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Boiler-Feed Regulator, Low-water Alarm, and Steam Trap.

It is needless to preface our description of the instruments shown in our engravings by any remarks upon the value of boiler-feed regulators or low-water alarms. Our readers have had their attention so often called to this subject that they are fully prepared to appreciate its importance.

The instruments we illustrate and describe have been tested, and found to be very sensitive and quick in their action. At the Fair of the American Institute, where they are now on exhibition, they attract much attention and favorable comment from engineers.

The construction of these instruments is based upon one general principle—that is, the action of gravity upon a counterpoised hollow sphere, the weight of which, together with its contents and that of the counterpoise, is made to oscillate a lever, according to the varying weight of the contents of the sphere, which may be water, water and steam, or steam alone, as will be seen by the description appended.

Fig. 1 shows the boiler-feed regulator. In this form of the instrument, pipes, A and B, connect the interior of the globe, C, with the interior of the boiler; the end of the pipe, A, called the discharge pipe, descending below the low-water line and that of the pipe, B, descending to this line. It is evident if the air contained in the pipes and globe, C, be allowed to escape through a pet-cock in the top of the globe, and the boiler be filled to the proper level, that, as soon as steam is raised in the boiler, water will be forced up along the pipes, A and B, by the accumulating pressure of steam and fill the globe, C.

The globe, C, is suspended on one end of a counterpoised lever, D, playing on knife edges like a scale beam. As soon as the globe is weighted with water its weight overbalances the counterpoise on the lever, D, and the latter makes an oscillation, and being connected with a bell-crank lever, E, operates through it to close or partially close a valve in the steam pipe, F, which supplies the pump, thereby checking the action of the pump and stopping the flow of water into the boiler. As soon, however, as the water in the boiler lowers through evaporation so that the end of the pipe, B, is uncovered, steam enters this pipe, and the water in the globe, C, descends by its own gravity to the boiler. The counterpoise on the lever, D, now overbalances the weight of the globe. The lever oscillates to the original position operating through the bell-crank, E, to open the valve in the pipe, F, letting steam into the steam cylinder of the pump, and setting the latter into action to supply water to the boiler again.

As soon as the water now rises to close the mouth of the pipe, B, steam no longer enters this pipe. The steam in the globe, C, condenses, and the pressure of steam in the boiler again forces water up the pipes filling the globe, which again descending cuts off steam from the pump and checks the supply of water to the boiler. In this way the supply of water is constantly regulated within certain limits depending altogether upon the position of the counterpoise on the lever, D, which may be set so that the globe will descend when only partially filled with water, if desired.

We have seen this and the other instruments described below in actual work, and are much pleased with the sensitiveness and the promptness of their action. They require no attention after the first adjustment, except perhaps to blow out dirt, which may in some instances accumulate in the pipes and globes, this is done through three-way cocks in the pipe, A, provided for that purpose.

It might at first seem that the pipes, A and B, would oppose the motion of the counterpoised lever and its appurtenances, but when it is said that these pipes are six feet long and only one half an inch in diameter, it will be seen that their flexibility will admit of the slight motion required. In practice they are found not to interfere in the least with the desired sensitiveness of the instrument.

Fig. 2 shows the operation of a modification of the same device, so as by means of an electric alarm to give notice of low water in a boiler. In this case, when the water falls below the pipe, B—called in this instance the "alarm pipe"—the globe rising closes the circuit maker and breaker, G, of the galvanic battery, K. The electric current now passes through the wires, H and I, setting in motion the electric alarm, L, which continues to sound until water is supplied to the boiler sufficient to raise the level enough to close the mouth of the alarm pipe, B.

Fig. 3 shows another modification whereby a whistle, O, is sounded by the opening of its valve through the medium of the chain, M, and the valve lever, N. This occurs whenever the water falls below the mouth of the pipe, B, and continues until the water rises again to its proper level.

Fig. 4 shows the application of the same device to a steam trap. In this case the globe, C, is filled (or partially filled, according as the instrument is adjusted) with water condensed from steam in its passage through pipes, etc. As soon as the water accumulates to the prescribed quantity the globe descends, moving the bell-crank valve lever, P, pivoted on the pin, Q, and opens a valve, R, in the discharge pipe, A, allowing the water to flow out. As soon as the water has escaped, the globe rises, and closes the valve, R, until such time as a further accumulation has been made. As we have said, all of these instruments are in full operation at the present Fair of the American Institute. Many of them are in use in various parts of the country, and we have been shown many testimonials from engineers who have tried them, speaking in high terms of their reliability and efficiency.

For further information, address R. M. Pratt, Treasurer, Berryman Regulator & Alarm Co., Hartford, Conn.

Fig. 1

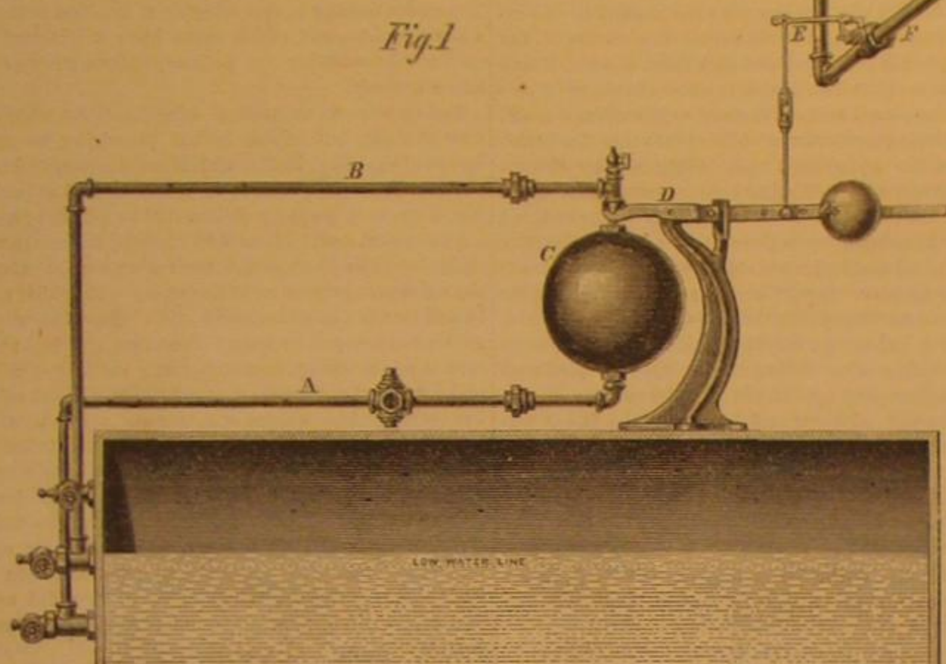
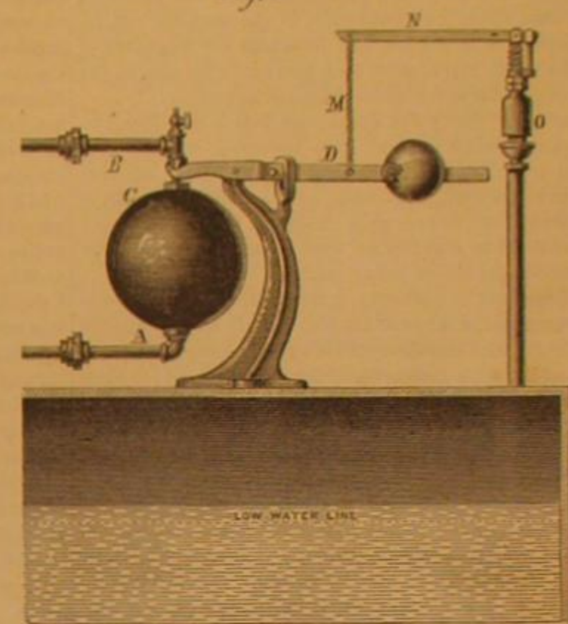


Fig. 3



BERRYMAN'S BOILER-FEED REGULATOR.

Fig 2

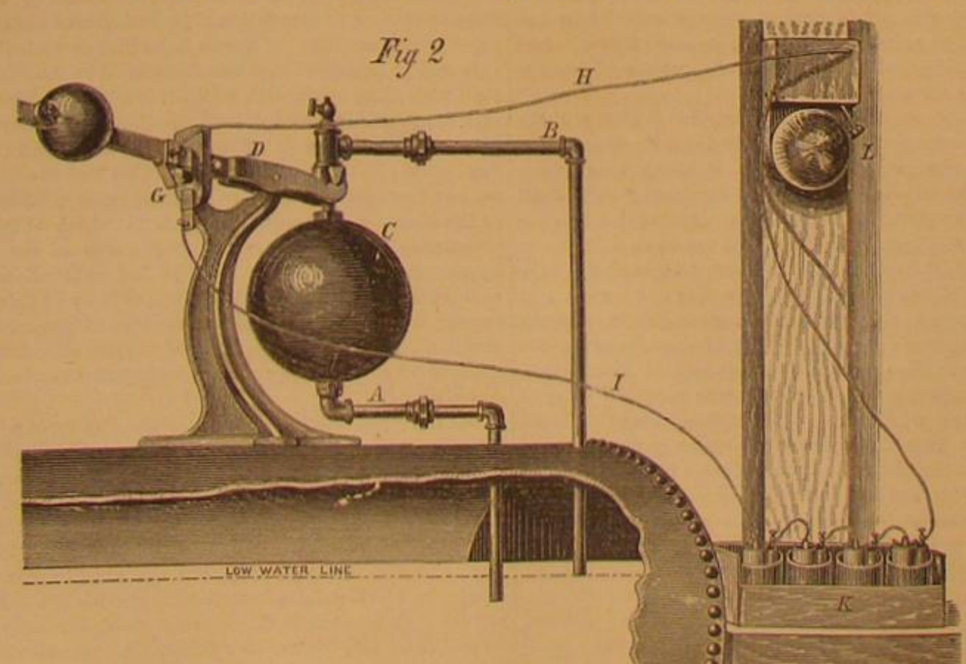
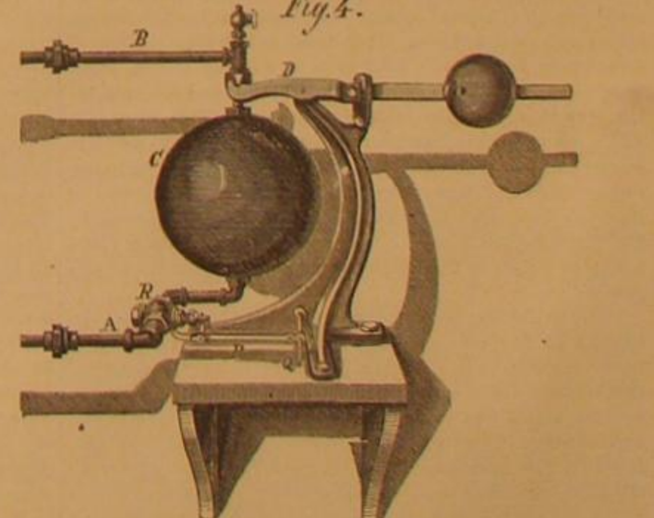


Fig. 4.



BERRYMAN'S LOW-WATER ALARM.

DYSPEPTICS should never eat fruit except at meal time, and then not to excess.

INAUGURAL ADDRESS OF THE PRESIDENT, THOMAS H. HUXLEY, LL.D., F.R.S., ETC., BEFORE THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

It has long been the custom for the newly-installed President of the British Association for the Advancement of Science to take advantage of the elevation of the position in which the suffrages of his colleagues had, for the time, placed him, and, casting his eyes around the horizon of the scientific world, to report to them what could be seen from his watch tower; in what direction the multitudinous divisions of the noble army of the improvers of natural knowledge were marching; what important strongholds of the great enemy of us all, Ignorance, had been recently captured; and, also, with due impartiality, to mark where the advanced posts of science had been driven in, or a long-continued siege had made no progress.

I propose to endeavor to follow this ancient precedent, in a manner suited to the limitations of my knowledge and of my capacity. I shall not presume to attempt a panoramic survey of the world of Science, nor even to give a sketch of what is doing in the one great province of Biology, with some portions of which my ordinary occupations render me familiar. But I shall endeavor to put before you the history of the rise and progress of a single biological doctrine; and I shall try to give some notion of the fruits, both intellectual and practical, which we owe, directly or indirectly, to the working out, by seven generations of patient and laborious investigators, of the thought which arose, more than two centuries ago, in the mind of a sagacious and observant Italian naturalist.

It is a matter of every day experience that it is difficult to prevent many articles of food from becoming covered with mold; that fruit, sound enough to all appearance, often contains grubs at the core; that meat, left to itself in the air, is apt to putrefy and swarm with maggots. Even ordinary water, if allowed to stand in an open vessel, sooner or later becomes turbid and full of living matter.

The philosophers of antiquity, interrogated as to the cause of these phenomena, were provided with a ready and a plausible answer. It did not enter their minds even to doubt that these low forms of life were generated in the matters in which they made their appearance. Lucretius, who had drunk deeper of the scientific spirit than any poet of ancient or modern times except Goethe, intends to speak as a philosopher, rather than as a poet, when he writes that "with good reason the earth has gotten the name of mother, since all things are produced out of the earth. And many living creatures, even now, spring out of the earth, taking form by the rains and the heat of the sun." The axiom of ancient science, "that the corruption of one thing is the birth of another," had its popular embodiment in the notion that a seed dies before the young plant springs from it; a belief so widespread and so fixed, that Saint Paul appeals to it in one of the most splendid outbursts of his fervid eloquence:

"Thou fool, that which thou sowest is not quickened, except it die."

The proposition that life may, and does, proceed from that which has no life, then, was held alike by the philosophers, the poets, and the people, of the most enlightened nations, eighteen hundred years ago; and it remained the accepted doctrine of learned and unlearned Europe, through the Middle Ages, down even to the seventeenth century.

It is commonly counted among the many merits of our great countryman, Harvey, that he was the first to declare the opposition of fact to venerable authority in this, as in other matters; but I can discover no justification for this widespread notion. After careful search through the "Exercitationes de Generatione," the most that appears clear to me is, that Harvey believed all animals and plants to spring from what he terms a "*primordium vegetale*," a phrase which may now-a-days be rendered "a vegetable germ; and this, he says, is *oviforme*," or "egg-like;" not, he is careful to add, that it necessarily has the shape of an egg, but because it has the constitution and nature of one. That this "*primordium oviforme*" must needs, in all cases, proceed from a living parent is nowhere expressly maintained by Harvey, though such an opinion may be thought to be implied in one or two passages; while, on the other hand, he does, more than once, use language which is consistent only with a full belief in spontaneous or equivocal generation. In fact, the main concern of Harvey's wonderful little treatise is not with generation, in the physiological sense, at all, but with development; and his great object is the establishment of the doctrine of epigenesis.

The first distinct enunciation of the hypothesis that all living matter has sprung from pre-existing living matter, came from a cotemporary, though a junior, of Harvey, a native of that country, fertile in men great in all departments of human activity, which was to intellectual Europe, in the sixteenth and seventeenth centuries, what Germany is in the nineteenth. It was in Italy, and from Italian teachers that Harvey received the most important part of his scientific education. And it was a student trained in the same schools, Francesco Redi—a man of the widest knowledge and versatile abilities, distinguished alike as scholar, poet, physician, and naturalist—who just two hundred and two years ago, published his "Esperienze intorno alla Generazione degl' Insetti," and gave to the world the idea, the growth of which it is my purpose to trace. Redi's book went through five editions in twenty years; and the extreme simplicity of his experiments, and the clearness of his arguments, gained for his views, and for their consequences, almost universal acceptance.

Redi did not trouble himself much with speculative considerations, but attacked particular cases of what was supposed to be "spontaneous generation" experimentally. Here are dead animals, or pieces of meat, says he; I expose them to the air in hot weather, and in a few days they swarm with maggots. You tell me that these are generated in the dead flesh; but if I put similar bodies, while quite fresh, into a jar, and tie some fine gauze over the jar, not a maggot makes its appearance, while the dead substances, nevertheless, putrefy just in the same way as before. It is obvious therefore that the maggots are not generated by the corruption of the meat; and that the cause of their formation must be a something which is kept away by gauze. But the gauze will not keep away aeriform bodies or fluids. This something must, therefore, exist in the form of solid particles too big to get through the gauze. Nor is one left in doubt what these solid particles are; for the blowflies, attracted by the odor of the meat, swarm round the vessel, and, urged by a powerful, but in this case, misleading instinct, lay eggs, out of which maggots are immediately hatched, upon the guaze. The conclusion, therefore, is unavoidable; the maggots are not generated by the meat, but the eggs which give rise to them are brought through the air by the flies.

These experiments seem almost childishly simple, and one wonders how it was that no one ever thought of them before. Simple as they are, however, they are worthy of the most careful study, for every piece of experimental work since done, in regard to this subject, has been shaped on the model furnished by the Italian philosopher. As the results of his experiments were the same, however varied the nature of the material he used, it is not wonderful that there arose in Redi's mind a presumption that, in all such cases of the seeming production of life from dead matter, the real explanation was the introduction of living germs from without into that dead matter. And thus the hypothesis that living matter always arises by the agency of pre-existing living matter, took definite shape; and had, henceforward, a right to be considered and a claim to be refuted, in each particular case, before the production of living matter in any other way could be admitted by careful reasoners. It will be necessary for me to refer to this hypothesis so frequently, that, to save circumlocution, I shall call it the hypothesis of *Biogenesis*; and I shall term the contrary doctrine—that living matter may be produced by not living matter—the hypothesis of *Abiogenesis*.

In the seventeenth century, as I have said, the latter was the dominant view, sanctioned alike by antiquity and by authority; and it is interesting to observe that Redi did not escape the customary tax upon a discoverer of having to defend himself against the charge of impugning the authority of the Scriptures; for his adversaries declared that the generation of bees from the carcass of a dead lion is affirmed, in the book of Judges, to have been the origin of the famous riddle with which Sampson perplexed the Philistines—

"Out of the eater came forth meat,
And out of the strong came forth sweetness."

Against all odds, however, Redi, strong with the strength of demonstrable fact, did splendid battle for Biogenesis; but it is remarkable that he held the doctrine in a sense which, if he had lived in these times, would have infallibly caused him to be classed among the defenders of "spontaneous generation." "*Omne vivum ex vivo*," "no life without antecedent life," aphoristically sums up Redi's doctrine; but he went no further. It is most remarkable evidence of the philosophic caution and impartiality of his mind, that, although he had speculatively anticipated the manner in which grubs really are deposited in fruits and in the galls of plants, he deliberately admits that the evidence is insufficient to bear him out; and he therefore prefers the supposition that they are generated by a modification of the living substance of the plants themselves. Indeed, he regards these vegetable growths as organs, by means of which the plant gives rise to an animal, and looks upon this production of specific animals as the final cause of the galls, and of at any rate some fruits. And he proposes to explain the occurrence of parasites within the animal body in the same way.

It is of great importance to apprehend Redi's position rightly; for the lines of thought he laid down for us are those upon which naturalists have been working ever since. Clearly he held *Biogenesis* as against *Abiogenesis*; and I shall immediately proceed, in the first place, to inquire how far subsequent investigation has borne him out in so doing.

But Redi also thought that there were two modes of Biogenesis. By the one method, which is that of common and ordinary occurrence, the living parent gives rise to offspring which passes through the same cycle of changes as itself—like gives rise to like; and this has been termed *Homogenesis*. By the other mode the living parent was supposed to give rise to offspring which passed through a totally different series of states from those exhibited by the parent, and did not return into the cycle of the parent; this is what ought to be called *Heterogenesis*, the offspring being altogether, and permanently, unlike the parent. The term Heterogenesis, however, has unfortunately been used in a different sense, and M. Milne-Edwards has, therefore, substituted for it *Xenogenesis*, which means the generation of something foreign. After discussing Redi's hypothesis of universal Biogenesis, then, I shall go on to ask how far the growth of science justifies his other hypothesis of Xenogenesis.

This progress of the hypothesis of Biogenesis was triumphant and unchecked for nearly a century. The application of the microscope to anatomy in the hands of Grew, Leeuwenhock, Swammerdam, Lyonet, Vallisnieri, Reaumur, and other illustrious investigators of nature of that day, displayed such a complexity of organization in the lowest and minutest forms, and everywhere revealed such a prodigality of provision for their multiplication by germs of one sort or another, that the hypothesis of Abiogenesis began to appear not only untrue, but absurd; and, in the middle of the eighteenth century, when Needham and Buffon took up the question, it was almost universally discredited.

But the skill of the microscope makers of the eighteenth century soon reached its limit. A microscope magnifying 400 diameters was a *chef d'œuvre* of the opticians of that day; and, at the same time, by no means trustworthy. But a magnifying power of 400 diameters, even when definition reaches the exquisite perfection of our modern achromatic lenses, hardly suffices for the mere discernment of the smallest forms of life. A speck only $\frac{1}{25}$ of an inch in diameter has, at ten inches from the eye, the same apparent size as an object $\frac{1}{10000}$ of an inch in diameter, when magnified 400 times; but forms of living matter abound the diameter of which is not more than $\frac{1}{40000}$ of an inch. A filtered infusion of hay, allowed to stand for two days, will swarm with living things, among which any which reaches the diameter of a human red blood corpuscle, or about $\frac{1}{3200}$ of an inch, is a giant. It is only by bearing these facts in mind that we can deal fairly with the remarkable statements and speculations put forward by Buffon and Needham in the middle of the eighteenth century.

When a portion of any animal or vegetable body is infused in water it gradually softens and disintegrates; and, as it does so, the water is found to swarm with minute active creatures, the so-called Infusorial Animalcules, none of which can be seen except by the aid of the microscope; while a large proportion belong to the category of smallest things of which I have spoken, and which must have all looked like mere dots and lines under the ordinary microscopes of the eighteenth century.

Led by various theoretical considerations which I cannot now discuss, but which looked promising enough in the lights of that day, Buffon and Needham doubted the applicability of Redi's hypothesis to the infusorial animalcules, and Needham very properly endeavored to put the question to an experimental test. He said to himself, if these infusorial animalcules come from germs, their germs must exist either in the substance infused or in the water with which the infusion is made or in the superjacent air. Now the vitality of all germs is destroyed by heat. Therefore, if I boil the infusion, cork it up carefully, cementing the cork over with mastic, and then heat the whole vessel by heaping hot ashes over it, I must needs kill whatever germs are present. Consequently, if Redi's hypothesis holds good, when the infusion is taken away, and allowed to cool, no animalcules ought to be developed in it; whereas, if the animalcules are not dependent on pre-existing germs, but are generated from the infused substance, they ought, by and by, to make their appearance. Needham found that under the circumstances in which he made his experiments, animalcules always did arise in the infusions when a sufficient time had elapsed to allow of their development.

In much of his work Needham was associated with Buffon, and the results of their experiments fitted in admirably with the great French naturalist's hpypothesis of "organic molecules, according to which life is the indefeasible property of certain indestructible molecules of matter, which exist in all living things, and have inherent activities by which they are distinguished from not living matter. Each individual living organism is formed by their temporary combination. They stand to it in the relation of the particles of water to a cascade or a whirlpool or a mold into which the water is poured. The form of the organism is thus determined by the reaction between external conditions and the inherent activities of the organic molecules of which it is composed; and, as the stoppage of a whirlpool destroys nothing but a form, and leaves the molecules of the water, with all their inherent activities, intact, so, what we call the death and putrefaction of an animal or of a plant is merely the breaking up of the form or manner of association of its constituent organic molecules, which are then set free as infusorial animalcules.

It will be perceived that this doctrine is by no means identical with *Abiogenesis*, with which it is often confounded. On this hypothesis, a piece of beef, or a handful of hay, is dead only in a limited sense. The beef is dead ox, and the hay is dead grass; but the "organic molecules" of the beef or hay are not dead, but are ready to manifest their vitality as soon as the bovine or herbaceous shrouds in which they are imprisoned are rent by the macerating action of water. The hypothesis, therefore, must be classified under Xenogenesis, rather than under Abiogenesis. Such as it was, I think it will appear, to those who will be just enough to remember that it was propounded before the birth of modern chemistry and of the modern optical arts, to be a most ingenious and suggestive speculation.

But the great tragedy of science—the slaying of a beautiful hypothesis by an ugly fact—which is so constantly being enacted under the eyes of philosophers, was played, almost immediately, for the benefit of Buffon and Needham.

Once more, an Italian, the Abbé Spallanzani, a worthy successor and representative of Redi in his acuteness, his ingenuity, and his learning, subjected the experiments and the conclusions of Needham to a searching criticism. It might be true that Needham's experiments yielded results such as he had described, but did they bear out his arguments? Was it not possible, in the first place, that he had not completely excluded the air by his corks and mastic? And was it not possible, in the second place, that he had not sufficiently heated his infusions and the superjacent air? Spallanzani joined issue with the English naturalist on both these pleas; and he showed that if, in the first place, the glass vessels in which the infusions were contained were hermetically sealed, by fusing their necks; and if, in the second place, they were exposed to the temperature of boiling water for three quarters of an hour, no animalcules ever made their appearance within them. It must be admitted that the experiments and arguments of Spallanzani furnish a complete and crushing reply to those of Needham. But we all too often forget that it is one thing to refute a proposition and another to prove the truth of a doctrine which implicitly, or explicitly, contradicts that proposition; and the advance of science soon showed that, though Needham might be quite wrong, it did not follow that Spallanzani was quite right.

Modern Chemistry, the birth of the latter half of the eighteenth century, grew apace, and soon found herself face to face with the great problems which Biology had vainly tried to attack without her help. The discovery of oxygen led to the laying of the foundations of a scientific theory of respiration, and to an examination of the marvelous interactions of organic substances with oxygen. The presence of free oxygen appeared to be one of the conditions of the existence of life, and of those singular changes in organic matters which are known as fermentation and putrefaction. The question of the generation of the infusory animalcules thus passed into a new phase. For what might not have happened to the organic matter of the infusions, or to the oxygen of the air, in Spallanzani's experiments? What security was there that the development of life which ought to have taken place had not been checked, or prevented, by these changes?

The battle had to be fought again. It was needful to repeat the experiments under conditions which would make sure that neither the oxygen of the air, nor the composition of the organic matter, was altered, in such a manner as to interfere with the existence of life.

Schulze and Schwann took up the question from this point of view in 1836 and 1837. The passage of air through red-hot glass tubes, or through strong sulphuric acid, does not alter the proportion of its oxygen, while it must needs arrest or destroy any organic matter which may be contained in the air. These experimenters, therefore, contrived arrangements by which the only air which should come into contact with a boiled infusion should be such as had either passed through red-hot tubes or through strong sulphuric acid. The result which they obtained was, that an infusion so treated developed no living things, while, if the same infusion was afterwards exposed to the air, such things appeared rapidly and abundantly. The accuracy of these experiments has been alternately denied and affirmed. Supposing them to be accepted, however, all that they really proved was, that the treatment to which the air was subjected destroyed *something* that was essential to the development of life in the infusion. This "something" might be gaseous, fluid, or solid; that it consisted of germs remained only an hypothesis of greater or less probability.

Cotemporaneously with these investigations, a remarkable discovery was made by Cagniard de la Tour. He found that common yeast is composed of a vast accumulation of minute plants. The fermentation of must, or of wort, in the fabrication of wine or of beer is always accompanied by the rapid growth and multiplication of these *Torulæ*. Thus, fermentation, in so far as it was accompanied by the development of microscopial organisms in enormous numbers, became assimilated to the decomposition of an infusion of ordinary animal or vegetable matter; and it was an obvious suggestion that the organisms were, in some way or other, the causes both of fermentation and of putrefaction. The chemists, with Berzelius and Liebig at their head, at first laughed this idea to scorn; but, in 1843, a man, then very young, who has since performed the unexampled feat of attaining to high eminence, alike in mathematics, physics, and physiology—I speak of the illustrious Helmholtz—reduced the matter to the test of experiment by a method alike elegant and conclusive. Helmholtz separated a putrefying, or a fermenting, liquid, from one which was simply putrescible or fermentable, by a membrane, which allowed the fluids to pass through and become intermixed, but stopped the passage of solids. The result was that, while the putrescible, or the fermentable, liquids became impregnated with the results of the putrescence, or fermentation, which was going on at the other side of the membrane, they neither putrefied (in the ordinary way) nor fermented; nor were any of the organisms which abounded in the fermenting or putrefying liquid generated in them. Therefore, the cause of a development of these organisms must lie in something which cannot pass through membrane; and as Helmholtz's investigations were long antecedent to Graham's researches upon colloids, his natural conclusion was that the agent thus intercepted must be a solid material. In point of fact, Helmholtz's experiments narrowed the issue to this: That which excites fermentation and putrefaction, and at the same time gives rise to living forms in a fermentable or putrescible fluid, is not a gas and is not a diffusible fluid; therefore, it is either a colloid, or it is matter divided into very minute solid particles.

The researches of Schroeder and Dusch, in 1854, and of Schroeder alone, in 1859, cleared up this point by experiments which are simply refinements upon those of Redi. A lump of cotton-wool is, physically speaking, a pile of many thicknesses of a very fine gauze, the fineness of the meshes of which depends upon the closeness of the compression of the wool. Now Schroeder and Dusch found that in the case of all the putrefiable materials which they used (except milk and yolk of egg), an infusion boiled, and then allowed to come into contact with no air but such as had been filtered through cotton-wool, neither putrefied nor fermented, nor developed living forms. It is hard to imagine what the fine sieve formed by the cotten-wool could have stopped except minute solid particles. Still the evidence was incomplete until it had been positively shown, first, that ordinary air does contain such particles; and, secondly, that filtration through cotton-wool arrests these particles and allows only physically pure air to pass. This demonstration has been furnished within the last year by the remarkable experiments of Professor Tyndall. It has been a common objection of Abiogenesists that, if the doctrine of Biogeny is true, the air must be thick with germs; and they regard this as the hight of absurdity. But nature is occasionally exceedingly unreasonable, and Professor Tyndall has proved that this particular absurdity may, nevertheless, be a reality. He has demonstrated that ordinary air is no better than a sort of stirabout of excessively minute solid particles; but these particles are almost wholly destructible by heat; and that they are strained off, and the air rendered optically pure, by being passed through cotton-wool.

But it remains yet in the order of logic, though not of history, to show that, among these solid destructible particles, there really do exist germs capable of giving rise to the development of living forms in suitable menstrua. This piece of work was done by M. Pasteur in those beautiful researches which will ever render his name famous; and which, in spite of all attacks upon them, appear to me now, as they did seven years ago, to be models of accurate experimentation and logical reasoning. He strained air through cotton-wool, and found, as Schroeder and Dusch had done, that it contained nothing competent to give rise to the development of life in fluids highly fitted for that purpose. But the important further links in the chain of evidence added by Pasteur are three. In the first place, he subjected to microscopic examination the cotton-wool which had served as strainer, and found that sundry bodies clearly recognizable as germs, were among the solid particles strained off. Secondly, he proved that these germs were competent to give rise to living forms by simply sowing them in a solution fitted for their development. And, thirdly, he showed that the incapacity of air strained through cotton-wool to give rise to life, was not due to any occult change effected in constituents of the air by the wool, by proving that the cotton-wool might be dispensed with altogether, and perfectly free access left between the exterior air and that in the experimental flask. If the neck of the flask is drawn out into a tube and bent downwards; and if, after the contained fluid had been carefully boiled, the tube is heated sufficiently to destroy any germs which may be present in the air which enters as the fluid cools, the apparatus may be left to itself for any time, and no life will appear in the fluid. The reason is plain. Although there is free communication between the atmosphere laden with germs and the germless air in the flask, contact between the two takes place only in the tube; and as the germs cannot fall upwards, and there are no currents, they never reach the interior of the flask. But if the tube be broken short off where it proceeds from the flask, and free access be thus given to germs falling vertically out of the air, the fluid which has remained clear and desert for months, becomes, in a few days, turbid and full of life.

These experiments have been repeated over and over again by independent observers with entire success; and there is one very simple mode of seeing the facts for oneself, which I may as well describe.

Prepare a solution (much used by M. Pasteur, and often called "Pasteur's solution") composed of water with tartrate of ammonia, sugar, and yeast-ash dissolved therein. Divide it into three portions in as many flasks; boil all three for a quarter of an hour; and, while the steam is passing out, stop the neck of one with a large plug of cotton wool, so that this also may be thoroughly steamed. Now set the flasks aside to cool, and when their contents are cold, add to one of the open ones a drop of filtered infusion of hay, which has stood for twenty-four hours, and is, consequently, full of the active and excessively minute organisms known as *Bacteria*. In a couple of days of ordinary warm weather, the contents of this flask will be milky, from the enormous multiplication of *Bacteria*. The other flask, open and exposed to the air, will, sooner or later, become milky with *Bacteria*, and patches of mold may appear in it; while the liquid in the flask, the neck of which is plugged with cotton wool, will remain clear for an indefinite time. I have sought in vain for an explanation of these facts, except the obvious one, that the air contains germs competent to give rise to *Bacteria*, such as those with which the first solution has been knowingly and purposely inoculated, and to the mold *fungi*. And I have not yet been able to meet with any advocate of Abiogenesis who seriously maintains that the atoms of sugar, tartrate of ammonia, yeast-ash, and water, under no influence but that of free access of air and the ordinary temperature, re-arrange themselves and give rise to the protoplasm of *Bacterium*. But the alternative is to admit that these *Bacteria* arise from germs in the air; and if they are thus propagated, the burden of proof, that other like forms are generated in a different manner, must rest with the assertor of that proposition.

[Remainder next week].

Another Case of Spontaneous Combustion.

The recent great fire in Chicago is now supposed to have been spontaneously originated in a bundle of greasy rags. How long will it be before people generally understand that such rags are dangerous? The general carelessness in the storage of these and similar dangerous substances is only equaled by that in the domestic use of matches. We saw a business man the other day throw without thinking an unextinguished match into his paper waste basket. We not unfrequently step on matches in walking through public buildings or on the ferry boats which detonate under our feet. How many men, women, or children when they drop a match never think of stooping to pick it up, but take a new one from the box, rather than subject themselves to a slight inconvenience, which might perhaps prevent the destruction of thousands of dollars' worth of property. To always extinguish matches before throwing them away, and always pick them up when dropped, are habits which should be taught to every child.

THE MANUFACTURE OF SOLUBLE GLASS.

[From Feuchtwanger's "Treatise on Soluble Glass."]

The potash soluble glass is obtained by mixing 15 parts powdered quartz or pure sand with 10 parts purified pearl ashes, and 1 part charcoal in a Hessian crucible, and exposing the mixture so long to a heat until the mass after six hours has become vitrified. Charcoal is employed for assisting, by its decomposition, the production of carbonic acid, as also some sulphuric acid which may have been produced. It is at present, however, omitted, and if manufactured on a large scale the vitrification is done in a reverberatory furnace capable of holding from 1,200 to 1,500 pounds. The ashes and sand must be well mixed togther for some time and the furnace must be very hot before throwing the mixture in it, and the heat must be constantly kept up until the entire mass is in a liquid condition. The tough mass is then raked out and thrown upon a stone hearth and left to cool. The glass mass so obtained appears to be hard and blistery, of blackish gray color, and if the ashes were not quite pure it will also be adulterated with foreign salts. By pulverizing and exposing it to the air it will absorb the acidity, and by degrees the foreign salts will, after frequent agitation and stirring, be completely separated, particularly after pouring over the mass some cold water, which dissolves them, but not the soluble glass. The purified mass is now put into an iron cauldron, containing five times the quantity of hot water, in small portions, and with constant agitation, and replacing occasionally hot water for that which evaporated during the boiling, and after five or six hours the entire mass is dissolved; the liquid is removed and left to settle over night, in order to be able to separate any undecomposed silex. The next day it is evaporated still more until it has assumed the consistency of a sirup, and standing 28° B. and is composed of 28 per cent potash, 62 per cent silica, and 12 per cent water. It has an alkaline taste, and is soluble in all proportions of water, and is precipitated by alcohol, and if any salts do effervesce they may be wiped off. The color is not quite white, but assumes a greenish or yellowish white color.

MANUFACTURE OF SODA SOLUBLE GLASS.

To 45 parts silica or white river sand are added 23 parts carbonate of soda fully calcined, and 3 parts charcoal, and is then treated in the same manner as the other glass. The proportions of the mixture are altered by the different manufacturers, some propose to 100 parts silex, 60 parts anhydrous glauber salt, and 15 to 20 parts charcoal. By the addition of some copper scales to the mixture, the sulphur will be separated. Another method is proposed by dissolving the fine silex in caustic soda lye. Kuhlman employs the powdered flint, which is dissolved in an iron cauldron under a pressure of 7 to 8 atmospheres. According to Liebig the infusorial earth is recommended in place of sand on account of being readily soluble in caustic lye, and he proposes to use 120 parts infusorial earth to 75 parts caustic soda, from which 240 parts silica jelly may be obtained. His mode is to calcine the earth so as to become of white colors, and passing it through sieves. The lye he prepares from 75 ounces calcined soda, dissolved in five times the quantity of boiling water, and then treated by 56 ounces of dry slacked lime; this lye is concentrated by boiling down to 48 deg. B.; in this boiling lye 120 ounces of the prepared infusorial earth are added by degrees, and very readily dissolved, leaving scarcely any sediment. It has then to undergo several operations for making it suitable for use, such as treating again with lime water, boiling it, and separate any precipate forming thereby, which by continued boiling forms into balls, and which can then be separated from the liquid. This clear liquid is then evaporated to consistency of sirup, forms a jelly slightly colored, feels dry and not sticky, and is easily soluble in boiling water.

The difference between potash and soda soluble glass is not material; the first may be preferred in whitewashing with plaster of Paris, while the soda glass is more fluidly divisible.

It may be observed that before applying either soluble glass, it ought to be exposed to the air for ten to twelve days, in order to allow an efflorescence of any excess of alkali, which might act injuriously.

DOUBLE SOLUBLE GLASS.

This is a compound of potash and soda, and is prepared from 100 parts quartz, 28 parts purified pearl ashes, 22 parts anhydrous bicarbonate of soda, and 6 parts of charcoal, which are spread in such manner as already described. If the mass is fully evaporated to dryness, it forms a vitreous solid glass which cannot be scratched by steel, has a conchoidal fracture, of sea-green color, translucent and even transparent, and has specific gravity of 1·43.

Soluble glass, after Kaulbach, for the use of sterro-chromic painting, is obtained by fusing 3 parts of pure carbonate soda and 2 parts powdered quartz, from which a concentrated solution is prepared, and 1 part of which is then added to 4 parts of a concentrated and fully saturated solution of potash glass solution, by which it assumes a more condensed amount of silica with the alkalies; and which solution has been found to work well for paint. Siemen's patent for the manufacture of soluble glass, consists in the production of a *liquid quartz* by digesting the sand or quartz in a steam boiler tightly closed and at a temperature corresponding to 4-5 atmospheres, with the common caustic alkalies, which are hereby capacitated to dissolve from three to four times the weight of silica to a thin liquid. The apparatus, which was patented in 1845, is well known in this country; as some persons, many years later, obtained a patent for the same apparatus in the United States, which on inspection does not differ from that of Siemens Brothers.

SCREW REVERSING GEAR FOR LOCOMOTIVES.

The value of screw-reversing gear for locomotives is daily more appreciated. In goods and shunting engines especially it saves a driver a great deal of labor. But the great difficulty hitherto encountered in its use lies in the fact that in cases of emergency it is impossible to reverse with promptitude.

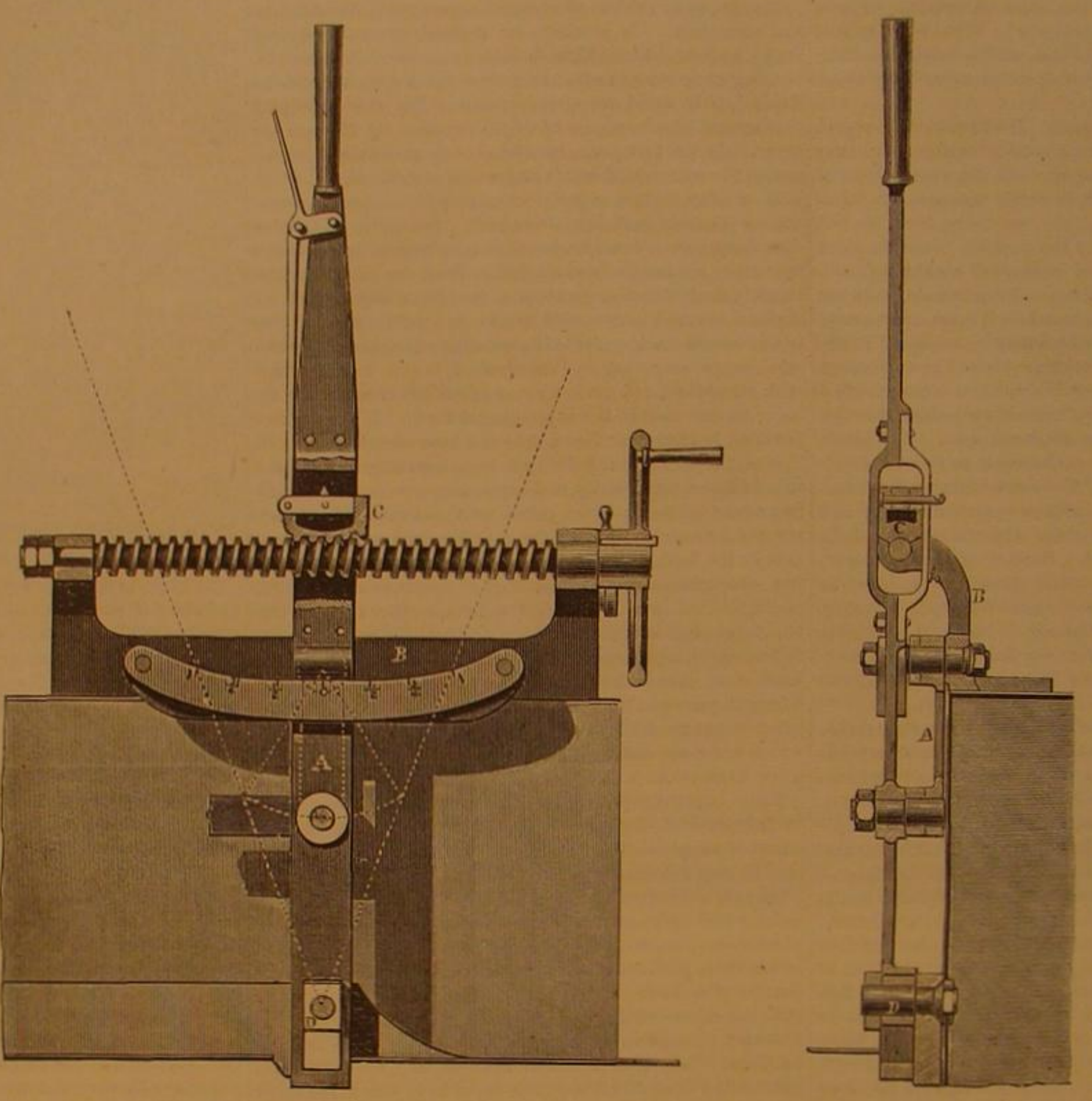
In the annexed engraving we show an arrangement, invented and patented by Mr. A. Alexander, of the Worcester Engine Works Company, England, and fitted with success to a large number of locomotives built by the company for the Nicholas Railway, Russia.

This reversing lever differs from others hitherto introduced for working both by hand and screw, in having a straight cylindrical screw of the ordinary form, rigidly fixed in bearings at each end. The screw, when the lever is moved by hand, acts in place of the common notched quadrant.

The motion of the detent in the lever is kept parallel to the axis of the screw by the application of a radius link, A. An end of this link is fastened to the frame, B, which carries a straight double-thread screw, and the other end is attached to the lever. By means of this parallel motion the teeth of the detent, C, when drawn up, move when the lever is worked backward and forward nearly in a straight line parallel with the axis of the screw.

Owing to the form of the detent, C, about three teeth are always in gear with the screw in every position. In the engine frame is a stud carrying a block, D, and on this the lower end of the reversing lever, which has an oblong slot, moves up and down as the lever is moved, either by hand or screw.

It should be observed that the first design of lever on this system had an ordinary single detent falling between the threads of the screw. The present form of detent block keeping several teeth in gear was suggested by Mr. Thow, of the Worcester Engine Works. It is a decided improvement.—*The Engineer.*



SCREW REVERSING GEAR FOR LOCOMOTIVES.

Guns and Gun-Making.

The annual produce, writes a contemporary, on the authority of a competent correspondent, of arms and ammunition in France exceeds in value 15,000,000 francs, or $3,000,000. Of this amount two thirds are represented by guns and bayonets, and the residue by side arms, caps, and cartridges. The trade employs in the aggregate 15,000 work people. Its principal seat—the Birmingham of France—is St. Etienne. The raw material employed, both iron and steel, is produced in France. Iron costs thirty-three francs per cwt., and steel varies in value from forty-seven francs to eighty francs per cwt. The use of steel in the manufacture of rifle barrels is proportionately greater than in England, the total quantity used being 2,500 tuns per annum. The wood of which the stocks are made is grown in France. Since the year 1855 the gun trade of France has been characterized by a very extended employment of the best machinery. It is admitted by Birmingham gunsmiths that the barrels used by French producers of small arms are as good as they can possibly be. The locks are not so good. They "speak" well, but pull unequally, and come up at last with a jerk. Compared with the sweet oily action of our best English "Brazier" locks, the French productions are positively inferior. On the average, the guns produced in France are much higher in price than those of Birmingham manufacture.

It is mentioned that a noticeable feature in the chassepot, as in the Prussian needle gun, is the absence of a lock, the discharge being effected by a sliding bolt in the back part of the breech action, which is shot forth by a spiral spring. This spring is said to be the weak point of the chassepot. If, however, it has a tendency to become weaker after much using, as is supposed to be the case, it could still be easily replaced. A stronger objection seems to lie in the great force required to push the bolt back into full cock. This had to be done by the direct pressure of the hand or thumb of the soldier upon the whole force of power of the spring. In pulling up an ordinary lock a powerful leverage is obtained in the hammer, which makes the action easy and pleasant. This, on the contrary, is heavy and fatiguing, and must tell in the course of a day's work.

The Belgian gunsmiths, especially in what are termed *armes de luxe*, are woefully behind the French, although to the latter they are indebted for most of their designs; the barrels are the best features of Belgian guns, being well made, clean, and of almost infinite variety in their twistings. A minute observer remarks: "The Damascus patterns in Belgium are even more varied and intricate than in France, and they are produced at astonishingly low prices for what they are or seem to be, for tales are rife about the Belgians veneering their barrels with Damascus iron." The locks are quite as defective as the French, but it is noticeable that quotations of arms in Belgium are considerably lower than in France. A common breech-loader marked in Paris 90 francs is quoted 56 francs in Brussels. The commonest muzzle-loader, a double gun, sells as low as 14½ francs, and a single gun of equal quality is quoted 6 francs; but neither are safe to use.

Again, the Belgians have a very soft and easily workable malleable iron, which they know how to cast to perfection; and they make a very liberal use of it indeed in the manufacture of their revolvers. The bodies, the barrels, and sometimes even the chambers, are made of it, and every workman knows how much easier it is to file up a clean casting in soft iron than a lump of wrought iron, however shapely it may be forged. This is a very important item in the cost. Soft as the iron may be, the pistols are made very light, but the metal is evenly distributed. Even the hammers and triggers are made of cast iron. The springs have not much strength, but sufficient to strike a pin cartridge, and for pin cartridges the Belgian revolvers are invariably made. They are at the outset cheaper than English revolvers, but they do not last so long, and therefore in the long run they are dearer.

The best guns of Prussian make are chiefly remarkable for their very chaste and elaborate decoration. In other respects they are heavy, and have great cheek pieces on the butts. In the Prussian needle gun, as in the chassepot and other military breech-loaders of note, one leading idea seems to prevail. This is the opening of the breech by the pulling back of a bolt, which, when the charge is inserted, is pushed home and turned down.

In the Snider another plan is adopted. A solid block is lifted out of the breech, pushing the charge into the barrel in front of it, and replacing it. The various ways of hinging this block and securing it when down form half the varieties of breech-loaders. In one the block turns over to the right, in another to the left; in one backwards, in another forwards; all differing in some minor, though perhaps essential, detail, but the leading idea is the same, and had its origin, no doubt, in the Armstrong gun.

The method of converting the Enfield into the Snider rifle is very simple. About two inches of the upper part of the Enfield barrel are cut away at the breech, and a solid breech stopper working sideways on a hinge is placed in the opening thus made. A piston passes through the stopper, and when the breech is closed, one end of it receives the blow from the hammer, and the other communicates it to the center of the cartridge, and fires it. There is an arrangement for withdrawing the old cartridge cases after each discharge.

Casting a Steel Ingot.

A casting designed for the beam of the screw steamship *Munster*, belonging to the City of Dublin Steam Packet Company, has just been made at the Norfolk Works, Saville street, Sheffield. The mold in which the ingot was cast was upwards of 14 feet in length, and 3 feet in diameter, and was fixed in the middle of the principal melting furnace. About 300 men were in attendance, under the personal superintendence of Mr. Mark Firth. Almost military precision was observed in bringing from distant parts of the works the crucibles containing molten steel ready to be poured into the mold. This was fixed in a central position, and close at hand were 150 "holes," with tributaries from many other parts of the premises, and we believe that altogether there were 270 in operation. In about half an hour the contents of 544 crucibles, of 64 lbs. each, were poured into the mold, making a total of 34,816 lbs.

Bromine and Iodine.

The bromine of commerce was derived mostly from salines until the salt mines of Stassfurt were opened. The method of manufacture is similar to that followed in the separation of iodine.

Upon opening the mines at Stassfurt, bromine was found in the mother liquors in considerable quantities, and at present the principal part of the European product is derived from this source. As high as 300 grns. per gallon have been obtained from these mother-liquors. Although but two or three of the manufactories at this place have economized this substance, the price of bromine has greatly decreased during the last five years. This decrease has been hastened by the large production of bromine in the United States.

Although the amount of bromides in the Saratoga waters is considerable, yet the comparatively limited flow of water here and the large consumption of these waters for medicinal purposes precludes the manufacture. But from the strong salines our supply is derived in large quantities. At Tarentum, Sligo, and Natrona, in Western Pennsylvania, Pomeroy, Ohio, and Kanawha, West Virginia, the manufacture of bromine has become of considerable importance. The production of 1870 will reach 126,000 pounds, a quantity probably in excess of our consumption. In 1867 the Stassfurt product of bromine was nearly 20,000 pounds.

The total product of iodine in Great Britain and France is about 200,000 pounds annually, and outside these two countries very little is produced. As the average product of iodine is about ten pounds to the tun of kelp, and it requires twenty tuns of wet weed to produce one tun of kelp, this total product represents the burning of 400,000 tuns of sea-weed. At the present price, the iodine produced is of more value than the alkaline salts, which were the original object of the industry.

Iodine is not produced in the United States. Since its use was first established here the price has fallen from $16 to $5 per pound. At present, bromine is furnished for less than $1·50 per pound.

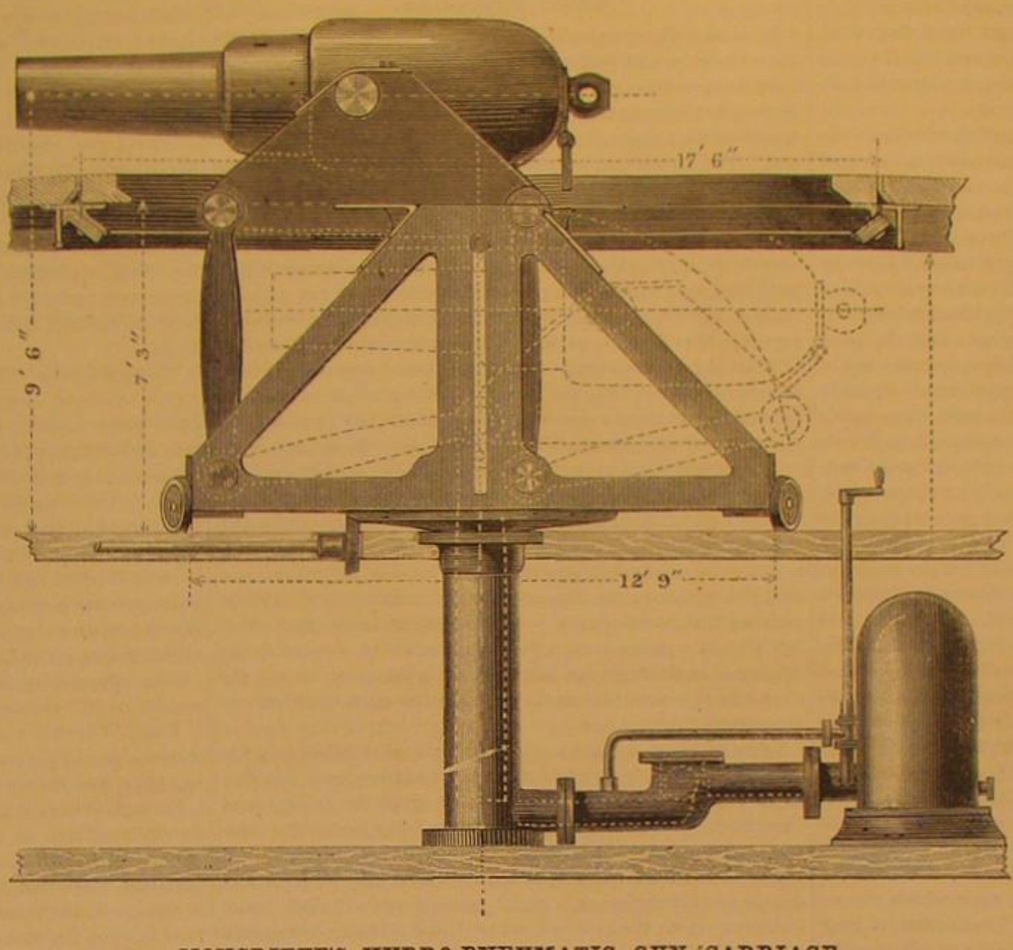
The chief consumption of iodine and bromine is for medicinal purposes in the form of iodides and bromides of potash, soda, or ammonium. A small proportion is consumed in photography. Bromine has been proposed as a discharge in calico printing, and during the late war was to some extent employed as a disinfectant. As yet, but a small proportion of the bromine of the saline mother-liquors is economized but should the manufacturers turn their attention to this important substance, the consequent reduction in price will render its economical employment in other directions possible.—*American Chemist.*

A House Built by one Man.

The *South London Press* tells a story of perseverance. About four years ago an eccentric personage, who follows the pursuit of bird-catching, purchased a small plot of land on the eastern side of Nunhead Cemetery. Here he resolved to build a good-sized six-roomed brick house with his own hands. He at once set to work, and, strange to say, has nearly finished his task. He has been his own architect, his own bricklayer, his own laborer, his own joiner, his own plumber and glazier, and, what is still more strange, has built the house without one particle of scaffolding, and even carried his own bricks from the maker by the armful as he was able to afford them. The work is said to appear very substantial, and to do him great credit. During the operations he has been living in a small brick hut, built by himself on the plot at the outset, in company with a little son and a loquacious parrot. He probably thought himself a second Crusoe on an uninhabited island, and behaved as such.

HYDRO-PNEUMATIC GUN CARRIAGE.

We illustrate herewith, from *Engineering*, the revolving hydro-pneumatic gun carriage, especially designed for naval purposes. The engraving we now publish shows the perfected system in all its details, and indicates both the loading and firing position of the gun, which is mounted upon a revolving carriage. The circular travel described by the wheels upon the lower deck is 12 feet 9 inches, and at the upper deck the framework is free to turn round an inclined path 17 feet 6 inches diameter, upon which rollers set at an angle take their bearing, the revolving motion being effected by bevel gearing, as shown. Under the carriage is placed an hydraulic cylinder, the ram of which has a T-shaped head, and is provided with small rollers which bear upon the under side of the moving part of the carriage. In the lower part of the carriage, that which has no movement except a circular one, a vertical opening is left on each side, as shown, and these serve as guides for the ascending or descending ram, the end of the T-head, projecting through the openings on either side. Parallel links, the position of which, when the gun is in firing position, is vertical, are secured at the lower end to the bottom of the fixed part of the carriage, and at the upper end to the movable part, their motion being the same as the links in a parallel ruler, as the gun rises or falls. Connected with the hydraulic cylinder is a pipe leading to an air vessel, and having a valve chamber containing a spherical valve. A bye-pass pipe, which can be opened or closed by a lever from the gun platform, establishes an independent communication between the air chamber and that portion of the main pipe between the valve chamber and the hydraulic cylinder. In the rear of the air chamber is a small pipe for supplying water-deficiencies by leakage. The action of the mechanism is as follows: Water is pumped into the apparatus until the air in the air chamber is placed under a considerable pressure. When the gun is loaded, and it is desired to raise it, the opening of the bye-pass establishes a communication with the hydraulic cylinder, the ram of which rises carrying with it the gun. The valve is then closed, and when the piece is fired the recoil throws it back with a constantly decreasing velocity, due partly to the increasing resistance of the coupling links, and partly to the increasing pressure within the air chamber.



MONCRIEFF'S HYDRO-PNEUMATIC GUN CARRIAGE.

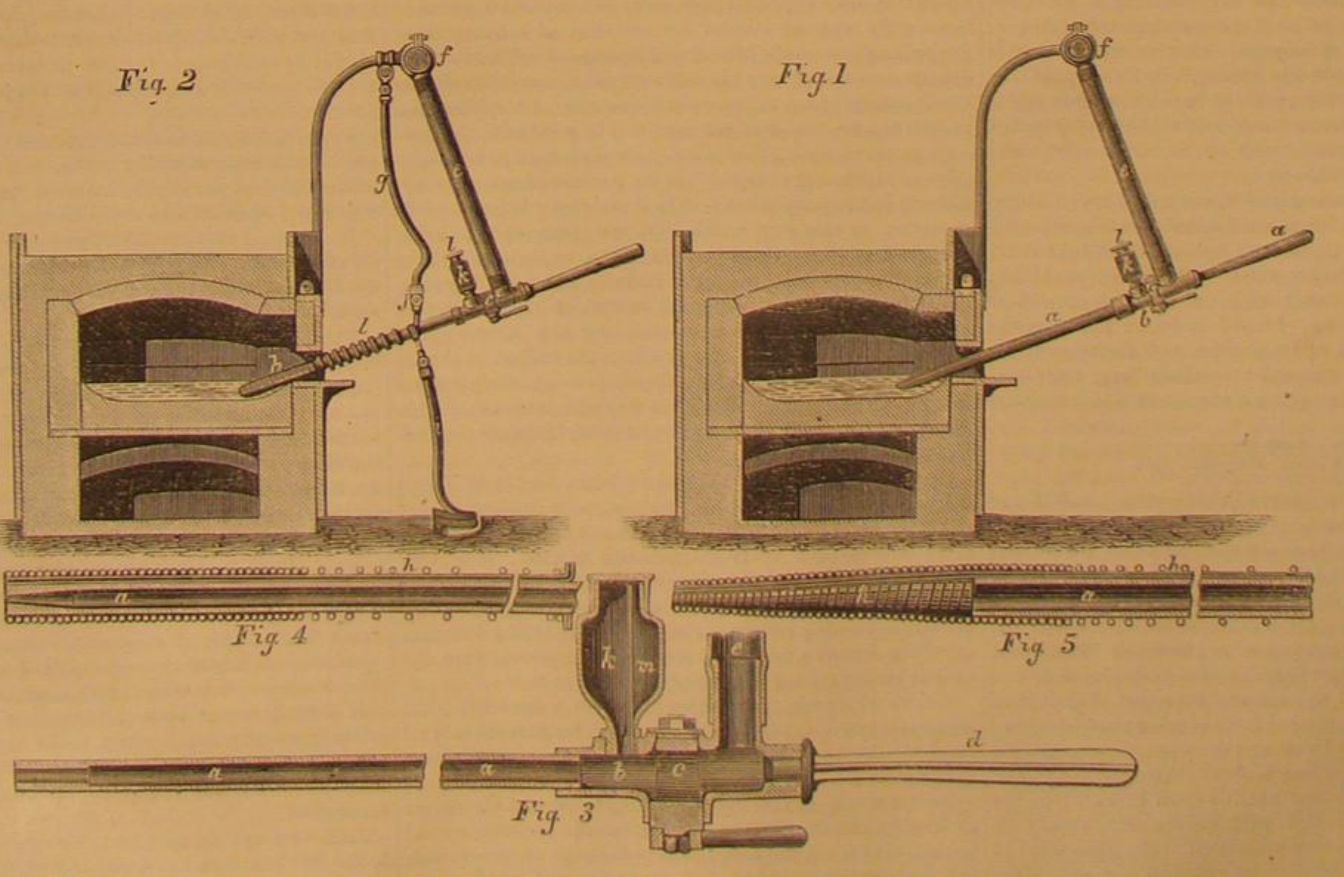
PONSARD'S IMPROVEMENTS IN APPARATUS FOR PUDDLING IRON, ETC.

[From Mechanics' Magazine].

According to this invention, just patented by Mr. A. Ponsard, of Paris, it is proposed to combine with a tubular stirrer which is suspended at or near its center of gravity so as to be easily manuvered a coil of pipe, which is made to closely surround the fore part of the stirrer, through which coil cold water is caused to circulate for the purpose of preventing the burning of the end of the stirrer. The stirrer itself is suspended by a flexible pipe or by a properly-jointed metallic pipe from an overhead fixed main pipe extending along any number of furnaces, and supplied with compressed air from a blower or other source, such air passing down the interior of the stirrer into the liquid metal in the furnace. A handle is fitted on to the rear end of the stirrer for facilitating the working of the same, and a stopcock is provided on the stirrer for regulating the passage of the blast therethrough. A second stopcock is also fitted on to the cold-water pipe in a position convenient to the hand of the puddler. The cold water is also supplied through a flexible pipe from a fixed main overhead, and is carried direct to the point of the stirrer, either by quick coils or by a straight length of pipe parallel to the stirrer itself, and then returns by a series of close coils back to the rear part of the stirrer, where it communicates with a flexible pipe for carrying off the water which has been heated by the metal in the furnace. The stirrer may either consist of a tube extending the full length required, or this tube may stop some distance short of the end of the stirrer, the remaining length being composed solely of the cold-water coils, before referred to, closely brazed together.

In order to facilitate the admixture of any of the well-known chemical reagents employed in the manufacture of iron and steel in a dried and pulverized state with the metal, a closed box or receptacle is fitted on to the stirrer, and communicates therewith, an air pipe being caused to enter the said box from the interior of the stirrer, so as to maintain an equal pressure therein and facilitate thereby the descent of the ordinary or any other suitable dried and pulverized chemical reagents into the tubular stirrer, whence they are forcibly expelled by the blast into the molten metal. The same apparatus may be used with a reverberatory furnace for making steel, and, so far as regards the arrangement of the coiled pipe, is applicable as an adjustable pipe blast or tweer in substitution for the ordinary water tweer. Figs. 1 and 2 of the engravings show in section the application of the improved rabble to a puddling furnace; Fig. 3 is a longitudinal section drawn to an enlarged scale of the rabble detached, and Figs. 4 and 5 show in longitudinal section on an enlarged scale two different arrangements for applying cold water circulation to the rabble. This rabble is composed, as shown in Fig. 1, of an iron tube, *a*, attached to a tube, *b*, which carries a cock, *c*, and a handle, *d*, for the purpose of manipulation. The tube, *b*, is by means of a flexible tube, E, placed in communication with a conduit, *f*, fed by a blast engine, which may serve to supply one or more puddling furnaces. The flexible tube, *e*, may be composed of metal and jointed, or of caoutchouc, leather, or strong cloth coated with caoutchouc, and provided with an external strengthening covering. It is arranged so as to form also a support to the rabble, and thus relieve the workman, who has simply to conduct it into the molten cast iron, the agitation of which is effected by the outlet of the air which escapes from the end of the rabble. In order to prevent the tube, *a*, from being injuriously affected by the high temperature to which it is subjected there is suspended at the side of the air inlet tube another flexible tube, *g*, Fig. 2, maintained constantly supplied with cold water from a reservoir, where it is compressed under considerable pressure. This tube is connected to the iron tube, *h*, which is laid along the rabble to its extremity, and then wound around it spirally and brought back to its starting point, where it is attached to another flexible tube, *i*, which serves to carry away the water which has become heated. A cock, *j*, is provided within reach of the workman for the purpose of regulating at will the rate of flow of the water in order to prevent its vaporizing in the tube, *h*. In the arrangement shown in Fig. 4 the inlet water pipe, *h*, is laid in a straight line along the rabble to its extremity, whence it returns in the form of spirals or coils towards the handle.

Fig. 5 shows a modification of the preceding arrangements. In this the iron tube which forms the hollow rabble is dispensed with at the end which enters the furnace, and the spirals of the water tube, *h*, are brazed and welded together, thus forming a rigid durable tube of themselves. Whichever arrangement may be adopted the rabble as it is constantly cooled by the current of water traversing over or around it cannot be deteriorated or burned by contact with the incandescent matters in fusion, or if so, only very slightly. The operation of puddling takes place in the following manner: After having melted the cast iron on the hearth of the furnace the workman lays hold of the hollow rabble by the handle, *d*, and after having opened the cocks, *c* and *j*, plunges it into the molten cast iron so as to submit every portion of the material to the action of the air in order to refine it. This operation may be arrested at any stage; thus it may be suspended at the desired point in order to obtain puddled steel, or prolonged to produce wrought iron. By the simple forms and arrangements adopted for this tool these various operations are facilitated and rendered more convenient; the rabble may be readily withdrawn in order to test the degree of refining of the cast iron. This method of puddling at a high temperature admits of the steel being run into ingots in lieu of withdrawing it from the furnace in blooms as in ordinary puddling. With this new mechanical puddler it will be advantageous to operate upon a hearth of silica for pure cast irons.



PONSARD'S APPARATUS FOR PUDDLING IRON, Etc.

for cast irons containing phosphorus to a marked extent it is desirable to operate upon a hearth of magnesia or of carbon agglomerated with lime, in order that it may be less liable to be effected by the basic matters which the puddling of these cast irons necessitates.

For pure cast iron it is evident that this system of puddling may be carried out with facility, and will give good results, but the greatest advantage that it presents is its application to the puddling of the common cast irons containing phosphorus, which it has been attempted to purify by the use of raw tartar and alkaline carbonates, nitrate of soda, chloride of sodium, hyperchlorites, and such-like reagents. But it is difficult to use these reagents in reverberatory furnaces, their relative volatility rendering the reactions very imperfect. The contact between these matters and the cast iron is purely superficial, and the stirring of the workmen cannot sufficiently remedy it.

The improved puddling apparatus or rabble admits of the whole of these reagents being used in a more efficient manner by driving them with the air in fine jets through the cast iron, thus multiplying with the orifice the points of contact. For the puddling of impure cast irons this puddling apparatus is provided with a distributing receptacle, *k*, fixed on the tube, *b*, as shown in the drawing. This receptacle may be composed of thin sheet metal or malleable cast iron, the upper part being by preference contracted, and the neck closed by means of a capsule, *l*, secured by a bayonet screw or other joint. The lower part terminates in a small opening of about 1-8in. diameter, through which the salts or reagents employed (which are contained in the receptacle, *k*,) fall into the tube, *a*. They are carried along the tube, *a*, by the current of air under pressure and driven into the molten metal. In order that the pressure of the air may not prevent the salts or reagents from falling freely a small tube, *m*, is provided and fixed in the receptacle, *k*, so as to admit of the entrance of compressed air into its upper portion. The salts employed should be thoroughly dried and pulverized. The method of operating with the distributor is exceedingly simple. The rabble being out of the furnace and the cocks, *c* and *j*, closed the workman raises the capsule, *l*, and inserts in the receptacle, *k*, the reactive or purifying agents (such as salts or oxides) to be blown into the furnace; he then closes the capsule, opens quickly the cocks, *c* and *j*, and introduces the rabble into the molten cast iron, into which the salts or reagents, which are carried along by the current of air, are forced in fine jets. When the whole charge has been forced in, the rabble is withdrawn from the furnace, the cocks, *c* and *j*, closed, and the receptacle refitted; after which the refining of the cast iron may be resumed. This operation may be renewed several times during the working of one charge, but this is left to the judgment of the workman.

In the puddling of cast irons containing sulphur or phosphorus it is desirable to remove the slag or scoriæ containing the sulphur and phosphorus, and to replace it by scoriæ free from such impurities, which may be effected either by introducing into the molten mass oxides of manganese or titaniferous iron ore forced in through the improved rabble. By operating in this manner the whole of the phosphorus in the cast iron may be removed and pure wrought iron produced from the most impure cast iron.

It will be readily perceived that this mechanical puddler facilitates the refining of the cast iron, since it relieves the workman of the more laborious part of the operation, and since the stirring or agitation is much more energetic by the injection of air than by the ordinary method; a saving of time is therefore effected; it admits of compressed air being applied in a practical manner to the puddling of cast iron and to the manufacture of steel in a reverberatory furnace; and of the employment of reagents, either as oxidants or as fluxes, by being forced into the furnace. By its adoption the quality of the wrought iron produced from phosphoric pig is greatly improved, and also a considerable saving, both in fuel and time, is effected, together with an increase in the daily yield of the puddling furnaces.

Either of the above arrangements, as applied to the rabble, is applicable to tweers for metallurgical furnaces, whereby their durability is increased to an almost unlimited extent, while the use of the ordinary water tweers is dispensed with. This arrangement of tweer with an internal current of water admits of its being plunged more or less into the furnace, and in general of its position and direction being varied without any deterioration resulting from their contact with the fuel or the molten materials in which they are immersed.

Oiling Farm Implements.

The Boston *Cultivator* gives the following sensible and practical advice to its readers:

"Every farmer should have a can of linseed oil and a brush on hand, and whenever he buys a new tool, he should soak it well with the oil and dry it by the fire or in the sun, before using. The wood by this treatment is toughened and strengthened, and rendered impervious to water. Wet a new hay rake and when it dries it will begin to be loose in the joints; but if well oiled, the wet will have but slight effect. Shovels and forks are preserved from checking and cracking in the top of the handle by oiling; the wood becomes smooth as glass by use, and is far less liable to blister the hand when long used. Ax and hammer handles often break where the wood enters the iron; this part particularly should be toughened with oil to secure durability. Oiling the wood in the eye of the axe will prevent its swelling and shrinking, and sometimes getting loose. The tools on a large farm cost a heavy sum of money; they should be of the most approved kinds. It is a poor economy, at the present extravagant prices of labor, to set men at work with ordinary old-fashioned implements. Laborers should be required to return the tools to the places provided for them; after using, they should be put away clean, bright, and oiled. The mold-boards of plows are apt to get rusty from one season to another, even if sheltered; they should be brushed over with a few drops of oil when put away, and they will then remain in good order until wanted."

Correspondence.

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

Boiler Explosions.

MESSRS. EDITORS:—Ignorance and stupidity still hang upon the minds of ordinary men respecting those perennial inflictions, known as "fatal boiler explosions." Unfortunately, much difference of opinion exists in the minds of the engineering community, regarding the cause of these disasters. The distinction between the bursting and the exploding of a boiler has not been defined with any degree of accuracy.

Some engineers are very fond of airing their ignorance, by asserting that when boilers burst nothing serious can result therefrom, save extinguishing the fires, and causing slight local damages to the boiler. To this too prevalent opinion there are strong reasons for not subscribing. Suffice it to say, that it is difficult to escape the conviction that much loss of life and property results from its general acceptance. Huge boilers of several hundred-horse power are often allowed to burn and corrode, for several years, without any examination whatever as to their condition. If the plates be so rust-eaten and corroded that a pocket-knife could be thrust through them without difficulty, the owner and those in charge of the engine and furnace, take the matter very quietly, comforting themselves with the assurance that the only danger connected with the management of a boiler is an explosion, and that due attention to the pump and indicator will always prevent that contingency. On the other hand, the act of bursting is a mere local affair, conveniently limited to the forcing of a rivet, or the rending of a tube, by which the elements of destruction are released in the most harmless and accommodating manner.

Some of these danger-scorning people will go so far as to affirm that there is no absolute necessity to overhaul a boiler, as it will always give timely warning of its rickety and dangerous condition, by bursting in that particular and commodious spot where it is weakest.

Has any one who has inquired into this subject, with any degree of thoroughness, a right to be surprised that boiler disasters are on the increase, when those directly concerned appear so devoted to the crab-like direction of progress in the matter? The most provoking peculiarities connected with the inquiries into these casualties are, that no one is to blame, and that the killing and maiming of a score or two of human beings are considered as circumstances belonging to the natural order of things.

There are, doubtless, many boiler casualties which are caused by ignorance and carelessness on the part of operatives; but it is scarcely going too far to say that most of the phenomena called explosions are simply the bursting or rending of boilers corroded and worn out by excessive wear. In this case the whole of the rickety fabric suddenly gives way under an increase of pressure, which a sounder structure could bear with perfect safety.

The system at present in use of embedding the large class of boilers in masses of solid masonry, should be unreservedly condemned, as it is the indirect cause of more than half the disasters that occur with such frequency. When a boiler cannot be thoroughly repaired without the necessity of disintegrating and pulling down walls of brick and mortar several feet in thickness, it requires no very blamable degree of suspicion that in nine cases out of ten no repairs will be made. A very dim idea, in fact, can be formed of the condition of a boiler under such circumstances, seeing that it is completely buried out of sight. "Out of sight, out of mind" is an ancient adage, not inapplicable to the present case. There are many boilers now in operation in this city which have not been overhauled or examined for many years, because much expense and delay would be incurred in "getting at them." The presiding functionary treats the matter in question with an indifference that makes a prudent observer tremble for the future. The opinion that is generally expressed on the subject is, that it will be quite time enough for a thorough overhauling when a flue, tube, or something else gives way and puts out the fires. Surely such an order of things imperiously demands legislative correction.

Some effective measures should be taken for the thorough inspection of boilers at stated periods, quite irrespective of the delay and cost which may be incurred by disemboweling them from massive layers of brick and mortar. It is said, with some truth, that wise men often quail at the very things which fill the thoughtless with a sense of security. The mode of managing boilers at the present day would doubtless afford the former a boundless source of uneasiness, were the subject looked into as searchingly as it ought to be.

Boilers which are "bricked up" present a neat and compact appearance, and it is too often taken for granted it is all right within, when the demon of devastation may break loose at any moment.

Boilers should be thoroughly covered to prevent the escape of heat by radiation and convection, but the covering should be such that it can not only be easily removed when required, but the material should be such that steam can readily penetrate so as to expose leakages. There is evidently an opening here for improvement, and any one who can successfully fill it will be entitled to rank among the benefactors of mankind.

C. M. O. HARA, C. E.

Gas and Air Carbureters.

MESSRS. EDITORS:—The want of a safe, reliable, cheap, convenient, and stationary method for domestic illumination, where heat is not a means of production, and the great number of, and increasing patented contrivances therefor, prompt me to respectfully submit the following remarks upon this highly important subject:

A consecutive history of the progress in carbureting illuminating gas and air would be most interesting, but would require more space than is designed for this paper.

More than forty years ago the late and world renowned Mr. William Clegg, of London, who first practically introduced commercial gas, tried several plans to increase its illuminating power by combining it with the vapors of some light hydrocarbon, and for some years after those trials other persons atempted it. Yet, while several were, like Mr. Clegg, temporarily successful, all of them finally abandoned it.

About the year 1848 the late eminent and widely known Mr. Charles B. Mansfield, also of London, succeeded in carbureting atmospheric air, but he was compelled to manufacture his naphtha "benzole," a distillate from coal tar, by a new process. His invention was made public at the time, but was found too expensive for general introduction. Other inventions were patented subsequently for the same use, but practical objections, more or less serious, were found to all of them.

Up to the year 1858, the hydrocarbons to be obtained were either charged with some non-volatilizable property, or, if pure, were made in limited quantities, and they were expensive and difficult to obtain. But after the improved method for distilling petroleum, coal tar, etc., by gradual heat and distinct vaporization, then those naphthaline products were first obtained in a condition of purity, quantity, and cost, to warrant the popular introduction of carbureters, which had increased in variety, in this country and Europe, since the year 1865 for treating either common gas or air. Embarrassments are, however, still encountered in the attempt to treat either gas or air in this way.

The carbureting features of the various systems employed consist of four classes, each being enveloped in a close vessel.

First. Where the medium to be carbureted passes directly into the fluid by a series of small openings from the conducting pipe, and thence to the service pipe.

Second. Where it passes into and through some absorbing porous medium, as sponge, cotton, wool, shavings, pumice stone, etc., which is saturated by the fluid, in some cases by capillary attraction from a shallow reservoir below in which it rests, and in others where the fluid is allowed to fall or trickle upon the mass from above.

Third. Where it passes over a series of shallow trays or channels lined with a warm fabric that is kept saturated automatically with the fluid.

Fourth. Where a woven or a spun fabric or a fibrous woody material is arranged in a regular fixed position, and either stands in or upon or is rotated in the fluid below it.

In all of which systems the result is that the vapors of the fluid are mixed, with more or less facility or uniformity, with the gas or the air which passes through the instrument.

The difficulties have chiefly arisen from the following causes:

First—Quality of the fluid. The hydrocarbons obtainable were charged with oily or resinous matters, which, collecting in the apparatus, rendered it inoperative until cleared of its contents.

Second—Uniformity of pressure and size of flame. This difficulty particularly pertains to carbureters for commercial gas, the pressure of which is only equal to a column of water about three inches high: hence its passage through the instrument should be quite unobstructed, the size of the burner should be enlarged, or the gas pressure increased, which latter will tend to induce leakage at the joints of gas pipes and fixtures.

This difficulty is, however, modified by the fact that if the gas be well and uniformly carbureted, the light thus being intensified does not require a size of flame to produce a light due to the standard size of the burner.

It is found this trouble of pressure applies often, also, to air carbureters, owing to their construction, which impedes the flow and varies the size of the flame, as more or less burners are worked.

Third—Tendency to surcharge the gas or the air with the vapor, and its condensation in the pipes. As the volume or density of the vapors taken into the pipes is always due to the temperature of the medium passing into the carbureter—the mixture being mechanical, only—and while the higher the temperature the greater is the load this medium will take up, it follows that if after leaving the instrument the temperature be lowered, as is often the fact, a due proportion of those vapors must separate there and accumulate.

They finally trickle down and along to the burners, so that on turning the cock and applying the match, you will have, instead of an upward flame of gas, a downward stream of liquid fire, igniting all combustible matter within its reach.

Fourth—Refrigeration. A result of all evaporation is refrigeration, and this causes, with most carbureters, a diminution of temperature upon their exteriors, so that when in a cellar or other place holding moist atmosphere, water becomes condensed upon the apparatus and frozen there as solid ice, to the detriment, and often involving the safety, of the instrument.

Fifth—Safety. In addition to the insecurity, as represented in the two last mentioned difficulties, are others attending the charging of fluid to the apparatus, and the necessity of skilled attendants, which embarrassments or hazards from the use of this class of inventions have induced combined opposition to them from our most respected and powerful underwriters.

SUMMARY.—The following are essential requisites to the successful use, safety, and convenience of apparatus for naphthalizing of gas or air for illuminating or for heating purposes:

First. The apparatus should be substantial, not liable to derangement, simple in construction, requiring no special skill in its management, easily taken apart, readily put together again, and uniform in its action.

Second. It should present the largest possible surface for evaporation for its bulk or cubic contents, and be safe or doubly safe against any possible accident from leakage of gas or naphthaline, with facilities for charging it readily, without risk of escape of fluid or vapor, and by the least possible trouble.

Third. Its construction should be such that the pressure of the medium entering the apparatus should not be diminished at the outlet pipe, so that the size of flame will always be the same, irrespective of the number of lights used within the capacity of the instrument.

Fourth. It should be provided with a surrounding air chamber of a non-conducting medium to avoid the accumulating of intense cold on the exterior of the apparatus, insuring a depressed temperature to the vaporized medium below that to be assumed by the gas or mixture after entering the service pipes.

Fifth. The fluid should leave no residue or deposit when evaporated.

Sixth. Its cost to consumers should be within the reach of persons of moderate means.

The time has arrived when this important category of economic art should take its proper rank of usefulness and value in popular domestic comfort and economy, and also those branches of trade where in heating with gas it must be found indispensable. J. BURROWS HYDE.

Carpenters Poisoned by Chemicalized Wood.

MESSRS. EDITORS:—The St. Louis, Vandalia & Terre-Haute Railroad Co. have just finished building a freight depot in this city, the timbers—shingles included—of about half the building were saturated with a poisonous compound—arsenic, corrosive sublimate, and salt. If anything else, I do not know.

Inclosed is a slip of newspaper containing an account of the death of one of the carpenters employed on the building:

"Levi Willison, one of the men poisoned sometime since by working on the timbers and shingles of the Vandalia depot building, which had been saturated with some chemical preparation to render them non-combustible, died yesterday. No inquest was held. Another workman, whose name we could not ascertain, is not expected to recover."

Nearly all the carpenters were in a condition similar to the patients that are to be seen in a venereal hospital. The genital parts were most affected. Perhaps he poison would not affect them so if the work was done in cold weather. The timber so prepared will only smoulder away when put in a fire—no blaze.

I consider the inventor anything but a public benefactor unless he can invent some means to save the workmen. The harm outweighs the good. JOHN O'CONNELL.

East St. Louis, Ill.

[We wish our correspondent would ascertain and inform us whose process was employed in the preparation of this timber.—EDS.

Mississippi State Fair.

MESSRS. EDITORS:—You were kind enough to announce in June that our State Fair would be held Oct. 10th. The time was soon after changed to Oct. 24th, so as not to conflict with the St. Louis and Memphis fairs, from which points we expect many visitors.

The Mississippi State Fair will open at Jackson on Monday, Oct. 24th, and will continue to include the Saturday following. Machinery can be entered and placed in position after Oct. 15th. We are well prepared for a grand exhibition of the industry of our State, and there will be thousands of planters here to note what is new and useful in the way of agricultural implements, machinery, etc.

We are pleased to know that the SCIENTIFIC AMERICAN will be represented by Prof. Colton, from whom we have had the pleasure of a call. I. L. POWER.

Jackson, Miss.

FORTIFICATIONS AND HISTORY OF STRASBOURG.

This city, the capital, in old times, of the half German province of Alsace, and now the capital of the department of the Lower Rhine, boasts its five hundred cannon and its eighty-two thousand inhabitants, and is one of the strongest fortresses in France. It stands on the Ill, about a mile and a half from the broad Rhine, and the stream beside which it is built intersects it with many channels.

Louis the Fourteenth, in 1681, always unscrupulous in his ambition, got possession of Strasbourg, which was then a free imperial town, by an unexpected foray upon it during a time of peace. It was the ambition of France, even then, to extend her Rhenish frontier and push Germany further back. Vauban instantly set to work to secure the conquest by strengthening what was weak, and increasing what was already strong. He built a pentagonal fortress or citadel of five bastions, besides five sluice houses, whose outer works extend to the arm of the Rhine. He gave this stronghold—which will hold seventeen hundred and fifty men—the motto, "Servat et observat." He also constructed large sluices at the spot where the Ill enters the town, so as to lay the whole country round, between the Rhine and the Ill, under water, in case of need. On the side of the Porte-des-Mines, which could not be inundated, the glacis was mined. The arsenal contains—or did before the present war—arms and equipments for nearly four hundred thousand men, and it has also nine hundred and fifty-two cannon, including the five hundred and fifty required for the ramparts and for the citadel. To all these resources of the semi-German town, facing the Duchy of Baden, we must add a cannon foundery, which, every year, produces three hundred pieces of artillery of various calibers, and boasts one furnace that will contain twenty-six thousand four hundred kilogrammes. The town, as a military center, also possesses eight barracks, sufficient for the accommodation of ten thousand men, a military hospital, built for twelve or eighteen hundred beds, and used, since 1814, as a military hospital school. The stronghold is also the seat of a regimental school of artillery, under the command of a general. It is impossible for the traveller to forget, when in Strasbourg, that the town is an important fortress, for all the seven gates are shut in the winter at eight, and in summer at ten o'clock, though diligences are allowed to enter later, as well as travelers by post or steamboat.

The greatest modern event that has taken place at Strasbourg was the wild attempt at an insurrection made in that city by a certain Prince Louis Bonaparte—a man not yet altogether forgotten—on the 30th of October, 1836, the year Charles the Tenth died. The misguided prince, son of Louis, the ex-King of Holland, had been educated in Switzerland, and was a captain of artillery in the army of that country. Having entered into a treasonable correspondence with Col. Vaudry, of the Strasbourg garrison, who gained over a few of the men, and filled the adventurer's mind with too sanguine hopes, the prince came to Strasbourg to fire the train and try for the throne. On the morning of the 30th of October, the prince, dressed as like his uncle as possible, and wearing decorations and a cordonrouge, proceeded to the barracks. The zealous colonel, assembling his men instantly, told them, with great alacrity in lying, that there had been a revolution in Paris; that Louis Philippe was no more; lastly, that Napoleon the Second, a descendant of the "great man," had been proclaimed; and that there, in fact (pushing forward the prince), he stood before them. The coup de théâtre succeeded for the moment. The soldiers, pleased at the remarkable attention paid to them by the new emperor, shouted and followed him as their commander. The prefect was arrested in his bed, and a guard was placed over him. A body of the mutineers, led by a Colonel Pargin, then marched to the house of General Voirot, the commander of the division, and requested his allegiance to the new chief. The general, however, calmly addressing the soldiers, soon convinced them that they had been tricked. The general, being then set at liberty, at once secured the citadel.

In the mean time, the emperor of an hour and his zealous colonel had proceeded to the barracks of the Forty-Sixth Regiment, and tried the old plan. But an aid-de-camp of General Voirot gave notice to the colonel of the regiment, who, going to the barracks, found the prince and his plotters reasoning with the soldiers, and trying to gain them over. The colonel was prompt; he at once closed the gates, and trapped the whole party. General Voirot then, having released the prefect, came down from the citadel, and carried the prince and his accomplices straight to prison. The minor conspirators were tried and punished, but the arch plotter, treated in a generous and somewhat contemptuous way by Louis Philippe, was packed off from L'Orient to the United States, on the 21st of November, in a French frigate. Singularly enough, a similar attempt was made at Vendôme on the very same day by an hussar sergeant, who wished to proclaim the rights of man, arm the pioneers, and march on Tours. He shot a brigadier who tried to arrest him, and then gave himself up. He was condemned to death.

The choicest promenades of Strasbourg are beyond the enceinte. The two finest are called the Contades and the Robertsau. The latter is composed of huge lawns, intersected by walks designed by Le Notre, Louis the Fourteenth's great gardener, of a splendid orangery (twelve hundred trees), where the Empress Josephine lodged in 1806 and 1809, of an English garden, a suspension bridge that leads to the Isle of Wacken, and of a smiling and coquettish village.

The two great celebrities of Strasbourg, besides the immortal but unknown discoverer of the pâté, are Kleber, Napoleon's general, and Guttenberg, the supposed discoverer of printing. A monument to Kleber stands in the center of the square named after him, and is raised over the hero's body, originally interred in the minster. This brave man, who, after many victories in Egypt, was assassinated by an Arab fanatic under a tree still shown in a garden at Cairo, was much esteemed by Napoleon. "Kleber sometimes sleeps," he said; "but when he awakes it is the awaking of the lion." There was a little of the German unreadiness and phlegm about this brave Alsacian until battle roused him. He was never seen at his best but when under fire.

Guttenberg, who practiced printing as early as 1436, at Strasbourg, perfected his invention at Mayence. His assistant, Peter Schöffer, who made metal letters with even greater success than his master, was a native of Strasbourg. The statue of Guttenberg in the herb market, now called the Place Guttenberg, was modeled by David.

But the wonder and delight of Strasbourg is the cathedral—one of the masterpieces of Gothic architecture. Founded by Clovis, in 510, reconstructed by Pepin and Charlemagne, destroyed by lightning in 1007, it was rebuilt in 1015 by Erwin de Steinbach, and finished in 1413 by Jean Hultz, of Cologne, after the tower had been four hundred and twenty-four years incomplete. According to tradition, ten thousand workmen toiled at the holy work for the good of their souls, "all for love, and nothing for reward."

An epitome of Gothic art, this cathedral contains specimens of every style, from the Byzantine upwards. Heaven send it a safe deliverance from Prussian shot and shell; let the gunners aim wide of that noble, heaven-piercing spire, which, according to the best guide books, rises four hundred and sixty-eight feet above the pavement—that is twenty-four feet higher than the great Pyramid—and sixty-four feet higher than St. Paul's, the body of the church itself being higher than the towers of York Minster. The view from this network of stone repays the giddiest person. Beyond the dull red roofs, and the high-roofed and many-windowed houses, spreads the whole country of the Rhine and Black Forest, and on the side of France you see those Vosges Mountains, that might have been held against the world. Hope describes the netting of detached arcades and pillars over the west end of the cathedral to be like a veil of the finest cast iron, so sharp and bright is the carving of the durable stone; while Dr. Whewell, comparing the building to an edifice placed under a rich open casket of woven stone, laments the sacrifice of distinctness from the multiplicity and intersection of the lines. The triple portal is peculiarly fine, and is, in itself, a world of quaint statues, and bas-reliefs. The middle arch is adorned with no less than fourteen statues of the Old Testament prophets; on the right arch are the Ten Virgins, and on the left the Virgins treading under foot the Seven Capital Sins. In the Revolution these carvings were destroyed, and the great brass doors melted down into money, but they have been restored with a most reverential care. The choir is plain and simple Romanesque, but the nave is the choicest early decorated German Gothic. The town's special treasures are the fine stained windows of the Fourteenth Century, recently restored (spare them, gentle gunners), the vast marigold windows, and the famous astronomic clock, one of the wonders of Europe, comprising a perpetual calendar, a planetarium on the Copernican system, and shows the hour, the day of the week, the month of the year. It was made in 1571, and, after standing still for fifty-six years (a good rest), was repaired in 1842 by a mechanician of the town. This part of the cathedral is supported by a single pillar of great symmetry, and above the Gothic cornice appears the effigy of Erwin de Steinbach, the architect of this vast building, whose tombstone was discovered, in 1855, in a humble little court behind the chapel of St. John. In an old house at the southwest corner of the Minster Platz there are preserved some curious ancient architectural drawings belonging to the cathedral.

The church of St. Thomas (Protestant) deserves a visit for its fine monument of Marshal Saxe, which cost the sculptor, Pigalle, whom Louis the Fifteenth employed, twenty-five years' labor. It represents the old warrior descending to the grave. France, a female figure, tries in vain to deter him, and, at the same time, to repel Death. Theatrical, say the critics, and French, but the expression of affection and anxiety in the woman's face is very tender and touching. This monument would have been destroyed by the revolutionary iconoclasts, had not a Strasbourg man named Mangelschott, when the church was turned into a straw warehouse, covered it up with bundles of hay. They also show in this church the mummies, curiously preserved, of a Count of Nassau Searwerden and his daughter.

The Jews of Strasbourg have now a splendid synagogue. In the middle ages they went through much here. In 1348 there was a wholesale holocaust of these poor wanderers, for two thousand of them, suspected by the ignorant citizens of poisoning wells and fountains, were burned in the Brand Gasse, where the Prefecture now stands. Rage and fear had seized the people and no Jew was henceforward allowed to sleep within the walls. Every evening, at the signal of a horn blown on the Minster Tower, the detested people were compelled to depart to their houses in the suburbs. The new church contains fragments of a Dance of Death, that grim allegory carried at last to a climax by Holbein.

The Academy, originally a Protestant school, formed in 1532, and made a university in 1621, was suppressed at the Revolution. Here the good Oberlin and Schöpflein and Schweighauser, and last, but not least of all, Goethe, studied. Goethe took his doctor's degree here in 1772. The Museum of Natural History is rich in Alsacian fossils, especially those of red marl and trias, and the fossil plants found at Sultz-les-Bains and Mulhausen. The botanical collection includes a section of the trunk of a silver fir from the Hochwald, near Bair; its diameter was eight ft., its hight one hundred and fifty.

The public library, near the new church, contains one hundred thousand volumes (be merciful to these treasures, too, O amiable artillerymen)! Among the priceless curiosities are the Landsberg Missal, or Garden of Delights; it is full of early Byzantine miniatures, circa 1180, and belonged to Herrade, Abbess of Stohenberg. Among the early printed books are Cicero, by Faust, 1465, a Strasbourg Bible, by Eggesteur, 1466, and a Mentchin Bible, printed at the same place in the same year. In the two halls are stored some Roman antiquities found in Alsace, the old town standard of Strasbourg, a statue of Rudolph of Hapsburg, and some painted glass from Molsteins. The hope that all these treasures may escape the chances of war will not be confined to students alone.

[Since the above was in type, Strasbourg has capitulated, and is now occupied by the Prussian forces. The defense was very stubborn and heroic.

THE work of erecting a water battery on the south side of Governor's Island, between Castle William and the South Battery, is now going on under the direction of General Newton and Colonel Eggleston. The battery will be mounted by thirty six guns, and will be in every respect a formidable work.

LEMONADE can be cheaply made from citric acid and water flavored with essence of lemon.

Improved Damper Rings for Stoves and Flue Kettle.

These improvements consist in an arrangement of the flues of stoves in connection with dampers on the cover rings, and a flue kettle hereinafter described.

Fig. 1 is a view of the top of a stove provided with these damper rings. Fig. 2 is a diagram showing the walls of the flues, and the way the damper rings act to direct the course of the flame and hot gases. Fig. 3 is a view of one of the damper rings with a part broken off to show how the improvements may be applied by manufacturers to any stoves in use, by a very slight alteration of the patterns described below.

We shall describe only such parts of the stove as are necessary to explain the action of the damper rings, and the flue kettle.

A, Fig. 2, represents the partition walls which divide the space under the top plate into compartments or flues, communicating with each other by openings, B, when these openings are not closed by the dampers of the rings, as shown at C.

One of the damper rings is shown at D, Fig. 1. It is made like the ordinary ring except that it has cast thereon a descending damper, E, which, when properly turned, stops one of the openings, C, as shown in Fig. 2.

It will be seen that this arrangement enables the flame to be carried around under the kettle holes just as may be desired, heating or cooling parts, or the whole of the top plate, and applying the heat in the most efficient and economical manner, and also in conjunction with the side flues, F, carrying the heat to the oven or the smoke pipe at the will of the operator.

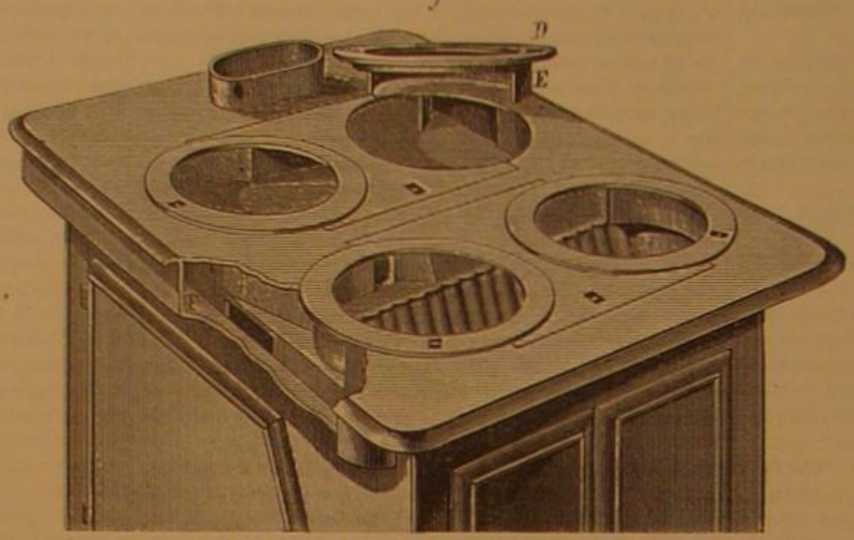
The flue kettle is shown in Fig. 4, with a portion of the outer shell broken off to show the internal construction. It will be seen that it consists of an outer and inner shell inclosing an annular space divided by a vertical partition, G. The bottom of the annular space is closed by a bottom wall except at the openings, H and I. A special damper ring is employed with the kettle, having the damper made as shown at J, forming a sort of chute through which the gases descend to the stove flues after having passed up through the aperture, H, and around the inner wall of the kettle, the inclination of which causes the gases to impinge against it, and heat it very effectually.

The kettle may be made of cast or sheet metal, and will, we think, be found a convenient and economical utensil. The inventor states that he can boil its contents very much quicker with the same fire than in a kettle of the ordinary construction.

The damper ring used with the kettle is provided with stops which secure its rapid and accurate adjustment. In stoves of any pattern this kettle can be used in connection with its ordinary furniture by putting in the proper partitions under the top plate, and altering the pattern of the top plate so that one side of the hole is cut out as shown at K, Fig. 3, say, one quarter of an inch. This amount of cutting will not unfit the hole for the common furniture, while it will allow the flue kettle and damper rings to operate.

Patented, Jan. 25, 1870, by Charles Van De Mark, whom address for further information, at Phelps, N. Y.

Fig. 1



VAN DE MARK'S DAMPER RINGS.

Fig. 2

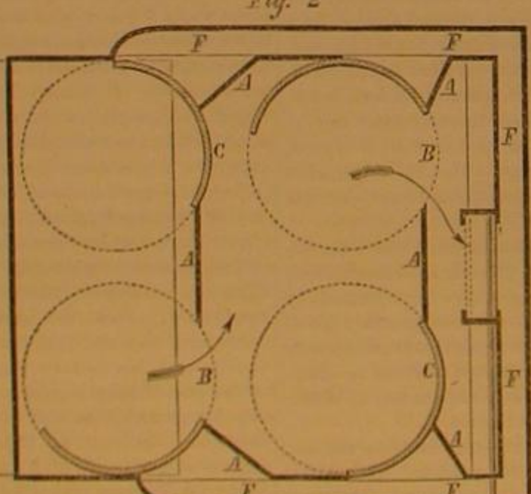


Fig. 3

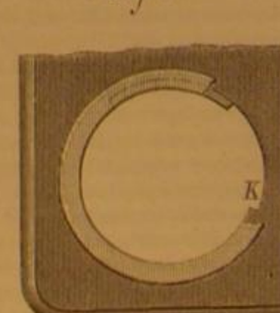


Fig. 4

Iron Girders.

Beams or girders of any kind are acted on by weights placed on them at stated places, inversely as the square of the distances of such places to the supports; thus, taking a length of 6 feet and another of 12 feet from one common support to one girder, it will (supposing it to be equally strong throughout its length) support more on that place the position of which will, when squared, be less than the square of the other place, having its distance from the nearest place of support greater. As, for instance, the one being 6 feet, which, when squared, is 36, and the other 12 feet, which, squared, gives 144, and 144 being four times 36, then, as these are to be taken inversely, the place that gives 36 will bear four times the weight that the place squaring 144 will do.

Now, commencing with the unit one, and taking a piece of iron which shall be two feet long between its supports and one inch square, and, say, that will sustain at one foot from its supports four tuns (breaking weight) then the square of one is one. Then, suppose we want to support the same weight at, say, 10 feet from the supports, then the square of $10=100$, and, as we have seen, the square of one is one; therefore, on the inverse principle, our one inch square iron will be of $\frac{1}{100}$ the necessary strength. Now, it also happens that the strength of beams increases as the square of their depths; and so, if we make the depth of our beam so that it shall square 100 times its present square, we shall, so far as strength is concerned, have effected our object, making in this the one inch deep the unit, then the $1^2=1$, as before, and $10^2=100=100\times1$, which gives us our original strength, theoretically, but not necessarily practically; for it would require some means to give it lateral stiffness; this must be done by reducing the depth and increasing the breadth, so as to retain the same strength. Now, it is evident that if two separate beams of the same dimensions be placed side by side, they will bear twice the weight that one will; and, therefore, one beam equal in size to the two will bear the same weight, provided there be not a faulty place in such beam, which, were it to occur in one of the two smaller ones, could not reduce more than half the strength of the two taken together; and consequently a beam will increase in strength in proportion to its breadth.

Now, as a beam increases in strength as the square of its depth, it will be found that doubling the depth of any beam must quadruple its strength; but to double its breadth only doubles its strength; then, not considering lateral action, any beam may be made twice as strong by doubling its depth and taking half its width away *ad infinitum*. This will not do practically, but as the proportion of the breadth to the depth is in a measure dependent on circumstances, no exact rule is invariably given, and in cast iron girders the areas of the flanges may alone be given.

If a girder should break, the lower part will be torn asunder, and the upper part will assist the tensile strength of the lower in proportion to its capability to resist compression. In cast iron this is said to be about six times as great as its power to resist tension; therefore it appears advisable to have in the lower part six times the metal there is in the upper; this would, at first sight, suggest a section to be, say, seven inches deep and one inch wide at top, and six inches wide at bottom, being in form like a perpendicular section through the imaginary apex of a truncated pyramid, but here we should have a great quantity of metal in the center doing little or no service. It will be economy to remove it, and to have the usual form of top and bottom flanges—the bottom being six times the area of the top; but then, this is to carry a load on the top, but when it becomes desirable to place the load on the bottom flange, then that flange would be liable to be broken off sideways from the web unless it would resist a pressure in that way greater than the strength of the girder; and when we come to consider that this flange will be acted on only in places, and in these with a corresponding increase of weight, we shall at once see that, to prevent portions of the bottom flange from being broken out at those places, an increase in depth or thickness of the bottom flange must be necessary; but, at the same time, it would appear probable that the counteracting influence of the two flanges would remain undisturbed by the weight being on the lower instead of the upper flange, provided that the lower flange remained uninjured by the weight; and if this be so, then it is probable that the differences in proportion of the flanges under the differing conditions of the weight being on the upper or lower flange, is a question deserving of actual trial and experiment, to enable us to know what weight would really break a piece out of a bottom flange of say two inches in thickness; it would appear, however, that the lower flange, when carrying the weight, should first be made to sustain its weight, and the upper one made to correspond to the usual proportion, which would appear in that case to necessitate a larger area of section. But in using any formula we should remember that the varieties of iron are widely different in their properties.—*The Builder.*

Steam Road Rolling in England.

The steam road-roller, says the *Engineer*, has now been more or less in use in Paris for the last ten years. In carrying out their six years' contract with the Paris municipality the engines of the contracting company there have already olled down nearly half a million of cubic yards of road metalling. That the interests of the users of the roads whether human or equine, are fully served, is evident to the most casual observer amongst the visitors of that beautiful city. Knowing many European capitals, we feel free to say that the Paris roads are unequaled, whether for their regular and smooth surfaces, their precise contours, or their freedom from mud in winter and dust in summer. It has been officially estimated that the diminution in draft due to the steam rolled surface saves an enormous annual sum to Parisian owners of horses and vehicles. This is easily accounted for when we remember that the draft on loose metalling is five times more than where the stones have been "run in" by the traffic; and that draft progressively rises to this five-fold amount on patches in varying states of consolidation.

Apart from equine and vehicular wear and tear caused by increased draft, it continually happens that horses are injured on the loose sharp stones by spraining the joints of their legs; especally on stones of too large a size to be consolidated by the comparatively narrow and light fellies of ordinary vehicles.

During this very season we know that more than one wealthy carriage owner proposed to bring actions for damage done in this way to horses passing on the macadamized part of Piccadilly. Still, much as West-end people object to loose metalling, they prefer its occasional appearance to the dangerous slipperiness of stone setts. No rider with any care for his own neck or his horse's knees will, if he can help it, ride over pavement. There are qualities in which a macadamized road must always excel paving. It is cheaper to lay down, it gives a better foothold, and it is free from the fearful noise of paved setts.

At first sight it might be expected that such roads as in Paris must be dearly paid for in maintenance. In England, at any rate, consolidating roads by rolling is looked upon as merely a luxury for parks and pleasure grounds; as it is believed that common vehicles roll roads down at no cost to road maintainers. In all probability road rolling was thus regarded when first used in France and Prussia; or, at the most, it was hoped to prevent injuries to horses, vehicles, and harness. But the virtue here displayed was found to be its own reward in the form of much saving in maintenance. It was in our pages that attention was in England first markedly drawn by Mr. Paget to the waste of metalling on unrolled roads, and generally to the great economical advantages of the process. From seven estimates, formed at different times, under the most varying circumstances, by different engineers—amongst whom are Field-Marshal Sir John Burgoyne, the engineer of the Seine Department, and Mr. Holmes, the Sheffield borough engineer—an average of 40 per cent saving in metalling can be proved to be produced by the imperfect process of horse road rolling as against traffic rolling. Now the experience of the last ten years in Paris, as compared with the experience of the previous thirty years or thereabouts, since horse rolling was adopted, has shown the French engineers that the steam rolled roads last twice as long as horse-rolled roads; or, in other words, while the horse roller diminishes road maintenance by 40 per cent, the remaining 60 per cent of any total to be expended, when no rolling is used, is itself brought down by one half where the steam roller is applied.

An Immense Irrigating Canal.—The Colorado *Tribune* of September 7 says: "Engineers go out on Monday to commence the surveys of one of the grandest enterprises for the improvement of an unsettled country that ever secured the attention of man. This is no less than the building of a gigantic irrigating canal, more than 100 miles in length, commencing in Platte Cañon, before the river debouches upon the plains, and extending to the head of the Republican River, in the eastern part of the territory. This immense canal will irrigate no less than *three million acres of land*, now useless except for stock purposes, and will be, if constructed, the means of making a place where a million people may find homes. The money to pay for the survey is raised, and the parties pushing it on can control the means to build the canal."

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NEW YORK, SATURDAY, OCTOBER 8, 1870.

Contents:

(Illustrated articles are marked with an asterisk.)

NAVAL ARCHITECTURE AND ENGINEERING.

A cotemporary remarks that "the loss of the British iron-clad *Captain* is an event that cannot fail to exert an important influence on naval architecture in the future," and there is no doubt of the truth of the remark. Within the last ten years there has been something almost constantly turning up or going down, to modify naval architecture.

This is not to be wondered at. The transition from wood to iron, as the material for the construction of war vessels, could scarcely have been accomplished without some failures and disasters. To suppose that it could, would be to suppose engineers incapable of error, iron incapable of penetration by shot, and the power of invention to devise means of attack, to be inferior to the same talent in devising means of defense.

There have, therefore, naturally been many mistakes made, as well as modifications necessitated by the continued improvement in the methods and instruments of attack.

The *Captain* seems to have been one of these mistakes. Her enormous weight of armor appears to have rendered her unfit to endure heavy weather. The query now arises whether such enormous weight of metal can be made by any modification of model compatible with good sea-going qualities in a ship. We do not believe any one is yet prepared to give a satisfactory answer to this question. There is no end of theorizing, and plenty of men will be found to take the affirmative, as well as the negative side in the debate, but experience with heavy iron-clad vessels has been such as to rather emphatically point to the negative as the ultimate decision of engineers. The advances secured in the weight and penetrating power of artillery seem to necessitate even as great or greater weight than that of the *Captain* in order to withstand the now well-nigh irresistible force of projectiles.

One serious difficulty in practical experiments with such vessels, is the enormous expense attending them. The *Captain* must have cost the British Government nearly or quite as much as a fleet of wooden war vessels. It is impossible, therefore, that in the race for naval supremacy such rapid progress can be made as some seem to expect. Some of the blunders committed, however, seem certainly too gross for the present state of knowledge on this subject.

For instance the French naval squadron, especially designed for service in the Baltic, has been found to draw too much water for that service, and has been withdrawn from it.

The Prussians have employed well known means to render difficult the navigation of the shallow waters on the south Baltic coast. The usual lights have been extinguished, and false lights substituted, and the inlets and entrances to rivers filled with torpedoes, and protected by light-draft gunboats which can run where the French ships are totally unable to follow them. Think of ships drawing from twenty to thirty feet of water sent upon such a service.

Of all the blunders committed by the French in the initiation and conduct of the present war, scarcely anything can exceed this. France has expended vast sums in experiment and in construction to produce a formidable navy that is at-most worthless to her in her present crisis.

England made a similar blunder in the Crimean war. She also sent to the Baltic a fleet of heavy-draft vessels, which proved of no use, yet with this lesson of history so recently learned and written, France has followed the example of England with the same results. How long is it to be before naval constructors will learn that only light-draft vessels are fit for such service.

But then here comes in the difficulty. To make formidable iron-clads of light-draft seems almost an impossible problem.

A NEW ARTIFICIAL LIGHT.

One of the arguments employed in our works on chemistry to prove that the atmosphere is a chemical mixture and not a true compound is derived from an experiment upon the solubility of air in water. Roscoe says, in his admirable treatise:

"When air is shaken up with a small quantity of water, some of the air is dissolved by the water; this dissolved air is easily expelled again from the water by boiling, and on analysis this expelled air is found to consist of oxygen and nitrogen in the relative proportions of 1 and 1·87. Had the air been a chemical compound, it would be impossible to decompose it by simply shaking it up with water; the compound would then have dissolved as a whole, and, on examination of the air expelled by boiling, it would have been found to consist of oxygen and nitrogen in the same proportions as in the original air, viz., as 1 to 4. This experiment shows, therefore, that the air is only a mixture, a larger proportion of the oxygen being dissolved than corresponds to that contained in the atmosphere, owing to this gas being *more soluble in water than nitrogen*."

It is somewhat remarkable that no practical application of this experiment has been attempted until recently. The principle above enunciated is now applied to the manufacture of oxygen from the air. By compressing atmospheric air into receivers filled with water, more than the usual quantity of oxygen will be dissolved, and the dissolved air can be forced into a second and third receiver, becoming each time more and more rich in oxygen, until an atmosphere is finally obtained that consists of 90 per cent of that gas. Some use for the nitrogen may be invented, but at present it is of little value. It is probable that this method will eventually prove the cheapest for the manufacture of oxygen. Experiments have established the fact that an atmosphere containing 50 per cent of oxygen yields results nearly equal to what can be obtained from pure oxygen. Thus far the chief investigations have been made in this direction of furnishing a new and cheap artificial light. As soon as we can feed an air to our lamps containing 30 or 40 per cent more than the usual proportion of oxygen contained in the atmosphere, the brilliancy of the light will be greatly increased and it will afford a much healthier light than is now given by our gas. A lamp has been invented in Cologne, called the Phillips Carbo-oxygen lamp where the oil is some cheap hydrocarbon, the wick of non-combustible material, probably asbestos, and oxygen is supplied from a reservoir by a peculiarly constructed apparatus. The flame is made to assume the form of a star, and any heating of the wick holder is prevented by the manner in which the oxygen jet is permitted to feed it. It is said that the lamp needs no special attention beyond that of filling it with the patented hydrocarbon liquid. The wick requires no trimming, and explosions are impossible, as the oxygen does not in any way mix with the gases that might be produced by the heat of the combustion. The light of a lamp consuming five and a half cubic feet of gas per hour is equal to 90 or 100 candles, or ten times that of an ordinary gas jet. In diffusive power it would, however, probably not equal a less brilliant light. For lighthouses, fog signals, and photographic purposes, and for studies for the microscope, such a lamp would be of great value. The usefulness of this method of obtaining oxygen would not be confined to the production of light. There are other important applications for that gas, and the moment that we can obtain it cheaply it will enter into metallurgical operations, into compound blow-pipes, into laboratory and pharmaceutical uses, and, in fact, be applied in a thousand ways. It is possible that we may find some other liquid than water that has great solvent power for oxygen with none for nitrogen. The receivers once filled with such a liquid need not be filled a second time, but an indefinite quantity of air could be absorbed and expelled from the same apparatus, and it is possible that this operation could be carried on by clock-work or some other mechanical means. We are manifestly on the eve of the discovery of an easy and cheap method for the manufacture of oxygen for artificial light and other purposes, and the source of the gas appears likely to be the atmosphere.

AFFAIRS IN PARIS.

In consequence of the hostilities at Paris, the office of the Scientific American Patent Agency has been temporarily removed to Fécamp, Seine-Inférieure, No. 22 Rue des Cordieries. Fécamp is not likely to be bombarded by the Prussians, and may be conveniently reached by our clients via Bordeaux or Marseilles.

A Paris correspondent of the New York *Tribune*, who lately went to call on some of his friends, says: "I found everyone engaged in measuring the distance from the hostile batteries to his particular house. One friend I found seated in a cellar, with a quantity of mattresses over it to make it bomb-proof. He emerged from his subterraneous "Patmos" to talk to me and after ordering his servant to pile on a few more mattresses, retreated again. Anything so dull as existence it is difficult to imagine."

Communication between Paris and the interior of France is now maintained by means of balloons and carrier pigeons. M. Durnorf, the aeronaut, lately carried a large mail from the beleaguered city. He left the Place St. Pierre, Montmartre, Paris, at eight o'clock in the morning. A strong east wind was blowing. He rose three thousand yards, and with a telescope saw the Prussians pointing cannon at him. The infantry also tried their rifles, but he was out of range. He descended near Evreup, and thence by rail to Tours.

The roar of cannon is now continuous at Paris, as the contending armies are constantly at work, harassing and destroying each other.

The French, judging from their own accounts, have devised an ingenious system of night attacks, by which they deprive the Prussians of rest, and frequently obtain important advantages over them by capturing prisoners. In these attacks the French use the electric light to blind the eyes of the enemy. Preparations have been made to light the city with petroleum if it becomes necessary to cut off all the gas.

THE SIEGE OF PARIS.

As London is the chief European center of commerce, Paris is the center of fashion and gaiety for the entire world. In time of peace its hotels are always crowded with people of every country and race, who bring to it and leave with it vast sums of money annually. The first Napoleon having in view the brilliant future of this modern Babylon, ravished every city which fell into his hands for works of art to decorate the streets, parks, and palaces of the French capital; thereby rendering it, in connection with its more modern improvements, undoubtedly the most attractive and splendid city the world has ever seen in any age.

One shudders at the probable condition of this beautiful city and its inhabitants at the present moment. The Palace of the Tuileries, the Palace of the Luxembourg, the Grand Hotel, and other public buildings are turned into hospitals and lazar houses, as shown by the yellow flags displayed upon them, and the city is crowded with probably fifteen hundred thousand non-combatants. The long list of disasters to the French arms has been crowned with news of the fall of Strasbourg which must strike to the hearts of the Parisians like the final death-blow to all hope of success for their cause. Their parks are dismantled, their beautiful groves destroyed, and their rich bronzes melted down as material for artillery. They are cut off from external intercourse with the world, and can only get such news of external affairs as the Prussians permit to pass their lines. They are consequently well posted as to their disasters, but anything calculated to raise hope could only, if it existed, reach them by devious and doubtful means. To crown all, it is reported that riots rage in the streets, and that firing can be both seen and heard from a distance between unknown factions, which must, whatever their character, add to the confusion and dismay of the populace.

It is hard for those who have not visited and sojourned in Paris to form any adequate idea of her former beauty, and what must be the aspect she now presents in her distress. Even though familiar with her splendid hotels, theaters, and churches, her boulevards, parks, and gardens, our imagination finds it impossible to picture the reality of the death and misery which now fill them all with cries of desolation and despair; and though we have felt that this war originated entirely with the French, and was begun on the most flimsy and insufficient pretext, we cannot withhold a sentiment of keenest pity and sorrow for the helpless misery of the—with all their faults—most refined, cultivated, and pleasant people the world has ever produced, nor help regretting the too probable fate of this unrivaled city.

THE CHEAP PRODUCTION OF POTASH.

In Vol. XXII., page 399, SCIENTIFIC AMERICAN, we gave the various methods employed for obtaining potash from feldspar, published in foreign journals, but failed to do credit to a distinguished American scientist who was one of the first to propose a practicable method for the resolution of minerals containing this alkali. The subject is of sufficient importance to recur to it once more.

At the meeting of the American Association for the Advancement of Science, held in New Haven in August, 1850, Professor Henry Wurtz, read a paper on green sand, which was afterwards published in *Silliman's Journal*, Vol. X., page 329, from which we quote the following:

"The pulverized and ignited marl (green sand) was mixed with a sufficient quantity of chloride of calcium to form upon the fusion of the latter a pasty mass. The decomposition of the green sand takes place in this case, at a low temperature and is so complete that I have founded upon this circumstance a method of decomposing minerals in the process of analysis which I have had the honor of presenting to the Association before. The mass, after fusion, falls to pieces in water, yielding to this solvent, in most cases, all the potash which was contained in the green sand employed in the form of chloride of potassium."

In the previous communication alluded to above, the process is given of fusing feldspar, hornblende, scapolite, etc., with chloride of calcium and chloride of barium. Subsequently to Professor Wurtz's valuable paper, to wit, in 1853, Prof. J. Lawrence Smith published in *Silliman's Journal* a process for "determining alkalies in minerals," which was essentially the one proposed by Dr. Wurtz, with the slight modification of the substitution for chloride of calcium of an equivalent mixture of carbonate of lime and sal ammoniac convertible by heat into carbonate of ammonia which passes off, and chloride of calcium which remains and accomplishes the decomposition. Professor Wurtz has found that his original plan, while less complex, is preferable on many accounts to Dr. Smith's modification. Dr. Smith's modification of Prof. Wurtz's method for the resolution of minerals by the "lime process," has become quite celebrated, and is given in all its details by Prof. S. W. Johnson, in his admirable edition of "Fresenius' Quantitative Analysis." Either of the methods accomplishes the object and appears preferable to any hitherto proposed.

In August, 1864, Professor Wurtz published in the *American Gas Light Journal and Mining Reporter*, an article entitled: "A Neglected Source of Wealth," in which he called attention to the importance of economizing the alkali of the green sand marl. He says, "it may be assumed that the average of potash in washed green sand of a good quality will be at least seven per cent. This is equivalent to 157 lbs. of anhydrous potash, or 188 lbs. of pure hydrate of potash per tun of 2,240 lbs. Now the very best qualities of American potashes, worth at the present (1864) market rates $14 per cwt., contain not more than seventy per cent of pure hydrate; so that a simple calculation shows that one tun of washed green sand marl, which should be delivered in New York for probably $7 or $8, contains $37·60 worth of potash. The green sand could also be employed for making alum by heating it red hot, then acting upon it with dilute sulphuric acid, crystallizing the solution, adding to the mother liquors a small quantity of chloride of potassium, obtained by another method from the green sand itself, which converts the iron alum formed into common alum and crystallizing again. If only five of the seven per cent of potash present were thus obtained in the form of alum, the quantity of alum from a tun would be 1,120 lbs.; only ten per cent of the crystallized alum being potash."

The treatment of green sand and all feldspathetic rocks proposed by Professor Wurtz does indeed contain the germ of neglected wealth. In view of the great amount of potash now accessible from the Stassfurt mines, it would hardly pay from a commercial point of view to work feldspar or green sand for that alkali, but there is another direction in which great benefit can be derived by the application of the method to the resolution of granitic rocks, greenstone, feldspar, basalt, green sand, hornblende, mica, scapolite, and other rocks and minerals for enriching our farming lands. It would hardly require any thing more complicated than a lime kiln for the fusion and subsequent leaching of these minerals. Many farmers already understand how to grind up bones and treat them with sulphuric acid to manufacture superphosphate. It would be just as simple an operation to heat the broken rocks and while still hot to project them into dilute sulphuric acid, and thus to disintegrate them or to fuse them, according to Dr. Wurtz's plan, with chloride of calcium or with carbonate of lime and sal ammoniac, after Dr. Lawrence Smith's method, or wanting all these substances, to heat the rocks red hot, then plunge them suddenly in cold water to render them friable, then grind them and mix with lime, and heat in a kiln, and afterwards leach out with water.

A practicable and simple method for economizing the potash of our common rocks would be a great boon to the country, and the solution of this question ought to command the attention of our men of science. An acre of ordinary wheat soil, ten inches deep, will weigh somewhere in the neighborhood of 1,000 tuns, and according to the estimate of skilled chemists, contains at any one time, of potash soluble in water, about seventy pounds. Two crops of wheat and hay would remove the whole of this, and the soil would be utterly exhausted unless some provision was made for supplying the waste. The natural source from which this waste is supplied is found in the rocks and minerals contained in the soil, and we have recently pointed out the newly discovered property of humic acid to dissolve silica, and thus help to decompose the rocks. Plowing, tilling, draining, all have their share in asserting the necessary decomposition, but these are at best but slow operations, and it would greatly facilitate matters to have a cheap supply of potash and phosphoric acid to add to the soil, in proportion to the removal of these substances by the crops.

Our works on agricultural chemistry contain full tables of the amount of mineral matter taken from the ground by every variety of crop. The wheat grains, the straw, the husks, the corn, everything has been analyzed, and the precise figures are given, so that a debit and credit account can be kept by the farmer with every field, and as the cattle are fed with food, so ought the ground to have returned to it all that it is deprived of by the crops, in this way an equilibrium can be established, and the farm can never be exhausted. In most instances the air, the water, and the rocks will furnish us all that we need if we only know how to manipulate them and make them do our bidding.

The saying of Benjamin Franklin is still true: "Every man has a gold mine on his own farm, and that lies only plow deep."

Common-Sense Chairs.

The above quaint expression is used in the heading of a circular before us, advertising a class of old-fashioned easy chairs, manufactured on a large scale, by F. A. Sinclair, at Mottville, Onondaga Co., N. Y.

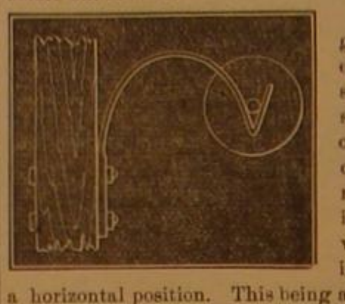
As applied, the title is most appropriate, for we have not seen, since the days of our grandmother, chairs combining so much strength and comfort as the articles to which it refers. The seats are composed of woven splints of ash, and the frames are made of hard wood, firmly secured together. A variety of patterns are made and sold under appropriate names, "Union Arm Chair," "Old Puritan," "Grandmothers' Rockers," etc. The largest size contains nearly as much timber as we have seen used by some speculators in constructing small houses in the vicinity of this city.

For watering-place hotels and piazzas in the country, we know of nothing so comfortable and appropriate as these chairs, but as to office use, for which the manufacturer recommends them, we disagree with him—they are too comfortable for business purposes.

Send to Mr. Sinclair as above for illustrated circulars, or call and see the articles, at 199 Fulton street, New York.

BALANCING CYLINDERS.

Our answer to C. E. M., of N. Y., on page 106, current volume, has called out a most valuable correspondence on the subject of balancing cylinders, of which we propose to give a summary in the present article. Our readers will recollect a letter from W. O. Jacobi, published on page 148, in which he stated that cylinders could be tested while running so as to balance them intelligently and perfectly. We expressed in a remark appended to that letter some doubt that this could be done. Since the appearance of the letter referred to we have been favored by a call from Mr. Jacobi, who has convinced us that cylinders can be tested as he proposes; and his method is so simple and ingenious that we gladly lay it before our readers.



The accompanying diagram shows the apparatus employed: A bent steel spring bar, having a V-shaped bearing, in which one of the journals of the cylinder to be balanced rests; the other end rests in a bearing adjustable vertically, so that the cylinder may be brought into a horizontal position. This being accomplished, the cylinder is set revolving at moderate speed by a belt and pulley on the end opposite the spring bar, and a piece of chalk is held so as to just touch it at the end resting in the bearing of the spring bar. If the end of the cylinder is out of balance it revolves around a center, which is not the center of the cylinder, and the chalk mark, clearly points out the place to add the counterpoising weight.

Mr. Jacobi states that in his establishment he has employed this method with perfect success in balancing the "fancys" in carding machines, these cylinders being long in proportion to diameter, and more difficult to balance than those short in proportion to diameter.

Mr. John Mitchell prefers balancing on pivots to using steel bars. He first balances the heads separately on the shaft, then marks the centers of the horizontal bars or "lags," suspends the cylinder on pivot centers, and balances by chipping or drilling. We tried this method in all its essential features some years since, but could never get so nice a balance as when we used steel bars. With the latter we never failed, but the cylinders we operated upon were very strong, and short in proportion to diameter. Mr. Mitchell would have added to the value of his communication by stating the character of the cylinders he has balanced in the method described, their size, and the speed at which they are run.

Another correspondent, who does not give his name, loosens the boxes allowing the cylinder room to jump, and marks with the sharp point of a file in the way prescribed by Mr. Jacobi with the chalk, operating on one bearing at a time. It seems impossible to reach the nicest adjustment in this way, and we should much prefer Mr. Jacobi's plan, the elasticity of the spring bar permitting motion from the slightest inaccuracy in balance.

This correspondent remarks that a crank shaft cannot be perfectly balanced, because the weight cannot be applied opposite the crank pin; but by suspending the bearings so as to allow the crank wheel to find its center of gravity, he has succeeded on a 20-pound crank wheel in balancing a 4-pound pitman rod, having a 5-inch stroke, running at a speed of 4,000 revolutions per minute.

Mr. G. Westinghener, of Schenectady, N. Y., balances cylinders from two to three feet in length, designed to run 1,500 revolutions per minute, as follows: The cylinders weigh about 200 pounds, and have a shell of wood. He uses small pointed pieces of iron rod, about an inch and one half in length as weights driving them partially in, so that they will not fly out when the cylinder is rapidly revolved. They are inserted one at each end, directly opposite each other. The cylinder is then set in motion to see whether it is more or less out of balance than before the insertion of the spikes, the positions of which are changed until the cylinder runs without shaking. He says this sometimes involves a number of experiments, but he always succeeds in getting them to run steady, and this he does on a bench that can be shaken easily by the hand.

We have no doubt a cylinder can be balanced in this way, but it seems a very slow and unmechanical method. The revolving of the cylinder to see whether it has lost or gained in balance cannot be called a very scientific method of test, if indeed it deserves the name of test at all. Mr. Jacobi's method, on the contrary, not only determines that the cylinder is out of balance, but at once indicates the point to add weight in order to correct the inaccuracy, in accordance with scientific principles. The one is mere "cut and try," the other proceeds directly to the object in view.

Mr. Phillip Strickler, who claims to have had a long experience in balancing cylinders and runner millstones, uses the steel bars for balancing cylinders, balancing successively each head as it is put on the shaft. Then if it is to be lagged with staves of wood or metal, he centers each on the edges, and balances them endwise separately on pivot centers. Then he places them on the heads in exactly the order they are to remain, and balances the whole on the steel bars, distributing the counterpoising weight along the light side, not concentrating it at a single point.

We know this method will secure a good balance, but it is positively essential that everything should be complete before balancing, and no alteration made afterward. Mr. Strickler's method of balancing runner millstones will be found with diagrams in our next issue. We also publish another letter on the subject of balancing in our correspondence columns this week.

The subject is one of the highest practical importance, and its full discussion is very desirable.

FAIR OF THE AMERICAN INSTITUTE.

We found, at our last visit, that notwithstanding the Fair has been now opened three weeks, still active preparations for the opening were still in progress. The shafting is not all running, and there is not steam power enough furnished by the boilers to run such machinery as is ready to run at any proper degree of speed. We, however, give this week brief notices of such machines as were present, and of which we were able to get some information. There are only three inclosures of

MACHINISTS' TOOLS.

Lucius W. Pond, of 98 Liberty street, New York, shows a fine collection, consisting of one 22-inch lathe with compound rest and cross feed, very strong and powerful; one 32-inch planer—a four-tun machine; one 22-inch planer—1½-tun machine, and one upright drill press. Mr. Pond has, within the last two years, completely re-organized his establishment, and now uses entirely new patterns, which give greater power and simplicity to the well-known and highly-appreciated tools of his manufacture. The old Jersey City Locomotive Works have recently been re-fitted and supplied throughout with Mr. Pond's tools made after these new patterns. The patterns of his lathes have been changed so as to give increased size to the parts which receive strain, and they are in all respects excellent tools. The 32-inch planer is very heavy and powerful, and both it and the smaller one alluded to, run with great smoothness of action. By using a simple train of cut gears and racks to drive the tables of his planers, Mr. Pond does away with stud gears ordinarily used with single belts, and is enabled to increase backing speed at pleasure. This collection of tools will not fail to please all mechanics who examine them.

The New York Steam Engine Company, 126 and 128 Chambers street, New York, exhibit one 20-in. planer, one 32-in. lathe, two drill presses, one car wheel boring machine, a machine for turning nuts, one shaping machine, one slotting machine, and a punching press. These are all fine tools, but the punching press shown is perhaps the most noticeable feature of the collection.

George W. Moore, of Worcester, Mass., shows in connection with the tools in this inclosure, a simple and useful gage to turn bevels of gears to agree with the drawing.

The Union Vise Company, 80 Milk street, Boston, Mass., exhibit two beautiful milling machines of different sizes, evidently both excellent tools. They also show a universal head for milling machine or planer by which spur and bevel gears can be cut, or work held upon an arbor or chuck can be milled at any angle, and in almost any position. They also show a machine for cutting spirals, either straight or conical, right or left hand, and of almost any pitch, the changes being made by the ordinary gears of an engine lathe. They show lastly the James Ross Steam Permeator or oil and tallow cup for lubricating the valves and cylinders of steam engines. They are beautifully designed and finished, and rank among the best of this class of devices.

Cowin & Johnson, of Lambertville, N. J., exhibit a universal lathe chuck, of peculiar construction, in which a socket wrench applied to one end of a worm shaft causes the jaws to simultaneously and firmly grasp the work. The working parts of this chuck are all covered, so as to be out of the reach of dirt, chips, etc., which often interfere with the action of chucks of this class.

PUMPS AND BLOWERS.

Knowles & Sibley, of 126 Liberty street, New York, exhibit various sizes of the Knowles Patent Steam Pump. This pump has neither cranks nor fly wheels. The main steam valve of the pump is not a rotary valve, but is an ordinary flat slide valve. The slight rotary motion given the valve rod simply puts the valve in a position to be driven horizontally on its seat. The steam cylinders are fitted with spring ring packing, with screws and springs, for proper adjustment. The water cylinders are fitted with composition heads and rings, adjustable by screws, or with leather rings or a patent fibrous head, according to the nature of the work required. All the joints are ground to fit, and require no packing. The glands and piston rods are solid composition. The valve seats are composition, and the valves, either rubber or metal, are very durable, and are placed in the pump so as to be easily accessible, and in the larger sizes, for fire or marine purposes, are got at immediately without removing any nuts or bolts.

J. H. A. Gerricke, 169 Broadway, New York, exhibits a turbinate force pump. It consists of a wheel case containing a turbinate wheel secured to shaft, and having vanes or paddles of different lengths at its curved periphery, which are bent at their discharge ends, closely fitting the space between it and the case, within which it revolves without touching. In the end of the wheel is an anti-friction pin (used in the vertical pumps) which revolves in a female step, secured in the case. An upper chamber contains anti-friction partitions and a bottom plate which withholds the weight of the water from the wheel.

The Valley Machine Company exhibit a bucket and plunger steam pump, being a vertical steam pump composed of the parts of a simple slide valve and eccentric steam engine attached in a novel and compact manner to a bucket and plunger pump that discharges water at both strokes of the piston. The water valves, which are of either metal or rubber, are placed in such position that access can be had to them by the simple removal of one bolt and without disturbing any of the pipes; the bearing surfaces subject to wear are either lined with Babbitt metal or fitted up with adjustable boxes, so that the wear can be taken up easily, or the bearings replaced at very little expense. These pumps are made by special machinery, and with uniformity of workmanship, which allows of any part being quickly and cheaply replaced when worn out or broken by accident.

The Woodward Steam Pump Manufacturing Company, 76, 78, and 80 Center street, New York, show a fine line of their pumps. These pumps are so widely known, and their reputation is so well established that we may pass them without further comment.

Charles B. Hardick, 23 Adams street, Brooklyn, exhibits several sizes of the Niagara Steam Pump. The valves of this pump may be removed by simply unscrewing a single nut, and any carpenter can make in a few minutes a set of valves for it of wood if the original ones should give out.

William D. Andrews & Brother, 44 Water street, New York, exhibit one central discharge centrifugal pump and one antifriction centrifugal pump. These pumps have long been before the American public, and are well known as most effective machines of their class.

George W. Nye, of Monmouth, Ill., exhibits a steam vacuum pump, the details of the construction of which we could not obtain.

The Rahway Manufacturing Co. exhibit one of Clark's Multiplying Pressure Fan Blowers. This powerful blower produces great intensity of blast with slow speed. Its construction is extremely simple, but comprises some nice scientific and mechanical principles. For full description and engraving of this blower, the reader is referred to page 183, Vol. XXII., of the SCIENTIFIC AMERICAN.

HOISTING MACHINES.

A number of these machines are on exhibition. Otis, Bros. & Co. show one of their hotel elevators by a working model of exquisite finish. In this elevator is comprised an automatic clutching apparatus, which prevents any descent of the car should the ropes break. Should a trunk projecting into the way of the elevator from any of the floors interfere with the descent of the car, brakes are automatically applied, and the steam is cut off; the car then stops, and the obstruction may be removed without damage.

Merrick & Son's improved hoisting apparatus, with Seller's attachment, is shown by Solon Farrar, 212 Grand street, New York. The platform of this elevator is secured from falling by gravity pawls which act automatically upon breakage of the ropes.

Wm. D. Andrews & Bro. exhibit a friction-grooved hoisting machine and portable engine combined. This is a fine powerful machine, running without noise, and the speed of which can be changed instantaneously.

F. P. Canfield, 71 Sudbury street, Boston, Mass., shows a self-hoisting machine, with a bell-crank lever brake operated by the hoisting rope.

Hinton & Furney Bros., 552, 554, and 556 West Twenty-seventh street, New York, show what they style the "Epicycloidal" hoisting machine, employing a peculiar mechanical movement by which, with a gear six inches in diameter, the same speed, and also, it is claimed, greater strength are attained than in the old method, with a gear eight feet in diameter. The machine does not recoil or run back, as in the old method. Hence safety pawls are dispensed with. The gears, which are only two in number, are covered from dirt and liability to accident, either to themselves or the workingmen. Pulley blocks are dispensed with, as the proper speed is obtained by the gear without their use. Hence, stronger but shorter ropes are employed.

C. H. Delamater, foot of West Thirteenth street, New York, shows one of Bacon's hoisting engines. This machine was described on page 120, current volume.

WOOD-WORKING MACHINERY.

The display in this department, though fair, is not equal to that made last year.

John B. Schenck, 118 Liberty street, New York, exhibit one of his large "Schenck Woodworth" planers. This machine is so well known to our readers that we need not describe it.

R. Ball & Co., of Worcester, Mass., exhibit the Russ Monitor Molding Machine, a very fine machine, capable of doing a great variety of excellent work. They also show a very ingenious and excellent hub-mortising machine, a hand boring machine, and a blind-slat tenoning machine.

H. B. Smith, of Smithville, N. J., displays a molding machine, a combined molding, planing, and matching machine, very fine, a heavy resawing machine, also very fine, a self-operating blind-stile boring machine, and a mortising machine. All these machines will well repay inspection.

J. T. Plass, of 202 and 204 East Twenty-ninth street, New York, exhibits the safety band saw, illustrated and described on page 129, Vol., XXI., of the SCIENTIFIC AMERICAN. The breaking of the saw on this machine does not endanger the operator.

First & Pryibil, 452, 454, and 456 Tenth avenue, New York, show a splendid band-saw machine made to saw bevel as well as straight. This is effected by moving the upper wheel sideways, without even taking off the saw or stopping the machine. The table, which works on a slide, is perfectly level, and connected with a lever, which again is connected with the upper sideway slide, being a radius from the center of lower shaft; the whole is moved by a screw.

C. B. Rogers & Co., of Norwich, Conn., also exhibit a very compact and strong band-sawing machine.

A very fine and simple jig-saw is shown by Thos. Connell, Birmingham, Conn. The saw is strained between two leather straps which run over two small pulleys. The ends of the straps remote from the saw are connected by straining wires to another strap which runs over another tightening pulley at the side of the machine. No cross-heads are employed, and the saw has a positive motion. It runs very rapidly, and some excellent specimens of work performed on it may be seen, which will reward the examination of the curious.

Close beside the latter machine stands Beach's Scroll Saw, illustrated and described on page 63, current volume of this journal. It is hard to say which of these saws is the superior one, and we shall leave it for the judges to decide this question. They are both well worth the examination of all who are interested in wood working.

A circular wood-working machine, shown by A. Wood, of Far Rockaway, N. Y., is a hand machine of great power, but which may be driven by other power if desired. It is designed to supply joiners and cabinet-makers with a cheap and effective machine that could be economically employed in expeditiously sawing boards, and in rabbeting, grooving, sash-sticking, etc.

An ingenious machine for shaving barrel hoops is shown by A. McAlpine, of Pittston, Pa. It will shave either straight or crooked hoops with great rapidity and uniformity. The machine is exceedingly simple, and well worth an examination from visitors.

Danger from Tobacco.

A writer in the London *Spectator* has taken some pains to point out what he believes to be "the true danger of tobacco." After adverting to the general use of this weed, which might, he alleges, be considered a harmless luxury but for one exceptional fact, he asks: "Has not tobacco a property belonging to very few substances, which makes its use exceptionally dangerous—the property, when administered in an overdose, of effecting some permanent change, probably in the spinal cord, which renders the victim forever after liable to injury from the minutest dose?"

Three cases are quoted from Dr. Druben's work on tobacco as pointing to the real danger arising from its use. The first case was that of a lawyer, thirty years of age, of athletic frame, who for five years had shown symptoms of a spinal affection, which had resisted all remedies. On the recommendation of Dr. Druben this person gave up the use of tobacco, in which he had indulged to excess. The result was that all the symptoms disappeared, as if by enchantment, and at the end of one month the cure was complete." The restoration to health lasted for some time, and until one day, dining with the doctor, he indulged himself, contrary to the earnest remonstrance of the former, in a cigar. No sooner had he finished the second one than he felt that all his old sensations had returned. Warned by this decisive intimation, the gentleman henceforth entirely gave up his cigar, took tonics for a month, and has ever since enjoyed excellent health.

The second case was that of a person who felt his energies declining, lost his appetite, and only found comfort in smoking very strong cigars. He complained of acute pain in the region of his stomach every afternoon, which only ceased at night, trembling of the limbs, palpitation, and sometimes sickness. On his relinquishing the use of tobacco for one month all the symptoms disappeared; but preferring the pleasure from tobacco to health, he resumed its use, and had in return a renewal of all his pains.

In the third case the patient, aged forty-five years, extremely sober and very regular in all his habits, was troubled by the premonitory symptoms of melancholy mania. He was perfectly aware of his hallucinations, but could not escape them. After two or three weeks' medical treatment, during which he felt no desire to use tobacco, these symptoms passed away, but they returned as soon as he resumed his cigar. Admonished by this experience he renounced tobacco entirely, and from that day has had no recurrence of the symptoms.

Other cases of a similar character are brought under the notice of physicians. The most determined devotee of tobacco who takes an overdose, or uses a much larger quantity than usual, will suffer more or less severely, and not only at the time, but at intervals afterwards, if the effects of the common dose be not carried off as rapidly as usual.

A more enlarged view of the deleterious effects of tobacco on the human system would lead to a great extension of the list of what the London writer chooses to call exceptional cases. It would be found that the stomach, the heart, and the lungs and the different senses are all made to suffer, and to become sadly deranged in their allotted offices by the prolonged and not always by the excessive use of tobacco. In minor degree the cases of interference with good and pleasant feelings from the constant use of tobacco are legion, and should make us modify not a little the word "harmless luxury," as applied to the general use of this weed. It is indeed a luxury, but it is a luxury for which the indulger has to pay very high taxes in addition to those levied by the internal revenue laws.

The writer in the *Spectator* is disposed to lay down as an axiom that men of highly strung, sensitive, nervous organizations, and men who habitually eat little, are better without tobacco. He adds the wholesome advice to all sufferers from tobacco that "there is no remedy whatever except total abstinence. If the mischief has once been done, one cigar or one pinch of snuff is as bad as a hundred."

Some persons can give up the practice at once, as we have known in the case of a printer, who, on being assured by his physician that he would be better without his quid, took it out of his mouth, and exclaiming, "There it goes!" threw it in the fire. Years passed on, and this man persisted in his abstinence, much, as he alleged, to his gain in increased strength and readiness to work. In other cases we have known men of strong religious convictions, and who, from the injury done to their health, conscientiously believed it to be their duty to desist from the use of tobacco, struggle long and hard before they triumphed over the enslaving habit.

Nails for Out-door Work.

Every one is familiar, says the *American Builder*, with the fact that a piece of rusty iron, wrapped in cotton or linen cloth, soon destroys the texture of the fabric. A rusty nail, for example, if laid upon a few rags, will soon produce large holes in them, or it will, at least, render every point it touches so rotten that the cloth will readily fall to pieces at these points, and holes will be produced by the slightest hard usage.

Iron, during the process of rusting, tends to destroy any vegetable fiber with which it may be in contact. This explains, to a certain extent, the rapid destruction of the wood that surrounds the nails used in out-door work, whereby the nail is soon left in a hole much larger than itself, and all power of adhesion is lost. Part of this effect is, no doubt, due to the action of air and water, which creep along the surface of the nail by capillary attraction, and tend to produce rottenness in the wood as well as oxidation in the nail. But when we compare an old nail hole with a similar hole that has been exposed during an equal time, but filled with a wooden pin instead of an iron nail, we find the wood surrounding the wooden pin has suffered least, and we may, therefore, fairly attribute a destructive action to the rusting of the iron. It might, at first sight, be supposed that, as the oxide of iron is more bulky than the pure iron, the hole would be filled more tightly and the nail held more firmly to its place. But, although this effect is produced in the first instance, yet the destruction of the woody fiber and the pulverization of the oxide soon overbalance it, and the nail becomes loose. Of course, the iron itself is also destroyed, its strength being diminished, and we have, therefore, a double incentive for preventing or diminishing the action we have described.

The only way to prevent this action is to cover the nail with some substance that will prevent oxidation. This might be done by tinning, as is common with carpet-tacks. Coating them with oil or tallow would be efficient if the act of driving did not remove protecting matter entirely from a large portion of the surface. But, even then, it will be found that the oil or fat is stripped off the point, and gathered about the head in such a way as to prevent the entrance of air and moisture into the hole. The most efficient way to coat nails with grease is to heat them to a point sufficient to cause the grease to smoke, and then pour the grease over them, stirring them about in a pot or other vessel. When the nails are hot, the melted grease will attach itself to them more firmly than it would have done if they were cold—indeed, so firmly that it will require actual abrasion of the metal to separate it.

In erecting fences, laying plank or board sidewalks, and the like, it becomes an important matter to secure the nails against the influence we have mentioned, and yet the work must be done rapidly and cheaply. Nails may be readily prepared as described, or they may be simply dipped in oil or paint at the moment when they are driven in. In cases where it is not advisable to paint the whole fence, it is a good plan to touch the head of every nail with a brush dipped in oil or paint of the same color as of old wood.

Nils Ericsson.

It is with great regret we notice an announcement of the death of Nils Ericsson, the greatest engineer Sweden ever possessed. Nils Ericsson, who was born in the year 1802, was the son of Olaf Ericsson, an ironmaster of Langbanshyttan, and he was the elder brother of Captain John Ericsson, the celebrated engineer, who has achieved so great a name on both sides of the Atlantic. During his lifetime Nils Ericsson received many honors at the hands of his Government; but it is not for them, but for his executed works, and his labors to promote the prosperity of his country, that his name will be remembered by the people of Sweden. It was to his skill and energy that the construction of the system of State railways in Sweden was mainly due, and among the many important works carried out by him we may mention the reconstruction of the celebrated Trollhätte canal, the docks at Stockholm, and the canal between Saimen and the Gulf of Finland.—*Engineering*.

New Machinery.

In one of the mills in Lowell, where the new system of cotton picking is said to have been reduced to less than 1½ mills per pound on the amount of cloth produced, and the work at the same time very much improved. This improvement is being introduced into Lowell, Fall River, and other places. By actual test two of these machines will take the place of one Creighton opener and four English lappers of two beaters each, taking out more dirt than the five machines combined, and leaves the cotton in better condition. For small mills that are now using an opener and two lappers of the ordinary kind (breaker and finisher), one of these machines, it is said, will do the work of the three in a much better manner. The laps when finished (ready for the card) are so even that they only vary a quarter of an ounce to the yard. Cotton manufacturers and insurance agents will do well to investigate this system, of which R. Kitson, of Lowell, is the patentee.—*Commercial Bulletin*.

Arrangement and Maintenance of Batteries.

The quantity of electricity which exists in the form of a current upon a given length, size, and quality of wire, is proportional to the number of cells in the battery; for, while the quantity of electricity produced by a battery is proportional to the amount of zinc decomposed in each cell, and is no greater in a battery of one hundred cells than in any one single element of that one hundred cells, the electro-motive force which is required to overcome the resistance of the conductors, or to force the quantity generated by a single cell through the wire, increases with every additional cell.

The quantity of electricity existing in the form of a current upon a telegraph wire from a given number of battery cells, is inversely proportional to the resistance of the wire, relays, and battery. To summarize: The electro-motive force being constant, the quantity of electricity which flows through any circuit is inversely proportional to the resistance.

The resistance being constant, the quantity of electricity which flows through any circuit is directly proportional to the electro-motive force.

It is evident from the above considerations that the number of cells employed in a battery for working a telegraph wire should be strictly proportional to the resistance of the wire and relays. If a battery of a certain number of cells is employed to work several wires, the resistances of all the circuits should be approximately the same; for if a wire one hundred miles long is attached to a battery which supplies another wire of twice the length, the shorter wire will have twice the quantity of current that the longer wire receives. If, therefore, the electro-motive force of the battery is sufficient to work the longer wire, it is twice as great as the shorter wire requires, and the surplus strength is wasted. In estimating the length of a wire, of course the resistances of the relays must be included, and the size and condition of the wire, or its conductivity, properly considered.

Applying the foregoing principles, the strength of current upon each of the following wires when supplied from separate batteries of 50 cells each, will be found as stated in the eighth column. When all the wires are supplied from one battery of 50 cells the strength of current upon each will be as stated in the ninth column.

Number of Line.	Resistance of Line.	Resistance of Relays.	Resistance of Line and Relays.	Resistance of Line and Relays increased by 50—Battery.	Conductivity of Wires.	Conductivity of Wires, each increased by 50 ohms.	Strength of Current when supplied by separate batteries of 50 cells each.	Strength of Current when supplied from one battery of 50 cells.
1	3000	7600	10600	10650	·00009433	·00009389	4,694	4,108
2	3000	6800	9800	9850	·00010204	·00010152	5,076	4,443
3	3000	5800	8800	8850	·00011363	·00011299	5,649	4,948
4	3000	4800	7800	7850	·00012820	·00012764	6,382	5,582
5	3000	3600	6600	6650	·00015151	·00015037	7,518	6,507
6	1700	2800	4500	4550	·00022222	·00021978	10,989	9,677
	3400	1400	4800	4850	·00020833	·00020618	10,309	9,072
8	2000	2600	4600	4650	·00021739	·00021505	10,752	9,466
9	2000	1000	3000	3050	·00033333	·00032786	16,393	14.515
10	2000	600	2600	2650	·00038461	·00037735	18,867	16,748
11	3000	400	3400	3450	·00029411	·00028985	14,492	12,807
12	1000	400	1400	1450	·00071428	·00068965	34,482	31,104

The problem of working the twelve wires from one battery is a case of branch circuits, and the question is, What is the joint or combined resistance of the twelve branches? This will readily be found to be R—337,384. If now we add to this the common resistance of the battery R—50, the total resistance of the circuit will be R+R—387,384, and the strength of current flowing through the battery, or generated by it, will be $S=\frac{50000}{387384}=129{\cdot}0709$. Now, this strength of current divides itself among the twelve branches in proportion to their several conductivities, as exhibited in the sixth column (conductivity is reciprocal of resistance, thus $\frac{1}{10600}={\cdot}00009433$).

If the resistance of the battery were less than 50, the strengths of current in the last column would approach more nearly to those in the eighth column; but, on the contrary, were the resistance of the battery more than 50, the strengths of current upon the wires supplied from a common battery would depart more widely from those supplied by separate batteries of the same electro-motive force.—*George B. Prescott in the Journal of the Telegraph.*

Use for Blast Furnace Slags.

We have published several articles on this subject, giving an account of the manufacture of chemical salts, cements, pavements, and the like, from what has always been a waste material, and now hear of the proposition to cast the cinder from the furnaces into slabs, garden rollers, posts, pillars, and so forth. In certain metallurgical operations these articles can be made to resemble porphyry. In some parts of Germany the slag is cast in molds, and is at first used by the workmen for cooking and heating purposes, and afterwards for building houses and walls. The prospect is fair of furnace slags becoming valuable for many purposes.

Professor Huxley's Address Before the British Association.

Our readers will find in another column a portion of Professor Huxley's inaugural address before the British Association for the Advancement of Science. As a discussion of the origin of life and the various hypotheses in regard to this interesting subject, and as a clear expression of the views of one of the greatest biologists of the age, it will be found worthy of the most careful perusal. We shall conclude the address in our next issue.

STEEL TYPES FOR TYPOGRAPHICAL USE.—By an ingenious mechanical contrivance, not unlike that in use for making nails, previously softened steel wire is converted into types which are afterwards hardened. With a single machine and a one-horse power steam engine it is said in an English journal 35,000 types can be made in twelve hours, while the types thus made are of a superior finish, and cheaper, also, on account of the less expense of the steel as compared with the ordinary type metal (usually an alloy of antimony and lead, in the proportion of one part of antimony to four of lead, with a very small quantity of copper, the latter being usually present in sufficient quantity in what is termed hard lead).

ARITHMETICAL.—Any number of figures you may wish to multiply by 5 will give the same result if divided by 2—a much quicker operation; but you must remember to annex a cipher to the answer when there is no remainder, and when there is a remainder, whatever it may be, annex a 5 to the answer. Multiply 464 by 5, and the answer will be 2,320; divide the same by 2, and you have 232, and as there is no remainder, you add a cipher. Now take 359—multiply by 5, the answer is 1,795; on dividing this by 2 there is 179 and a remainder; you therefore place a 5 at the end of the line, and the result is again 1,795.

IT is stated that an average Egyptian can see nothing distinctly at a distance of more than 500 yards, and has no acuteness in detecting an object within as many feet. A recent traveler says that when the railway was constructed the utmost difficulty was found in procuring men capable of seeing or recognizing the difference between signals only a hundred yards off. Many candidates came, but few passed the test. One man was nearly passed, but the engineer was not quite satisfied that the fellow had not been "making good shots" at the colors. So he held up his hat at 150 yards, and the hapless signalman pronounced it to be "the red flag."

THE Hoosac Tunnel, during last month, advanced 150 feet at the east end, and 112 at the west. The central shaft reached the grade of the tunnel August 13, and a force was employed during the remainder of the month in trimming pouches of rock and putting in new timbers and machinery.

WE are indebted to James R. Smedburg, C. E., of the San Francisco (Cal.) Gas Works, for a copy of the Engineers' Index to the *London Journal of Gas Lighting*, covering the first seventeen volumes of that valuable publication. This Index will be of great value to all who are interested in the science and laws of gas engineering.

TWO thousand of Krupp's workmen are said to have enlisted in the German army. Krupp's guns are also in the same army, and are giving good reports.

NEW BOOKS AND PUBLICATIONS.

A PRACTICAL TREATISE ON SOLUBLE OR WATER GLASS, Silicates of Soda, and Potash for Silicifying Stones, Mortar, Concrete, and Hydraulic Lime, Rendering Wood and Timber Fire and Dry Rot Proof, etc., with Hundreds of Recipes for Soap, Cements, Paints, and Whitewashes, Railroad Sleepers, Wooden Pavements, Shingles, etc. By Dr. Lewis Feuchtwanger, Chemist, and Mineralogist. Concluded with various Essays on the Origin and Functions of Carbonic Acid, Limestones, Alkalies, and Silica; and a Complete Guide for Manufacturing Plain and Colored Glass. With several Wood-cuts. New York: Published by L. and J. W. Feuchtwanger, 55 Cedar street.

It will be seen by this title that a great variety of practical subjects are discussed by the author, who is well known as a man thoroughly posted in these and cognate matters, and also as the author of a valuable treatise on gems. The author was the first to introduce the use of soluble glass to the American public, and has devoted much time in experiments with it. Whoever reads the book will not be disappointed in finding much information on points not generally well understood in this country. An extract from the work will be found in another column.

THE CANADIAN ILLUSTRATED NEWS.

This excellent weekly periodical, which is about the size of the SCIENTIFIC AMERICAN and other current illustrated papers, now comes to us greatly improved in its style of illustrations. Our Canadian cotemporary has from the first exhibited a commendable spirit of enterprise in the production of all it's engravings by the photographic process, and now, by the recent introduction of improved steam presses, it is enabled to print its photographic pictures as quickly and in almost as good style, as the ordinary hand-cut wood engravings. We have seen some admirable specimens of printed photographs from nature done by the same method as that employed for the illustrations of the *Canadian News*, namely, Leggo's process, of Montreal. The publisher of the *Canadian Illustrated News* is Mr. George E. Desbarats, a practical printer of much experience, ability, and enterprise. The credit of establishing a weekly newspaper, profusely and regularly illustrated by photographic plates, belongs to Canada. There is no other paper like it in the world, that we know of. The Leggo process above alluded to, was some time ago fully described in the SCIENTIFIC AMERICAN.

Inventions Patented in England by Americans.

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

PROVISIONAL PROTECTION FOR SIX MONTHS.

1,431.—LOOMS AND SHUTTLES.—H. E. Towle, New York city. May, 18, 1870.

2,051.—TOILET AND OTHER MIRRORS.—G. H. Chinnock and E. P. Williams, New York city. July 20, 1870.

2,324.—PRINTING PRESSES.—W. Braidwood, New York city. August 24, 1870.

2,330.—PRINTING MACHINERY.—R. M. Hoe, New York city. August 24, 1870.

2,338.—LIQUID METERS.—J. F. De Navarro, New York city. August 25, 1870.

2,340.—TRAMWAYS AND ROAD SURFACES.—S. D. Tillman, Jersey City, N.J. August 25, 1870.

2,353.—TUNNELING.—W. Sykes, Toronto, Canada. August 27, 1870.

2,356.—SEWING MACHINE ATTACHMENT.—G. H. Collins, New York city. August 27, 1870.

2,359.—TACKS AND NAILS.—H. W. Wright Taunton Mass. August 27 1870.

Business Men Find It

Answers to Correspondents.

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

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

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

A. S. W., of Ca.—Evidently your chimney is not of sufficient capacity for your boiler furnace. Undoubtedly the cheapest way in the long run will be to increase the hight of the chimney by masonry, not by a 11-inch pipe, as proposed, in one corner of the chimney. Such a pipe would reduce the sectional area of the chimney flue, now 400 square inches, to 95 square inches. We consider the area of 400 square inches small enough for your boiler. The best thing for you to do is to get a competent engineer to calculate for you the proper dimensions of the chimney, and correct its deficiencies under his direction.

A. G. G., of N. Y., wishes to know the correct spelling of the name of the frame which supports the step and spindle of a flouring-mill stone. He says it is spelled by different people. "*Hearsh*," "*Burst*," and "*Husk*." We answer that the latter spelling is correct, and that the word is pronounced as spelled, "*Husk*."

B. B. D., of N. Y., wants to know if imperfectly glazed earthenware bottles may be rendered so tight by the use of water glass that they will not leak under the pressure of fermentation when holding root beer?—The beer is put into the bottles while hot. As water glass is dissolved in hot water, this substance will not answer the purpose. Perhaps some of our correspondents may have met with a similar difficulty, and found a good way to remedy it.

H. L., of Wis.—The scale which adheres to the inside of tea-kettles is difficult to remove without injury to the kettle. There are no acids we can recommend for the purpose. It may often be mechanically removed by tapping the outside of the kettle with a hammer. Sometimes boiling oak bark, or slippery elm bark in the kettle will start the scale. More often, however, it resists removal, except by chipping with a pointed steel instrument—a tedious operation.

F. E. M., of Pa.—The explanations you seek comprise a somewhat extensive course of reading. They cannot be made in our columns. They cover nearly the whole fundamental basis of mechanics and physics. For enlightenment you should peruse some able treatises on celestial and terrestrial physics and mechanics.

D. P. R., of Mo.—Colza oil is a general commercial name employed in France, Belgium, etc., for the oil manufactured by expression from the seeds of different species of *Brassica*, and has there the same signification as "rape oil" in England. "Colza" koolzaad, means cole or cabbage seed. "Colza" is the French name for "rape seed."

L. V. R., of N. Y.—A "noggin" is a wooden cup or mug of no definite capacity. We do not recollect ever seeing it used in any work as a definite measure, though it would seem that it has been, since the treatise on dyeing, of which you speak, so uses it. We are informed that in Ireland it is a measure of one gill.

R. S., of Pa.—The gas issuing from the spring you describe is undoubtedly sulphureted hydrogen. You can test it by holding over the spring a piece of paper wet with solution of acetate of lead. If sulphureted hydrogen be present it will turn the paper black.

W. J. H., of Ind.—Directions for softening water for manufacturing purposes, may be found on page 217, Vol. XXI., of the Scientific American, and in any good and complete treatise on dyeing.

N. A. H., of Ca., has tried several recipes for covering the soles of boots with rubber without success. He now appeals to our correspondents for information. If any have been successful we shall be happy to publish their method.

S. R. V., of Tenn.—A preparation for marking the glossy black letters used on show cards, and highly recommended, is lamp black, from which the oil has been removed by roasting, mixed with whites of eggs.

L. M., of N. Y.—The words upward and downward, when applied to direction, mean away from or toward the earth's center, in radial lines. It is obvious, therefore, that up or down, is not precisely the same direction for any two persons on the earth's surface.

W. P. D., of Vt.—The smell of petroleum is very difficult to remove from barrels which have contained it. We know of no method whereby you can accomplish it.

D. L. M. of Va.—The pressure of a vertical shaft and its appurtenances upon the step, is just the same while revolving, as when at rest.

C. L. P., of Minn.—Temper your brass plates for springs by hammering them cold. You can give elasticity to the softest brass in this way.

D. T. D., of R. I.—The notion that a given head of water will drive a wheel faster in the night than in the daytime, is a mistaken one.

L. P. W., of La.—The plates upon which music is engraved are made of 90 parts block tin, and 10 parts antimony.

Recent American and Foreign Patents.

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

Washer Cutter.—Patrick McCormick, Newark, N. J.—This invention has for its object to provide an instrument by means of which two or more concentric washers can at once be cut from one piece, and their size regulated at will.

Curtain Fixture.—W. P. Yates, Elmira, N. Y.—This invention relates to a new and useful improvement in curtain fixtures, having particular reference to the mode of revolving the cutter roller, and consists in so applying the power to the roller that a variable purchase is obtained, and so that at one point in each revolution the curtain will balance the spring.

Lock Nut.—James Moorcroft, Newport, R. I.—This invention relates to a new manner of locking a nut by applying it to the split end of a bolt, together with a conical screw for expanding said bolt within the nut, whereby the nut will be securely fastened.

Metallic Roof.—W. M. Barry, Nashville, Tenn.—This invention relates to a new and useful improvement in the construction of roofs for railroad and other purposes, whereby many of the objections which have hitherto been met with in the construction of roofs are obviated.

Jointed Oar.—C. Dann, La Crosse, Wis.—The object of this invention is to provide an oar which can be operated by a person facing the bow of a at.

Pepper Sauce.—E. McIlhenny, New Iberia, La.—This invention relates to a new process of preparing an aromatic and strong sauce from the pepper known in the market as Tobasco pepper.

Shutter Bar.—Julius Berbecker, New York city.—This invention relates to a new construction of the shutter bars or fastenings used on inside shutters.

Washing Machine.—E. S. Harper, Sutherland Springs, Texas.—This invention has for its object to furnish an improved washing machine, which shall be simple in construction, effective in operation, and easily operated, and which will not injure the clothes.

Mouse Trap.—W. K. Bachman, Columbia, S. C.—This invention has for its object to furnish an improved mouse trap, which shall be simple in construction, not liable to get out of order, easily se and reliable in operation.

Oyster Tongs.—Edward Ward, Smyrna, Del.—This invention relates to a new and useful improvement in tongs for taking oysters from the water, and consists in such a construction and arrangement of parts that the tongs are opened and closed by means of cords.

Melodeans.—J. C. Briggs, Ansonia, Conn.—The object of the present invention is to provide for a more even motion of the valve in an expression chamber, and not to allow the sudden violent movements of the same which are produced if the air only acts on one side of the pivot.

Horse Hay Rake.—G. E. Carleton, Oldtown, Me.—This invention has for its object to improve the construction of horse hay rakes, so that the rake may be raised to discharge the collected hay by the advance of the machine.

Wheat Steamer and Dryer.—C. T. Hanna, Keokuk, Iowa.—This invention has for its object to furnish an improved apparatus for steaming and drying wheat to soften it preparatory to grinding, which apparatus shall be simple in construction, effective in operation, and easily applied.

Hemmer.—Abel H. Bartlett, Spuyten Duyvil, N. Y.—This invention relates to improvements in that class of hemmers for sewing machines which are designed for making hems of different widths, and which are attached to the presser foot.

Stem-winding Attachment for Watches.—Fritz Robert Theurer, Chaux de Fonde, Switzerland.—This invention relates to improvements in attachments to watches for winding and setting them by turning the stem, and consists in an improved arrangement of means having for its object, mainly, to provide an apparatus which may be applied to watches already made, as well as to those being made.

Elevators.—Theo. H. Rudiger, Lawrence, Kansas.—This invention relates to improvements in elevators, and consists in arranging the spout on to which the articles elevated by the buckets are dumped, so that previous to the dumping the upper end will swing back under the bucket, so as to ensure the receiving of all the contents of the bucket, and then swing out of the way of the downward movement of the bucket in time to let it pass without obstruction.

Wagon Seats.—C. E. Hollenbeck, Kirkville, Mo.—This invention relates to improvements in the detachable spring wagon seats, used by placing them on the tops of the sideboards of the wagon boxes, or on cleats or ribs attached to the sides. The invention consists in an improved construction and arrangement of the springs.

Wiping Attachment for Feed Rollers.—Lyman Crawford, Holyoke, Mass.—This invention relates to improvements in wiping apparatus for the feed rollers of carding machinery, and consists in a combination with the rollers of wiping plates, one placed above the upper rollers, and another below the lower ones, each plate, having a concave face, to be provided with a wiping cloth, acting on the surface of the roller; also, a slot behind the wiper, through which the substance wiped from the said rollers, and collecting in masses, may escape or be removed, and the lower wiping plate is provided with a guard or scraper plate, arranged in conjunction with the lower roller to prevent any large collections of waste from being carried up by the said roller to the sliver.

Dumping Car.—Ed. C. Hegeler, La Salle, Ill.—This invention relates to improvements in dumping cars, and consists in arranging the boxes with one side, or end, as the case may be, sloping from about the center of the bottom upward, and providing the sloping side with rockers, on which the box, in tilting, will roll towards the edge for dumping, instead of tilting on hinges, as heretofore. The said rockers are provided with flanges, to keep them on the rails whereon they roll, and they have chains attached to their ends, and to the truck frame, in a way to prevent them from sliding on the rails they roll upon.

Furnace Grate.—Abraham L. Pennock, Upper Darby, Pa.—This invention relates to a new and useful improvement in grate bars for furnaces, whereby they are made cheaper, more useful, and more durable than they have heretofore been, and it consists in locking the bars together by means of locking pins running through, and at right angles with the bars, the said locking pins having notches for holding the bars, by means of which the distance of the bars apart may be varied so as to adapt the grate to either coarse or fine coal.

Cotton-seed Planter.—Fletcher Sloan, Bolivar, Tenn.—This invention has for its object to furnish an improved cotton-seed planter, simple in construction, and effective in operation, and which shall be so constructed that it may be readily adjusted for planting corn, peas, and other seeds, and for distributing guano and other fine fertilizers.

Plow.—David Morris, Bunker Hill, Ill.—This invention has for its object to improve the construction of plows in such a way as to enable the beam to be adjusted laterally to adapt the plows for use as a two or three-horse plow, as may be required, and which shall, at the same time, be simple in construction and effective in operation, holding the beam securely however adjusted.

Attaching Draft to Plows, etc.—George W. Kidwell, Elwood, Ind.—This invention has for its object to furnish an improvement in attaching draft to plows, harrows, reapers, mowers, and other machinery where the draft is attached by means of a clevis, which shall be so constructed that should the plow or other machine strike a stone or other obstruction, the horses will be kept from being injured and the machine from being broken by the sudden shock, and which will enable the line of draft to be adjusted to cause the plow to cut a wider or narrower furrow, as may be desired.

Earrings, Drops, etc.—Gottfried Haberland, Bloomington, Ill.—The object of this invention is to so construct earrings and drops that the same may be applied without requiring the perforation of the lobes. The invention consists in constructing the earring in form of a spring which will retain itself on the ear by spring pressure; the application and removal of earrings and drops is thereby considerably facilitated.

Manufacture of Hydrocarbon Oils.—William Spears, Jamestown, N. Y.—The object of this invention is to produce a highly valuable hydrocarbon oil or liquid for illuminating or other purposes, from the products of distillation in the process of manufacturing oils from crude petroleum, and consists in uniting (by the application of heat) the first and most volatile product of distillation (benzine) with the refuse tar, thereby forming a compound from which a highly valuable oil is distilled.

Valve Cock.—John C. Macdonald, St. Louis, Mo.—This invention has for its object to improve the construction of valve cocks so as to enable them to be ground to their seat at any time when necessary without removing them from their fittings, and, at the same time, to have a true working guide while being re-ground.

Official List of Patents.

Issued by the United States Patent Office

FOR THE WEEK ENDING Sept. 27, 1870.

Reported Officially for the Scientific American

SCHEDULE OF PATENT OFFICE FEES

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In addition to which there are some small revenue-stamp taxes. Residents of Canada and Nova Scotia pay $500 on application.

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107,646.—Pulley for Gates.—Ephraim S. Axtell, Macomb Mich.
107,647.—Mouse Trap.—William K. Bachman, Columbia S. C.
107,648.—Truss.—Sir William Baker, Austin, Texas.
107,649.—Metallic Roof.—William M. Barry, Nashville, Tenn.
107,650.—Hemmer for Sewing Machines.—A. H. Bartlett, Spuyten Duyvil, N. Y.
107,651.—Shuttle Fastening.—Julius Berbecker, New York city.
107,652.—Washing Machine. — John T. Bever, Lathrop, Mo.
107,653.—Tool for Cutting Wood Moldings.—Charles E. Boynton (assignor to himself and Isaac N. Vosburg), San Francisco, Cal.
107,654.—Machine for Cutting Material for Baskets.—L. H. Bridgeman, Rock Stream, New York.
107,655.—Melodeon.—J. C. Briggs, Ansonia, Conn.
107,656.—Coupling Jack.—H. A. Brown and E. B. Keith, Galesburg, Mich.
107,657.—Fluting Machine.—Samuel G. Cabell, Washington, D. C.
107,658.—Ageing Spirits.—Andrew Caldwell, Lexington, Ky.
107,659.—Flood Gate.—John Campbell and Addison Watson, London, Ohio.
107,660.—Horse Hay Rake.—Guy E. Carleton, Old Town, Me.
107,661.—Wash Stand and Tank.—H. W. Catlin, Burlington, Vt.
107,662.—Stalk Cutter.—Martin Caywood, Peoria, Ill.
107,663.—Mode of Inserting Glass in Vault Lights.—Zenas Cobb, Chicago, Ill.
107,664.—Tin Roofing.—Benjamin Coddington, La Fayette, Ind.
107,665.—Blower.—W. S. Colwell, Pittsburgh, Pa.
107,666.—Roller for Sewing Machines.—R. W. Courts, Russellville, Ky.
107,667.—Wiping Apparatus for Feed and other Rollers.—Lyman Crawford, Holyoke, Mass.
107,668.—Carriage Gearing.—Cornelius Custer, Norristown, Pa. Antedated Sept. 17, 1870.
107,669.—Jointed Oar.—Christian Dann, La Crosse, Wis.
107,670.—Machine for Shaping the Heads of Horseshoe Nails.—Norman Dexter, Bower Hill, Pa.
107,671.—Blind-slat Tenoning Machine. — Frank Douglass, Norwich, Conn.
107,672.—Pencil Case.—Charles H. Downes, Hudson City N. J.
107,673.—Egg Beater.—Timothy Earle, Valley Falls, Smithfield, and Gilbert K. Dearborn, Pawtucket, R. I., assignors, by mesne assignments, to Timothy Earle and E. D. Goodrich, Boston, Mass.
107,674.—Knife Scourer.—H. E. French, Unity, N. H.
107,675.—Machine for Sawing Marble.—J. E. French and J. M. Stephenson, Pendleton, Ind.
107,676.—Plow.—David Fulton, St. Helena, Cal.
107,677.—Sewing Machine.—Charles W. Godown, Lambertville, N. J.
107,678.—Machine for Jointing Staves.—S. S. Gray, Boston, Mass.
107,679.—Ear Ring.—Gottfried Haberland, Bloomington, Ill.
107,680.—Wheat Steamer and Drier.—Cyrus T. Hanna, Keokuk, Iowa.
107,681.—Washing Machine.—Elijah S. Harper, Sutherland Springs, Texas.
107,682.—Carpet Lining.—J. R. Harrington (assignor to G. K. Harrington), Brooklyn, N. Y.
107,683.—Dumping Car.—E. C. Hegeler (assignor to F. W Matthiesson & Hegeler), La Salle, Ill.
107,684.—Wagon Seat.—Charles F. Hollenbeck, Kirkville, Mo.
107,685.—Chair and Furniture Tips.—Francis H. Holton, Brooklyn, N. Y.
107,686.—Apparatus for Preparing Parchment or Water-proof Paper.—E. P. Hudson, New York city, assignor to New York Water-proof Paper Co., New York city.
107,687.—Manufacture of Rubber-coated Parchment Paper.—E. P. Hudson, New York city, assignor to New York Water-proof Paper Co., New York city.
107,688.—Baling Press.—Wm. Iler, Shreveport, La.
107,689.—Method of Preserving Fruit. — Geo. Jaques, Boston, Mass.
107,690.—Composition of Matter for Preserving Fruits from Decay.—Geo. Jaques, Boston, Mass.
107,691.—Sash Holder.—William F. Kells, San Francisco Cal.
107,692.—Attaching Draft to Plows.—G. W. Kidwell, Elwood, Ind.
107,693.—Chewing Gum.—Weston W. Kilbourn, Sanford, N. Y.
107,694.—Chimney Attachment.—A. H. Lanphear, Atchison, Kansas.
107,695.—Hay Elevator. — James Linderman, Bullville, N. Y.
107,696.—Heating Stove. — Adolphus Lotze, Cincinnati, Ohio.
107,697.—Valve Cock. — John C. Macdonald, St. Louis Mo.
107,698.—Potato Digger.—George M. Marks, Half Moon, Pa.
107,699.—Lamp Bracket. — Riverius Marsh, New York city.
107,700.—Washer Cutter.—Patrick McCormick, Newark, N. J.
107,701.—Peppersauce.—Edmund McIlhenny, New Iberia, La.
107,702.—Friction Locomotive.—T. S. Minniss, Meadville, Pa. Antedated Sept. 17, 1870.
107,703.—Grain-binding Attachment for Harvesters.—T. S. Minniss, Meadville, Pa. Antedated Sept. 17, 1870.
107,704.—Nut Lock.—James Moorcroft, Newport, R. I.
107,705.—Plow.—David Morris, Bunker Hill, Ill.
107,706.—Scaffold Bracket.—Charles Mudge, Ovid, Mich. Antedated Sept. 17, 1870.
107,707.—Washing Machine. — Abraham Mutersbaugh, Lewinsville, Va.
107,708.—Folding Chair.—Julius Nicoli, Boston, Mass.
107,709.—Corn Plow and Planter.—H. C. Osborn, Clark county, Ohio.
107,710.—Ditching Machine.—Jason C. Osgood, Troy N. Y

107,711.—Treating Tin Scrap for the Manufacture of Stannate of Potash, etc.—Adolph Ott, New York city.
107,712.—Furnace for Smelting Scrap Iron.—Adolph Ott, New York city.
107,713.—Tanning.—C. F. Panknin, Charleston, S. C.
107,714.—Ironing Machine.—C. F. Parker, Greenfield, assignor to Joseph Parker, Goodhope, Ohio.
107,915.—Furnace Grate.—A. L. Pennock, Upper Darby, Pa.
107,716.—Car Ventilator and Refrigerator.—William E. Phelps, Elmwood, Ill.
107,717.—Treadle for Sewing and other Machines.—B. C. Cole, Washington, D. C.
107,718.—Machine for Ornamenting the Surface of Wood, etc.—T. T. Ponsonby, Nottingham, England.
107,719.—Steering Apparatus.—T. C. Purington, Vallejo, Cal.
107,720.—Shutter Fastening.—Joshua Pusey, Philadelphia, Pa.
107,721.—Harvester Rake.—Amos Rank, Salem, Ohio.
107,722.—Cover for Stovepipe Holes.—Jos. A. Reed, Philadelphia, Pa.
107,723.—Steam Engine.—W. F. Richardson, Pittsburgh, Pa.
107,724.—Hinge for School Desks.—A. E. Roberts, Des Moines, Iowa.
107,725.—Tweer.—Joseph Rogers, Detroit, Mich.
107,726.—Elevator.—Theodore H. Rudiger, Lawrence, Kansas.
107,727.—Horse-detaching Device.—Anton Schmitt, Cincinnati, Ohio.
107,728.—Head-block for Saw Mills.—George Selden, Erie, Pa.
107,729.—Process of Uniting Rubber with Wood.—F. B. Shearer, Columbus, Ohio.
107,730.—Cotton-seed Planter.—Fletcher Sloan, Bolivar, Tenn.
107,731.—Metallic Tubing.—C. G. Smith, Chelsea, assignor to American Metallic Tubing Co., Boston, Mass.
107,732.—Beehive.—Jonathan L. Smith, Liberty Centre, Ill.
107,733.—Saw Set.—Wm. A. Smith, Dresserville, N. Y.
107,734.—Manufacture of Hydrocarbon Oils.—William Spears, Jamestown, N. Y.
107,735.—Kiln.—P. C. Taylor, San Antonio, Texas.
107,736.—Stem-winding and Setting Attachment to Watches.—F. R. Theurer, Chaux De Fond, Switzerland.
107,737.—Vapor Burner.—Wm. Thompson, Cleveland, assignor to himself, Jeremiah S. Bollman, and M. H. Kline, Mansfield, Ohio.
107,738.—Snapper Cleat.—John T. Thompson, Southport, Me.
107,739.—Lubricator.—Ernest Von Jeinsen, San Francisco, Cal.
107,740.—Oyster Tongs.—Edward Ward, Smyrna, Del.
107,741.—Vapor Burner.—Henry Wellington, Chicago, Ill.
107,742.—Brush.—John L. Whiting, Boston, Mass.
107,743.—Gas Carbonizing Attachment for Street and other Lights.—Samuel Whitney, Newark, N. J.
107,744.—Fastening for Necktie.—W. A. Wicks, Baltimore, Md.
107,745.—Mill Pick.—S. G. Williams, Trumansburg, N. Y.
107,746.—Automatic Cut-off for Steam Engine.—D. A. Woodbury, Rochester, N. Y.
107,747.—Curtain Fixture.—William P. Yates, Elmira, N. Y.
107,748.—Steam Engine Condenser.—Harrison Anderson, Peoria, Ill.
107,749.—Knit Fabric.—C. J. Appleton (assignor to himself Earl L. Stimson, and S. E. Stimson, Cohoes), N. Y.
107,750.—Knitting Machine.—C. J. Appleton (assignor to himself, Earl L. Stimson, and S. E. Stimson, Cohoes), N. Y.
107,751.—Feeding Device for Carding Machines.—J. W. Barbour, Winooski Falls, Vt., assignor to himself and William Earl, Nashua, N. H.
107,752.—Polled Sheet Iron.—Silas Barker and Henry S. Pratt, Hartford, Conn.
107,753.—Show Case.—Milo M. Belding, Brooklyn, N. Y.
107,754.—Cultivator Plow.—Victor Bolis, St. Mary's parish, La.
107,755.—Reed Board for Organs.—Riley Burdett, Chicago, Ill.
107,756.—Cement Walk, Pavement, and Road.—Charles Burgess, Rochester, N. Y.
107,757.—Plane.—T. O. Callahan, Boston, Mass.
107,758.—Saddle for Spinning Machines.—J. S. Casey, Voluntown, Conn.
107,759.—Fanning Mill.—G. E. Clarke, Racine, Wis.
107,760.—Corn Cultivator.—Jesse Clements, Blooming Grove, Ind.
107,761.—Corn Sheller, etc.—G. S. Coleman, Alexandria, Va. Antedated September 21, 1870.
107,762.—Adjustable Stop for Caster for Stove Legs.—William Coughlin, Clarksville, Ohio.
107,763.—Clothes Dryer.—Lewis Cutting, San Francisco, Cal.
107,764.—Curtain Fixture.—John Doyle, Hoboken, N. J.
107,765.—Splint Plane.—P. N. Drake and David Drummond, McGregor, Iowa.
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107,770.—Setting of Fence Posts.—William Fulkerson, Three Rivers, Mich.
107,771.—Coffee Roaster.—H. M. Gilbert, Ada, Ill.
107,772.—Picker Collar.—J. M. Gotham, Blackstone, Mass., assignor to himself and Lewis Devlin, Central Falls, R. I.
107,773.—Sash Holder.—P. W. Greenwood, Peterborough, N. H.
107,774.—Bedstead Clamp.—T. B. Gregory, Champaign, Ill.
107,775.—Permutation Lock.—W. N. Hall, Springfield, Iowa.
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107,803.—Cover for Cooking Utensils.—L. B. Oviatt Brooklyn Village, Ohio.
107,804.—Harvester Reel.—C. N. Owen, Salem, Ohio.
107,805.—Water Wheel.—Ezra Parker, Beverly, Ohio.
107,806.—Heating Stove.—Nathan Parish, Kalamazoo, Mich. Antedated September 21, 1870.
107,807.—Hoisting Machine.—Nathan Parish, Kalamazoo, Mich.
107,808.—Saw.—John Phillips, Chicago, Ill.
107,809.—Manufacture of Illumination Gas.—E. A. Pond, G. H. Pond, and M. S. Richardson, Rutland, Vt. Antedated September 24, 1870.
107,810.—Manufacture of Friction Match Cigar Lighter.—William Porter, St. Stephen, Canada.
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107,812.—Bedstead Fastening.—C. D. Purdy, La Porte, Ind.
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107,830.—Device for Actuating the Valves of Fluid Meters.—D. B. Spooner, Syracuse, N. Y.
107,831.—Corpse Preserver.—Samuel Stockton and John Schepler, Lambertville, N. J.
107,832.—Horse Hay Rake.—J. C. Stoddard, Worcester, Mass.
107,833.—Separating Animal from Vegetable Fibers.—James Stuart, London, England. Patented in England, August 6, 1869.
107,834.—Milk Pail.—Church Tabor, Craftsbury, Vt.
107,835.—Lantern.—Church Tabor, Craftsbury, Vt.
107,836.—Paper File.—Church Tabor, Craftsbury, Vt.
107,837.—Car Coupling.—G. B. Terry, Pittsford, and W. G. Hawley, Gorham, N. Y.
107,838.—Water Pipe.—John F. Ward, Jersey City, N. J.
107,839.—Meat Hook.—Samuel Weaver, Pottstown, Pa.
107,840.—Steam Generator.—William Weston, William R. Weston, N. R. Weston, and Burt Brett, Stevens' Point, Wis.
107,841.—Pump Valve.—James T. Whipple, Chicago, Ill.
107,842.—Carding-Machine Teeth.—William H. Whiting, Wilmington, Conn., assignor to himself and Marcus M. Johnson.
107,843.—Harness Saddle-Tree.—P. H. Wiedersum, New York city.
107,844.—Animal Trap.—John J. Wood, North Manchester, Ind. Antedated September 17, 1870.
107,845.—Whip-Socket Clasp.—Alva Worden, Ypsilanti, Mich.
107,846.—Wool-Washing Machine.—John Yewdall and Wm. Yewdall, Philadelphia, Pa.
107,847.—Machine for Cutting Stone.—Hugh Young, Middletown, Conn., and James L. Young, New York city. Antedated September 26, 1870.
107,848.—Manufacture of Illuminating Gas.—William Young, Magdalen Bridge, and Peter Brash, Leith, Scotland. Patented in England, April 6, 1870.

REISSUES.

4,129.—Tanning and Stuffing Leather.—W. B. Brittingham, La Fayette, Ind. Patent No. 98,916, dated January 18, 1870.
4,130.—Coffee Mill.—Thomas W. Brown, Boston, Mass., assignor to Charles Parker, Meriden, Conn.—Patent 105,545; dated July 19, 1870.
4,131.—Lubricator.—H. A. Daniels (assignor to the Daniels, Nichols & Gaylord Manufacturing Company), Waterbury, Conn. Patent No. 92,283, dated July 6, 1869.
4,132.—Furnace for Roasting Ores.—E. P. Hudson, New York city, assignor to the Hudson Ore-Refining Company. Patent No. 78,456, dated June 2, 1868.
4,133.—Rein Holder for Carriages.—Elias C. Patterson, Rochester, N. Y. Patent No. 62,879, dated March 12, 1867.
4,134.—Composition for Covering Steam Boilers, Steam Pipes, etc.—John Riley and C. W. Bissell (assignors, through mesne assignments, to the United States and Foreign Salamander Felting Co.), Troy, N. Y.—Patent No. 95,517, dated October 5, 1869.
4,135.—Millstone Dress.—Joseph Sedgebeer, Painesville, Ohio.—Patent No. 35,858, dated July 8, 1862.
4,136.—Solar Camera.—W. H. Masters, Princeton, Ill.—Patent No. 59,917, dated November 20, 1866.

DESIGNS.

4,361.—Blower Holder.—F. W. Brocksieper (assignor to Sargent & Co.), New Haven, Conn.
4,362.—Fire-Set Holder.—F. W. Brocksieper (assignor to Sargent & Co.), New Haven, Conn.
4,363.—Fire-Dog.—F. W. Brocksieper (assignor to Sargent & Co.), New Haven, Conn.
4,364.—Door Pull.—F. W. Brocksieper (assignor to Sargent & Co.), New Haven, Conn.
4,365.—Cook Stove.—Henry H. Culver, Kansas City, Mo.
4,366 and 4,367.—Corset.—D. H. Fanning, Worcester, Mass. Two patents.
4,368.—Figure of a Mechanical Toy.—Wm. C. Goodwin, Hamden, Conn.
4,369.—Mechanical Toy Figure.—Wm. C. Goodwin, Hamden, Conn.
4,370.—Figure of a Mechanical Toy.—Wm. C. Goodwin, Hamden, Conn.
4,371.—Cradle-Plate of Gate Latch.—Job Johnson, Brooklyn, N. Y.
4,372.—Badge.—William Riker, Newark, N. J.
4,373.—Punch Drawer.—Alonzo H. Rowe, Newburyport, Mass.
4,374.—Stove Plate.—N. S. Vedder and Francis Ritchie, Troy, N. Y., assignors to N. S. Vedder.

APPLICATIONS FOR THE EXTENSION OF PATENTS.

Method of Applying Steam to, and of Cutting Scarfs from Wood—George U. White, Belfast, Me., has petitioned for the extension of the above patent. Day of hearing Nov. 16, 1870.

Making Steel.—John Neville, of Brooklyn, N. Y., has petitioned for the extension of the above patent. Day of hearing Nov. 23, 1870.

Machine for Forging Iron.—Silas S. Putnam, Neponset, Mass., has petitioned for an extension of the above patent. Day of hearing Nov. 23, 1870.

Machine for Grinding Saws.—Edmund Andrews, Williamsport, Pa. has applied for an extension of the above patent. Day of hearing Nov. 30 1870.

Mode of Securing Springs in Upholstery.—Wendell Wright, Bloomfield, N. J., has applied for an extension of the above patent. Day of hearing Nov. 30, 1870.

Machinery for Weaving Shade Cord.—Thomas Nelson, Troy, N. Y., has applied for an extension of the above patent. Day of hearng Nov. 30, 1870.

Machinery for Grinding Paper Pulp.—Joseph Kingsland, Jr., Franklin, N. J., has petitioned for an extension of the above patent. Day of hearing Nov. 30, 1870.

Loom.—Benjamin G. Dawley, North Providence, R. I., has petitioned for an extension of the above patent. Day of hearing Dec. 7, 1870.

Advertisements.

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