuring Patents for new inventions in the United States and all foreign countries has been conducted by Messrs. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN; and as an evidence of the confidence reposed in our Agency by the Inventors throughout the country, we would state that we have acted as agents for more than FIFTEEN THOUSAND Inventors! In fact, the publishers of this paper have become identified with the whole brotherhood of Inventors and Patentees, at home and abroad. Thousands of Inventors for whom we have taken out Patents have addressed to us most flattering testimonials for the services we have rendered them, and the wealth which has inured to the Inventors whose Patents were secured through this Office, and afterward illustrated in the SCIENTIFIC AMERICAN, would amount to many millions of dollars! We would state that we never had a more efficient corps of Draughtsmen and Specification Writers than are employed at present in our extensive Offices, and we are prepared to attend to Patent business of all kinds, in the quickest time, and on the most liberal terms.

The Examination of Inventions.

Persons having conceived an idea which they think may be patentable, are advised to make a sketch or model of their invention, and submit it to us, with a full description, for advice. The points of novelty are carefully examined, and a reply written corresponding with the facts, free of charge. Address MUNN & CO., No. 37 Park-row, New York.

Preliminary Examinations at the Patent Office.

The advice we render gratuitously upon examining an invention does not extend to a search at the Patent Office, to see if a like invention has been presented there, but is an opinion based upon what knowledge we may acquire of a similar invention from the records in our Home Office. But for a fee of $5, accompanied with a model or drawing and description, we have a special search made at the United States Patent Office, and a report setting forth the prospects of obtaining a Patent, &c., made up and mailed to the Inventor, with a pamphlet, giving instructions for further proceedings. These preliminary examinations are made through our Branch Office, corner of F and Seventh-streets, Washington, by experienced and competent persons. Over 1,500 of these examinations were made last year through this Office, and as a measure of prudence and economy, we usually advise Inventors to have a preliminary examination made. Address MUNN & CO., No. 37 Park-row, New York.

Caveats.

Persons desiring to file a Caveat can have the papers prepared in the shortest time by sending a sketch and description of the invention. The government fee for a Caveat, under the new law, is $10. A pamphlet of advice regarding applications for Patents and Caveats furnished gratis on application by mail. Address MUNN & CO., No. 37 Park-row New York.

How to Make an Application for a Patent.

Every applicant for a Patent must furnish a model of his invention, if susceptible of one; or if the invention is a chemical production, he must furnish samples of the in redients of which his composition is composed, for the Patent Office. These should be securely packed, the Inventor's name marked on them, and sent, with the government fee, by express. The express charge should be prepaid. Small models from a distance can often be sent cheaper by mail. The safest way to remit money is by draft on New York, payable to the order of Munn & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents; but if not convenient to do so, there is but little risk in sending bank bills by mail, having the letter registered by the postmaster. Address MUNN & CO., No. 37 Park-row, New York.

Rejected Applications.

We are prepared to undertake the investigation and prosecution of rejected cases, on reasonable terms. The close proximity of our Washington Agency to the Patent Office affords us rare opportunities for the examination and comparison of references, models, drawings, documents, &c. Our success in the prosecution of rejected cases has been very great. The principal portion of our charge is generally left dependent upon the final result.

All persons having rejected cases which they desire to have prosecuted are invited to correspond with us on the subject, giving a brief history of their case, inclosing the official letters, &c.

Foreign Patents.

We are very extensively engaged in the preparation and securing of Patents in the various European countries. For the transaction of this business, we have offices at Nos. 66 Chancery-lane, London; 29 Boulevard St. Martin, Paris; and 26 Rue des Eperonniers, Brussels. We think we can safely say that THREE-FOURTHS of all the European Patents secured to American citizens are procured through our Agency.

Inventors will do well to bear in mind that the English law does not limit the issue of Patents to Inventors. Any one can take out a Patent there.

Circulars of information concerning the proper course to be pursued in obtaining Patents in foreign countries through our Agency, the requirements of different Patent Offices, &c., may be had gratis upon application at our principal office, No. 37 Park-row, New York, or either of our Branch Offices.

Interferences.

We offer our services to examine witnesses in cases of interference, to prepare arguments, and appear before the Commissioner of Patents or in the United States Court, as counsel in conducting interferences or appeals.

For further information, send for a copy of "*Hints to Inventors.*" Furnished free. Address MUNN & CO., No. 37 Park-row, New York.

The Validity of Patents.

Persons who are about purchasing Patent property, or Patentees who are about erecting extensive works for manufacturing under their Patents, should have their claims examined carefully by competent attorneys, to see if they are not likely to infringe some existing Patent, before making large investments. Written opinions on the validity of Patents, after careful examination into the facts, can be had for a reasonable remuneration. The price for such services is always settled upon in advance, after knowing the nature of the invention and being informed of the points on which an opinion is solicited. For further particulars, address MUNN & CO., No. 37 Park-row, New York.

Extension of Patents.

Valuable Patents are annually expiring which might be extended and bring fortunes to the households of many a poor Inventor or his family. We have had much experience in procuring the extension of Patents; and, as an evidence of our success in this department, we would state that, in all our immense practice, we have lost but *two* cases, and these were unsuccessful from causes entirely beyond our control.

It is important that extension cases should be managed by attorneys of the utmost skill to insure success. All documents connected with extensions require to be carefully drawn up, as any discrepancy or untruth exhibited in the papers is very liable to defeat the application.

Of all business connected with Patents, it is most important that extensions should be intrusted only to those who have had long experience, and understand the kind of evidence to be furnished the Patent Office, and the manner of presenting it. The heirs of a deceased Patentee may apply for an extension. Parties should arrange for an application for an extension at least six months before the expiration of the Patent.

For further information as to terms and mode of procedure in obtaining an extension, address MUNN & CO., No. 37 Park-row, New York.

Assignments of Patents.

The assignment of Patents, and agreements between Patentees and manufacturers, carefully prepared and placed upon the records at the Patent Office. Address MUNN & CO., at the Scientific American Patent Agency, No. 37 Park-row, New York.

It would require many columns to detail all the ways in which the Inventor or Patentee may be served at our offices. We cordially invite all who have anything to do with Patent property or inventions to call at our extensive offices, No. 37 Park-row, New York, where any questions regarding the rights of Patentees, will be cheerfully answered.

Communications and remittances by mail, and models by express (prepaid), should be addressed to MUNN & CO., No. 37 Park-row, New York.

Iron and Wooden Naval Vessels.

We take the following from the London *Mechanics' Magazine* :—

The first question for discussion is the comparative value of iron and wooden ships-of-war. In favor of the latter, we have a conservative party represented by Sir Howard Douglas, who is probably the ablest living advocate of "wooden walls." It is his opinion "that ships formed wholly, or nearly so, of iron, are utterly unfit for all the purposes and contingencies of war, whether as fighting ships or as transports for troops." In opposition to this opinion Mr. J. Scott Russell endeavors, and we think successfully, to establish:—

1. That iron steamships-of-war may be built as strong as wooden ships of greater weight, and stronger than wooden ships of equal weight.
2. That iron ships of equal strength can go on less draught of water than wooden ships.
3. That iron ships can carry much heavier weights than wooden ships.
4. That they are more durable.
5. That they are safer against the sea.
6. That they are safer against fire.
7. That they are much safer against explosive shells.
8. That they are much safer against molten metal.
9. That they are much safer against red-hot shot.
10. That they can be made impregnable even against solid shot.

As Sir H. Douglas has attacked the construction and sailing qualities of the *Great Eastern*, his opponent first disproves his assertions and predictions regarding her, and then states the facts regarding iron war-ships which have been ascertained by actual experiment. Experience has proved, first, that "when the thickness of a vessel's side is not more than half an inch, shots fired obliquely have glanced off the iron vessel which would have penetrated a wooden ship; second, that shots fired directly have passed through both sides of the ship, doing less damage to the ship directly and less damage by splinters than would have been the case in timber ships; third, that the shot holes have been as easily stopped, and more expeditiously and less expensively repaired than in wooden ships; fourth, that their plates of wrought-iron, even five-eighths of an inch, are proof against shells; that iron plates four inches and a half thick are nearly impenetrable to shot fired from the heaviest nature of guns; and, finally, that plates six inches thick are practically impenetrable."

Revolving Ships' Rig.—The revolving rig of Capt. Coles, of this city, has just been applied to the square sails of the bark *Liverpool*, now lying at the dock a short distance from the Grand-street ferry, East river. The sails by this rig are worked from the deck, not a man is required to go aloft. A long roller is suspended in brackets connected with the lower yard, and the sail is wound up on this roller by revolving it with ropes or chains from the deck. The sail is rolled up exactly like a piece of cloth on a weaver's beam, and any amount of its surface can easily be taken in or exposed as required. This rig is exceedingly snug, and although the *Liverpool* (now somewhat old) is the first vessel to which it has been applied in this port, those who command her believe it will operate well, and save a great amount of labor, while it insures greater safety. Such sails can be operated more rapidly than those which are rigged by the common method.

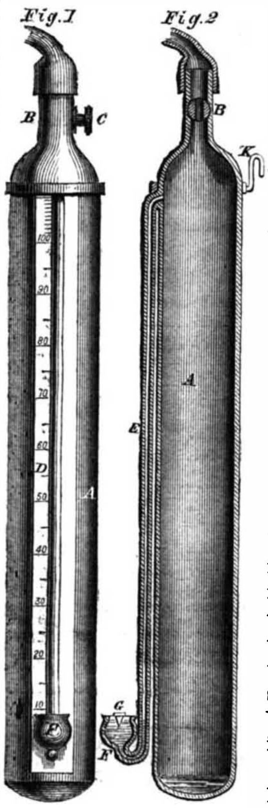
A friend of ours just returned from England informs us he visited the extensive machine works of Messrs. Platt & Brother, at Manchester, just before sailing, and they have now employed 5,000 workmen. They are the great manufactures of cotton machinery, and their works cover several acres of ground. The tools and machinery with which they manufacture their machinery for the market is made on their premises. The woodwork used is sawed from the log on the premises, and the metal-work is cast and manipulated from the raw material into the beautiful mechanism which is turned out of their extensive works.

165,226 children daily attend the public schools of the city of New York. The number of teachers is 1,548. Of these, 1,368 are women and only 180 men. The ladies—God bless them!—are the natural instructors of youth, and we are glad to note that this truth is so practically exemplified in the Empire City.

Nobel's Photometer.

The apparatus here illustrated, invented by Mr. Nobel, of England, is designed to measure the chemical rays of light, those which effect the changes in the photograph and all other chemical changes produced by light. It is based on the principle that while chlorine and hydrogen, mechanically mixed together, will remain uncombined an indefinite period in the dark, they immediately begin to enter into combination when exposed to light, or rather to the chemical rays of the sunbeam, the activity of the combination being proportioned to the intensity of the chemical rays. The product of the combination of hydrogen and chlorine is hydrochloric acid, which is rapidly absorbed by water.

To render these properties available for the measurement of the chemical force in any light, a glass tube,



A, is placed, by means of a flexible tube, in communication with a vessel containing equal quantities of chlorine and hydrogen gases mixed together mechanically. A capillary tube, E, communicates with the tube, A, at its upper end and with an open cup, F, of water at its lower end. A small quantity of water is placed in the lower end of the tube, A, to absorb the hydrochloric acid.

The tube, A, is filled with the mixed gases from the reservoir by opening the stopcock, B, the cup, F, remaining empty during the process of filling, in order that the gases, as they flow in, may expel the atmospheric air from the tube, A, through the small tube, E, and cup, F. When the atmospheric air is all driven out the stopcock is closed, the cup, F, is filled with water, and the instrument is suspended by the hook, K, in the light which it is desired to measure. As the light acts upon the mixed gases it causes them to combine, forming hydrochloric acid, which is absorbed by the water in the bottom of tube, A. This gradual removal of the gases diminishes their pressure upon the surface of the water in the small tube, E, when the weight of the atmosphere resting upon the surface of the water in the cup, F, forces this water along up the tube, E. A graduated scale is placed by the side of the tube, E, by which the hight of the column of water may be measured, and as the hight to which the water rises in a given time will vary with the intensity of the chemical action of the light upon the contained gases, the number of chemical rays in the light may be thus measured.

Way's electric light, described on page 248, Vol. III., of the Scientific American, is said to contain a larger proportion of chemical rays than the sunbeam; and the magnesium light, described on page 21 of the current volume, contains a larger proportion still. The chemical rays may be entirely separated from the luminous rays, so that it is possible to conceive of an apparatus which would take photographs absolutely in the dark.

Cast Platinum.—At the last sitting of the Academy of Sciences of Paris, M. Deville exhibited two ingots of platinum, weighing together a little over 55 lbs., which had been melted in the same furnace, and run into an ingot mold of forged iron. He states that platinum may be melted in any quantity; and once melted, it behaves precisely like gold or silver, requiring exactly the same precautions as in casting the precious metals. He also exhibited a platinum cog-wheel, cast in an ordinary sand mold in the same way as other metals; thus giving a new proof of the possibility of giving platinum all the forms that may be desired by the process.

American Street Railroads in Europe.

We have already chronicled the opening of a horse car railroad at Birkenhead, opposite Liverpool, England, and the progress of a similar enterprise at London, both under the auspices of an American.

We are happy to state that several other contracts, for similar cities in continental Europe, have been made. Street railroads are about to be commenced at Hamburg, Copenhagen, Berlin, and Pesth in Hungary. These roads are to be built by American engineers. A talented engineer from Worcester, Mass., has been selected as chief, and expects to sail shortly with an effective corps of assistants for the scene of labor. The cars and other appurtenances will be made in this country, and the whole work will be done in the very best manner. In a future number we intend giving further particulars.

The Aldermen of New York city have voted decorations for themselves. They have given each other a golden button, of oval shape, an inch and a quarter long and three quarters broad. These ornaments are of pure gold, and have the city arms engraved upon the face, together with the name of the owner and the district he represents. To be worn upon the left breast. Expense to the city, $600.

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