SCIENTIFIC AMERICAN

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THE ECLIPSE AGRICULTURAL ENGINE.

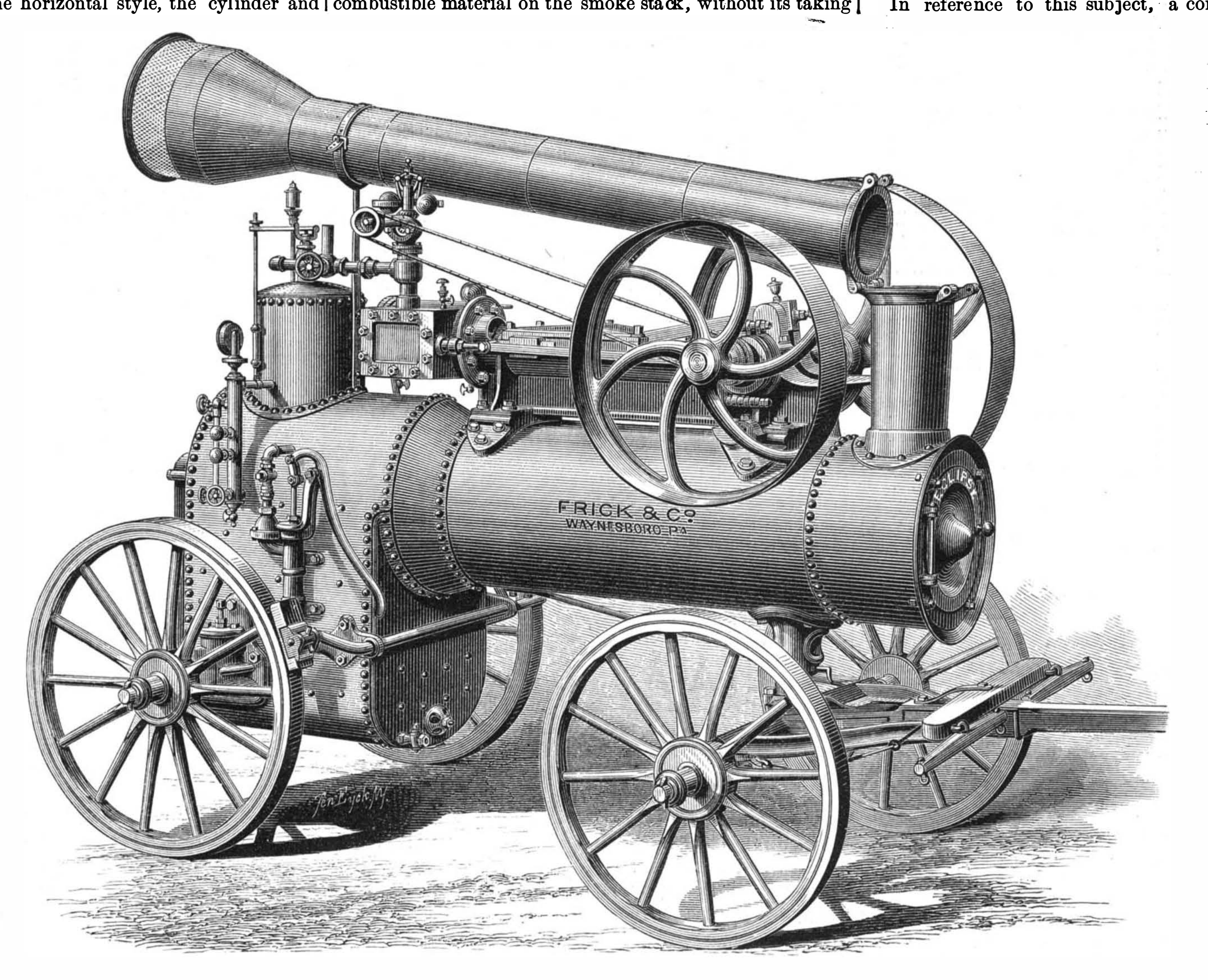
We illustrate herewith the well known "Eclipse" engine, mounted on wheels to adapt it for farmers' uses. The machine as thus arranged, the manufacturers inform us, vanquished all competitors at the Cincinnati Industrial Exhibition of 1874, and also during the field trials held under the auspices of the Centennial Commission, giving in both cases the most power with the least consumption of coal and water. From testimonials from parties using the engine, submitted to us, we learn that, with an 8 horse machine, 1,600 bushels of wheat were threshed with three fourths of a ton of coal and only five hogsheads of water. Another writer states that, with a 10 horse power engine, he is able to saw 3,000 feet of 1 inch oak timber per day, using a 48 inch saw. We have been obliged to obtain our information regarding the construction and advantages of this engine mostly from a pamphlet issued by the manufacturers; but from what we learn from other sources, we believe the Eclipse engine possesses all the qualifications herein stated.

The engine is of the horizontal style, the cylinder and steam chest being made in one casting. All of the exposed parts are felted and covered with iron. The frame or bed which comprises the cylinder head, the guides for the crosshead, and the two bearings for the crank shafts are also cast solid; so that it is impossible for the important working parts to get out of line. In shape, the bed is the half of a horizontal hollow cylinder, excepting a small portion of one extremity, which is an entire cylinder, which has a flange to which the cylinder and steam chest casting is bolted. The form of the bed enables all waste oil to be caught and afterwards led away by a suitable tube. The cylinder, being secured to the bed at one end only, is free to expand; and as the cylinder, steam chest, slide valve, and piston rod lengthen in the same direction, the engine will have the same lead and clearance when working as when cold. The pillow blocks are lined with anti-friction metal, and are provided with means for taking up lost motion. The crank shaft is double, made of forged iron, and is counterbalanced so that its motion is smooth and equable, even when at high speed. The piston has a metallic packing ring, and is self-adjusting; the piston rods are of steel. The pump is driven direct from the crosshead, its valves may be readily removed without disturbing the connections, and the water supply is easily regulated. A heater consisting of a large cast iron pipe, bolted near its end to the steam cylinder and supported by a bed bracket, receives the exhaust steam on its way to the smoke stack. The steam warms the feed water, the conduits of which pass two or three times through the entire length of the heater. All necessary fittings in the way of air cocks, self-feeding oil cups, governor, etc., are added; and the various parts are manufactured by special machinery so that they can be accurately duplicated.

In the boiler, which is of the locomotive style, the water space extends entirely around the fire box and ash pit, the water constantly circulating in the circular water bottom and thus preventing the accumulation of deposits. Each generator is made of the best boiler plate iron, the tubes are lap-welded, and a cold water pressure of 200 lbs. to the square inch is guaranteed to be withstood.

The wheels of the wagon have cast iron hubs, and are large enough to raise the boiler sufficiently to enable the forward wheel to pass underneath, so that the entire vehicle can be turned on a small space. The axles are of the best refined wrought iron; and strong cast iron brackets, containing spiral steel springs, sustain the weight of boiler and engine, thus enabling the machine to be moved over the roughest roads without injury. The springs are easily accessible for repair or adjustment, without dismounting engine or boiler. A new and powerful brake is used on the wheels. The fly wheels are turned smooth and true for belts, and are large enough to give the proper speed for threshing wheat, etc. The smoke stack is hinged, as shown in the engraving; so that, for storing or transportation, it can be laid down out of the way. It is also provided with an efficient device for arresting and extinguishing the sparks. This, we are informed, has been tested by putting straw and other combustible material on the smoke stack, without its taking fire. The ash pan also has a close-fitting door, to prevent danger from that source.

For further information, address the manufacturers, Messrs. Frick & Co., Waynesboro', Franklin county, Pa.



FRICK & CO.'S ECLIPSE AGRICULTURAL ENGINE.

Aniline Water Colors.

Aniline water colors are extensively used for tinting photographs, and are also being introduced for painting water color drawings. But as nearly all of these colors are altered by light, fade, and change, no honest artist will make use of them, unless he informs the purchaser by stamping some such notice as the following on the margin of the picture: "These colors, although pretty to look at, are good for nothing. They will soon fade."

Death of Signor Blitz.

Antonio Blitz, better known as Signor Blitz, the famous ventriloquist and conjuror, died recently in Philadelphia, in the sixty-seventh year of his age. Mr. Blitz came to this country from England in 1834, and at once became famous for his remarkable dexterity in the art of legerdemain. He was a very ingenious inventor, and many of the most startling tricks of later magicians originated with him. He besides was quite a humorist, and delighted to use his peculiar talents for purposes of harmless fun. It is related that a favorite amusement of his was to visit the markets, and there enjoy the astonishment of the old fruit women when he gravely extracted gold dollars from their oranges, and of the egg dealers, when their eggs hatched canaries under his marvellous touch.

Personally, Signor Blitz was a refined and pleasant gentleman and lavishly charitable to the poor. The best anecdote that is related of him describes how one sour-faced ascetic came and remonstrated with him, and taxed him with inculcating in the popular mind a proneness to deception. The Signor politely heard him through, and did not excuse himself in the slightest particular; but instead, he quietly extracted a pack of playing cards from his visitor's coat pocket and then a dice box and dice from the crown of his clerical hat. The giver of good advice departed in dumb astonishment.

Boiler Explosions.

In reference to this subject, a correspondent, H. P. G. C., writes to us to say that in his district, the oil regions of Pennsylvania, boilers are frequently too small for the work they have to perform, and that the men in charge of the boilers have frequently to quit this work to visit the wells which may be 60 or 600 yards away. Thus the boilers are left to mind themselves for hours at a time; and therefore, he claims, automatic safety appliances, such as fusible plugs, low water alarms, etc., would never be objected to by the engineers employed in the oil industry.

"An Engineer" points out the danger arising from scale in the boiler, which threatens destruction when the boiler has plenty of water as well as when the supply is short. Boiler plates get burnt by the excessive heat necessary to overcome the resistance of the scale; the scale may crack, the water come in contact with red hot iron, steam in prodigious quantities will be formed, and the boiler be unable to resist the sudden strain. He recommends the examination and certification of men in charge of stationary engines, and points out many well known advantages of the fusible plug.

Compressed Air for Power.

In using compressed air as a means of transmitting power, a velocity of about 40 feet per second for the air in its compressed state has been found to answer in practice. When the diameter of the pipe is so adjusted as to secure this velocity, the pressure expended in overcoming friction may be estimated at one per cent of the total or absolute pressure of the air, for every five hundred diameters of the pipe in length.—*Rankine.*

Fine Workmanship.

We recently received a small lathe chuck from the Morse Twist Drill Company, of New Bedford, Mass., sent as a sample of milling machine work. It is a superior specimen of a branch of machine shop manipulation of which we have reason, as a nation, to be justly proud.

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MATTER AS A MODE OF MOTION.

In his address as President of the British Science Association, in 1871, Sir William Thomson threw out two original suggestions, which prettily illustrate the different ways in which new ideas are popularly received. One of the suggestions was of no value whatever, yet it was immediately caught up and talked about the world over: we allude to the hypothesis that the earth might be indebted to a germ-bearing fragment of some exploded planet for its first beginnings of life. It was a brilliant fancy, and caught the popular eye at once; but being only a fancy, it vanished as suddenly as it flashed into light.

The other suggestion awakened no apparent response; it may be that it conveyed no meaning whatever to more than a dozen persons, in whose minds it germinated for years before it bore any fruit fit for transmission to the general public. Sir William had been discussing the question: "What is the inner mechanism of the atom?"—a question which must furnish the explanation not only of atomic elasticity but of chemical affinity and the difference of quality of the different chemical elements, at present mere mysteries in science—when he remarked that a fingerpost pointing the way to a full understanding of the properties of matter might be found in Helmholtz's exquisite theory of vortex motion.

This most pregnant suggestion fell, as we have said, without meaning on the ears of the multitude, and found no place in the popular discussion of the address which followed. At most—save among a few of the more advanced physicists and mathematicians—it may have given rise to the queries, what is vortex motion? and what is Helmholtz's theory? for which encyclopedias and textbooks furnished no answer. Even the latest and most scholarly of English encyclopedias makes no mention of vortex motion in its article on atomic theories. Thanks, however, to the speculations of the authors of "The Unseen Universe," a wider interest in Sir William's suggestion was aroused. Since then Professor Clifford has endeavored to remove the new theory from the narrow world of pure mathematics and make it intelligible to people of ordinary culture: and still later, Professor Tait, in his lectures on recent advances in physical science, has done still more to bring the subject within the range of popular science, so that most reading men have by this time at least heard of vortex motion, though they may but vaguely apprehend its nature or its bearing on the drift of scientific speculation.

Fairly good illustrations of vortex motion (under friction) may be seen in the cloud rings produced by the spontaneous explosion of bubbles of phosphoretted hydrogen escaping from water into air. Occasionally puffs of steam from the funnel of a locomotive will show vortex rings; and the same motion is also shown by the revolving ring of tobacco smoke sometimes ejected by clever smokers. By means of a simple apparatus made of a cigar box, with a round hole in one end and the other end closed with a tightly drawn cloth, Professor Tait produces vortex rings of great perfection and persistence. In the box, fumes of sal ammoniac are generated; and by striking smartly the cloth-covered end of the box, very beautiful and durable cloud rings are driven out of the circular opening at the other end. A more tangible illustration of vortex motion may be seen in a soft rubber ring made to revolve on a stick without advancing. In this case the friction of the stick as it is drawn through the ring causes the inner portion of the ring to move in the same direction; as the ring, as a whole, is kept from moving forward, the motion of the inner surface forward is counteracted by a motion of the outer surface backward, the two resulting in a revolution of the ring upon itself without any change in its form or in its position in space. In the case of the smoker's cloud ring, the friction of the lips holds back the outer portion as it makes its exit, while by the breath the inner portion is driven forward, and thus a vortex motion is created, which lasts until the cloud ring is dissipated or its motion is stopped by the friction of the air.

It seems a long way from a puff of tobacco smoke to a scientific theory of the innermost constitution of matter; but the scientific imagination often finds the simplest things the most suggestive, and sometimes reason can follow its most ambitious flights with a perfect bridge of mathematical demonstration. It has not yet been able to do so in this case it must be admitted; nevertheless, the conditions seem very favorable for ultimate success.

While studying the equations of motion in an incompressible frictionless fluid, some fifteen or sixteen years ago, Helmholtz demonstrated among other things that in such a fluid a vortex motion would be indestructible. The case is purely hypothetical; we know of no such fluid, and if it existed vortex motion could not be originated in it, since friction is essential to its production. But it is perfectly legitimate in mathematics to assume any imaginable conditions and then investigate their properties and results; and having supposed a vortex motion to exist in a perfect fluid, it is demonstrable that it would continue for ever, preserving its peculiar individuality to all eternity.

Even in air and water, vortex rings behave curiously like atoms; they preserve their individuality to the end; they cannot be made to destroy each other, nor can they be divided. Though nothing more than a rotating cloud of smoke, the sharpest knife cannot sever a vortex ring; it simply wriggles around the knife and keeps its course unharmed. In a perfect fluid, vortex filaments might be of any shape or degree of complexity, yet that shape would persist for ever unalterable.

Facts like these suggested to Sir William Thomson the idea that maybe the ultimate atoms of matter are simply vortex rings or filaments in a frictionless fluid filling all space. The mathematical verification of this hypothesis involves enormous difficulties—with present means, insurmountable difficulties; but Sir William has pursued it far enough to show that it explains a great many of the physical properties of matter.

From this view the assumed solidity of the ultimate atoms of matter gives place to extreme fluidity, the vortex atom being persistent and indivisible, not by reason of its hardness or solidity, but because its motion is indivisible. The origin of such motion remains of course unexplained, and, like the origin of life or force, unexplainable.

Taken in connection with Lesage's theory of gravitation the vortex theory offers many advantages over every other theory of the nature of matter; and as Professor Tait has remarked, with a little further development it may be said to have passed its first trial, and, being admitted as a possibility, may be left to time and the mathematicians to settle whether it will really account for everything experimentally found.

Having arrived at the conception that what we call matter may be only more or less varied phases of vortex motion in a universal frictionless fluid, which fluid possesses in itself none of the attributes of matter, Professor Clifford goes further, and holds it to be a necessary supposition that even where there are no material molecules the universal fluid is full of vortex motion, the inter-material spaces differing from matter simply in having their vortices smaller and more closely packed. In this way the difference between matter and ether is reduced to a mere difference in the size and arrangement of their component vortex rings.

SPECIAL MACHINE WORK VERSUS MANIPULATIVE SKILL.

The mechanical manipulation practised in this country is distinguishable from that practised in Europe in that handwork is mostly displaced by machine work; and this is in every way desirable, because the labor of the mechanic is lightened, and he becomes less and less an exerter of brute force. Furthermore, our producing capacity is greatly increased, while the cost of production is proportionately diminished. That these are desirable elements, even in the face of the fact that their existence is operating to some extent to destroy the quality of our workmen, is undeniable; but that these elements exist, it would be folly to deny. The very object of special tools is, in nearly all cases, to take the place of the most skillful workmen; and the skill required to operate a special machine is as a rule insignificant compared with that necessary to perform its duties by handwork. "What matter," it may be asked, "when the necessity for skillful handwork no longer exists?" No matter, providing that such be the case; but unfortunately it is not, because special machine work, no matter how well performed, can never equal the most skillful handwork. It can produce a quantity of good work at infinitely cheaper cost, and thereby almost exclude the finest of work from the market; and this is what, in many cases, it does. This is, no doubt, all things considered, a gain; but the detriment to manipulative hand skill remains. This condition of things, however, has its limits; and these will be found in the nature of the work. For example, a number of pieces of small work, such as watches, sewing machines, etc., may be made by special machinery of as good quality as an equal number of such articles could, in the ordinary course of things, be made by hand. A single watch or sewing machine may, however, be made by hand with a perfection that special machine work cannot approach. But when we come to treat of work of a larger size, such as the manufacture of a lathe or a locomotive, the term special machine work assumes an entirely new aspect. For instance, an axle lathe may be called a special tool, because in it nothing but axles are turned. The skill of the operator in this case requires to be just as great, since his operations are not performed by the machine, and there exists the same field for his manipulative skill. Upon all but small work, in fact, the special tools and appliances consist mainly of arrangements designed to assist in the chucking and holding of the work, and in machines intended for certain kinds of work respectively, such as planing, boring, turning, and slotting. These operations are performed with the same cutting tools as of yore. The reason of this is that the milling cutters, emery wheels, etc., which will answer well upon small work, cannot be relied upon for large, as they will not cut true, and any attempts hitherto made to adapt them to such work has resulted in inferior productions. Again, on small work three or four operations can be performed by one special machine without its being unhandy; but on larger work, the attempt to construct a machine for performing several operations produces unwieldiness, unhandiness, and usually failure.

Another element of consideration is that, while it is very easy to cast or forge small work uniform in size and shape (and it does not matter if an occasional piece is lost from a defect in its casting or forging), a defect or variation is much more liable to appear in a large casting; and as the loss would be a serious matter, it may, by a slight and often inconsiderable variation, be made to serve. We have also to remember that the greater part of the fitting of work depends for its truth upon the file, for machine tools do not as a rule cut the work sufficiently true. In lathe work, special tools are confined to appliances, chucks, standard reamers, gauges, etc.; and in work of a medium size, the use of these aids tends to make the operator more expert, and a more skillful workman. It is indeed to be remembered that in small and moderate sized lathe work, the duty performed by the tools is so great that it requires constant skill and attention to keep them in order; and the tools in use are in such continual motion as to render their employment one requiring skillful manipulation.

The interchangeability of parts is an excellent and valuable assistant in producing new machinery, but its usefulness is far from being universal, as it is commonly supposed to be; because in making repairs the new parts generally require to be larger than their original size, in order to compensate for the wear which has taken place in other parts, and hence it is that, as a rule, repairs are made by the users and not by the original manufacturers of machines. Repair shops for this reason are in general demand; and in view of this necessity, which calls for the highest manipulative skill, they generally contain the best of workmen and pay them the highest rates of wages.

STATE PATENT LAWS.

A bill now before the New York State Legislature, introduced by Mr. Lang and known as the patent right bill, is intended to protect the people of the interior of the State against the wiles of the swarms of patent right venders who perambulate the country, selling rights and taking promissory notes for bogus patents. It provides that the words "given for a patent right" shall be written or printed across the face of the note, and any person who shall take or sell a note without the above placed upon it shall be deemed guilty of a misdemeanor. The bill has been ordered to a third reading.

We suggest a slight amendment to this proposed law, to wit. strike out the words "patent right;" otherwise the law, if passed, would be void because in conflict with the Constitution of the United States.

The United States courts have more than once decided that no State has a right to legislate upon the subject of patents, nor to regulate, nor attempt to regulate, their sale. That power belongs alone to Congress.

In the case of M. J. Robinson, arrested by the local authorities of Indiana, 1870, for violation of the State law concerning the sale of patents, it was held by Judge Davis, of the United States Circuit Court, as follows:

"This is an attempt on the part of the Legislature to direct the manner in which patent rights shall be sold in the State, to prohibit their sale altogether, if these directions are not complied with, and to throw burdens on the owners of this species of property which Congress has not seen fit to impose upon them. I have not time to elaborate the subject, nor even to cite the authorities bearing on the question, and shall therefore content myself with stating the conclusion which I have reached.

It is clear that this kind of legislation is unauthorized To Congress is given by the Constitution the power "to promote the progress of science and the useful arts by securing for limited times to authors and inventors the exclusive rights to their respective writings and discoveries." This power has been exercised by Congress, who have directed the manner in which patents shall be obtained, how they shall be assigned and sold.

The property in inventions exists by virtue of the laws of Congress, and no State has a right to interfere with its enjoyment, or annex conditions to the grant. If the patentee complies with the laws of Congress on the subject, he has a right to go into the open market anywhere within the United States, and sell his property. If this were not so, it is easy to see that a State could impose terms, which would result in a prohibition of the sale of this species of property within its borders, and in this way nullify the laws of Congress which regulate its transfer, and destroy the power conferred upon Congress by the Constitution. The law in question attempts to punish by fine and imprisonment a patentee for doing with his property what the National Legislature has authorized him to do, and is therefore void."

In the case of Anthony *vs.* Carroll, where a State law of Massachusetts was cited as a bar to a patent right suit, Judge Shepley held, 1875, as follows:

"The policy of the Government to provide a uniform system of rights and remedies throughout the United States upon the whole subject matter of patents for new and useful inventions and discoveries, by placing it under the control of Congress and the federal courts, would be frustrated if such State legislation could directly or indirectly limit, restrict, or take away the remedy."

RECENT STUDIES OF LUMINOUS FLAMES.

For a long time Sir Humphrey Davy's explanation of the luminosity of flames—that it was due to the presence of highly heated solid particles—sufficed for all observed phenomena. A serious blow to its sufficiency was given, however, when Frankland discovered that certain flames were luminous under conditions which left no reason for supposing that solid matter could be present. For instance, hydrogen and carbon monoxide, burned in oxygen under a pressure of ten to twenty atmospheres, yield a luminous flame giving a continuous spectrum. So likewise the non-luminous flame of alcohol becomes bright when the pressure is increased to eighteen or twenty atmospheres. Frankland inferred from experiments like these that the luminosity of flames was due rather to the presence of the vapors of heavy hydrocarbons, which radiate white light, than to incandescent solid matter.

Still further doubt of the prevalent theory was raised by the experiments of Knapp, which proved that the diminished luminosity of a flame on the admission of air could not be due, as had been supposed, to an oxidation of the carbon suspended in the luminous gas, since the same effect was produced when nitrogen or carbon-dioxide, or other indifferent gas, was used as a diluent.

Stein and Blochmann attributed this effect to the direct influence of the diluting gases in separating the particles of carbon, so that the oxygen of the air might unite with them more quickly than under the ordinary circumstances of combustion. Wibel held, on the contrary, that the diminished luminosity was due entirely to the absorption of heat by the diluting gas, and supported his view by some very ingenious experiments. The correctness of this conclusion has been, in turn, controverted by the later experiments of Stein and Heumann, particularly the latter, which seem to show that the diminished luminosity consequent upon dilution is due not solely to dilution nor wholly to the cooling action of the added gases, but to both these causes acting together and frequently supplemented by a third cause—namely, the energetic destruction of the luminous material by oxidation. Heumann's experiments, which have been particularly ingenious and careful, lead to the following results: That hydrocarbon flames, which have lost their luminosity by the withdrawal of heat, become luminous again by the addition of heat; that flames rendered non-luminous, by dilution with air or indifferent gases, become luminous again on raising their temperature; that flames rendered non-luminous by excess of oxygen, which brings about energetic oxidation of the carbon, are rendered luminous again by diluting the oxygen with indifferent gases. In most cases of diminished luminosity two or all of these causes are at work.

Another unsettled question with regard to flames has been the cause of the non-luminous space between the opening of a gas burner and the flame, or between the wick of a candle and the luminous envelope. Blochmann attributed it to the inability of the surrounding air to mix at once with the stream of gas so as to make it combustible. Benevines, on the other hand, thought the dark space due to the mechanical action of the issuing gas, whereby the air is driven to a distance from the orifice of the burner—greater or less, according to the pressure on the gas, leaving a space wherein the gas is deprived of the requisite amount of oxygen and consequently remains unburned. Both these explanations are shown to be insufficient by the single circumstance that a flame never directly touches any cold body held within it. In all such cases Heumann finds an explanation of observed conditions in the cooling effect of its surroundings—burner, wick, cold iron, or what not—upon the gas. For a certain space around the cooling body the gas remains at a temperature too low for ignition.

Where the gas issues under high pressure, or is greatly diluted, the distance of the flame is attributed partly to this same cooling action of its surroundings, but more especially to the fact that the velocity of the stream of gas in the neighborhood of the burner is greater than the velocity of the propagation of ignition within the gas.

THE FLOWER TRADE OF NEW YORK.

On Broadway, Fifth and Sixth avenues, and the cross streets near them between Third street and Forty-seventh, there are thirty large florist concerns, each of which pays a rent from $1,000 to $4,500 a year, and does a yearly business of from six to forty thousand dollars. There are besides perhaps fifty smaller shops for the sale of flowers in different parts of the city. Many of the larger gardens and hot-houses were established during the flush times between 1860 and 1870, when large sums were lavished on floral decorations. At the wedding of Tweed's daughter, for instance, the floral designs, bouquets, and parlor decorations are said to have cost nearly $4,000. Since 1871 there has been no notable increase in the number of flower producers in this vicinity. The number of retail dealers, however, has increased, and with the greater competition and smaller demand the prices and profits have been materially lowered. Indeed, says a *Times* reporter, to whom we are indebted for a three-column review of the trade, it is only at holiday seasons that prices can be regarded as handsomely remunerative. For example, a shipment of roses and violets sent to Boston just before New Year's brought $15 a hundred for the roses and $1.50 for the violets; but by the 10th the same sorts of flowers were respectively worth only $4, and half a dollar a hundred.

At this midwinter season the assortment of flowers in the New York market embraces ten choice varieties of roses, four varieties of camellias, several varieties of carnations, violets in abundance, heliotropes, mignonettes, pansies, primroses, azaleas, forget-me-nots, the sweet alyssum, etc. The lilies of the valley seem to gain in popularity constantly; and notwithstanding the great number grown about New York, so high are they in favor that the price is always good. Roehrs, of Union Hill, N. J., grows 150,000 sprays of them annually. One day last year he sent to the city by one man 10,000 sprays, for which he received fifteen cents each, or $1,500 for a single back-load. Carl Jurgens, of Newport, Rhode Island, grows this winter 800,000 sprays of these little beauties. Roman hyacinths, which rival the lilies of the valley in popularity, are worth just now from seven to ten cents a spray, or from one and a half to two dollars a dozen. Orchids are always hard to get and very costly; sometimes as much as five dollars has been paid for a single flower. The finest collection of orchids grown for the trade in this country is believed to be that of George Such, of South Amboy, N. J.

Among foliage plants, ferns and smilax are most commonly used, and are justly prized for their effect in lighting up all floral decorations. Ordinary branches of ferns cost but three dollars a hundred, but some of the rarer kinds command as much as fifty cents each. The amount of smilax used here is enormous, experienced florists estimating that from 1,000,000 to 1,500,000 feet of this beautiful vine are made up annually in this city. Formerly it used to be imported entirely from Boston, at a cost of a dollar a yard for single strings; now that the local florists are growing it largely, the price is greatly reduced. This winter not more than three thousand dollars' worth of all kinds of flowers and foliage have been imported from Boston, while considerably more than that amount has been sent there, besides large shipments to Philadelphia, Baltimore, Albany, and other cities.

The best informed of our large flower-growers estimate that not less than $10,000,000 are invested in the wholesale florist's business, in land, greenhouses, and stock in this vicinity. The hot-houses cover over forty-five acres. At Union Hill, N. J., there are perhaps twenty acres under glass for the cultivation of flowers for the New York market. The general average of prices at the present time is, for loose roses, $1 a dozen, except for choice specimens, which command fifty cents, or even a dollar apiece; calla lilies, 25 cents each; smilax, 30 cents a yard; heliotropes, carnations, bouvardia and other small flowers, about 50 cents a dozen; hand bouquets from $5 to $25, according to size and composition; table designs from $5 to $100; funeral designs from $3 to $150.

For permanent house decorations, grasses, *immortelles* and pressed leaves are in great favor; the most beautiful grasses being the magnificent "pampas grass" plumes from California, which sell from 50 to 75 cents each, or $1 a pair for handsome specimens. *Immortelles*, of natural color and dyed, are brought from France, but not in large quantities.

PUTTING IN COAL.

We are in receipt of a letter from a correspondent in this city regarding the annoyances to which householders are subjected in putting in coal during the winter season. When a heavy snowfall blocks the streets, and coal carts cannot back up to the coal shoots, the drivers often carelessly dump their loads on the snow heaps, and quantities of coal are thus lost by becoming imbedded in the snow.

The remedy which will at once suggest itself to many is the adoption of the English system of delivering coal in sacks, each containing a given amount, say 200 lbs. This, in London, is obligatory; and in order to protect the purchaser against short weight, wherein, by the way, he is often woefully cheated by the system of delivery in vogue here, every cart in which the sacks are carried is provided with scales, so that the sacks may be weighed singly if the buyer makes the demand. In England, however, this is regulated by laws, and any similar statutes we do not possess. Hence there is no way of compelling coal dealers to deliver their coal in sacks; and besides there yet remains the trouble of emptying the bags into the cellar shoot. For this work, the extortion would undoubtedly be as great as for shovelling the coal by hand. Besides, the coal sacks must in some way interfere with the profits of the business, judging from a sign (now posted on a prominent thoroughfare in this city, before the office of a dealer in the commodity) to the effect that "coal will be delivered in 100 lbs. bags at 50 cents per sack." That is $10 per ton, or about double ruling prices based on bulk delivery.

The best way, we think, to introduce a reform is to make it profitable in a legitimate way to the persons on whom it is to act. To this end, we suggest making the bags themselves an article for sale; and instead of using hemp or other cloth in their manufacture, use paper. There is no question but that coarse brown paper can be made strong enough to hold 100 lbs. of coal during its transit from yard to cellar. Let this paper be well soaked in resinous material and it will constitute a firstrate kindling, possibly as good as the "fire lighters" of similar composition now sold. It will only be necessary then to lift the filled bags from the cart and toss them bodily down the shoot. Of course, it is immaterial if they break while sliding into the cellar. Coal thus transported would be protected from the weather, and would obviate the necessity of moistening to prevent dust while it was being deposited in the cellar; and even if abandoned by the cart driver on a snow bank, the coal would hardly suffer the fate of our correspondent's fuel. We live in an era of reform. It remains to be seen what enterprising coal dealer will adopt our suggestions.

Slate Roofs.

A very economical system of slating buildings with large slates is as follows: The rafters are placed at a clear distance apart about 1½ inch less than the width of the slates. Down the center of each rafter is nailed a fillet, thus forming a rebate on each side, in which the edges of the slates rest, being secured by black putty, or—as this looks smeary and uneven—by a second fillet 2 inches wider than the first, nailed over it so as to cover the edges of the slates and hold them down. Each slate laps about 3 inches over the one below it. Only half the number is required in this as compared with the ordinary method of slating, and no boarding or battens are necessary.—*Notes on Building Construction.*

IN our description of Mr. Guardiola's sugar evaporator, on page 82 of our last issue, we stated that the apparatus is calculated to produce defecated juice from, say, 8° to 25° Baumé. It should read: "The apparatus is calculated to produce, in about five minutes, syrup of about 25° Baumé in a continuous stream, from defecated juice of 8°," etc.

A LAWSUIT has been commenced by one firm of pianoforte makers against another, for damage caused by the latter's misrepresenting the nature of the Centennial awards, and claiming to have received a premium higher than that given to any other maker.

SOLAR PHOTOGRAPHS.

Photography has proved an invaluable aid in the study of solar physics. By its help astronomers now obtain pictures of sun spots accurate in all their details, of the different phases of eclipses, and of phenomena of too short duration for the eye fully to appreciate. At the observatory of the Roman College, Rome, Italy, Father Secchi photographs the sun daily by means of the instrument represented in Fig. 1; and having carried on this operation for several years, he is now possessed of a record of occurrences on the solar surface which has served as the basis of many important conclusions regarding our luminary. By comparing these pictures, the periodicity of the spots has been determined; and from data thus obtained, astronomers have reached the belief that the sun acts not merely as a center of attraction and luminous source, but that it exercises a potent effect on magnetic phenomena.

The engravings herewith given were reproduced from Father Secchi's photographs, in order to show that astronomer's new work on the sun. Figs. 2, 3 and 4 show very perfectly the wavy, unequal, and granulated surface of the sun, as exhibited by a telescope of high power. Fig. 2 represents the normal condition of the surface projected (much magnified) on a white screen. Fig. 3 exhibits the granulations with their interstices, observed directly. Fig. 4 is a facula on the surface thrown upon the screen. Fig. 5 is a photograph of a sun spot, showing its rounded form at the moment of complete development; and in Fig. 6 are several such spots, grouped together.

The depth of the immense cavities forming the spots is usually about one third the earth's diameter, and never exceeds 4,000 miles. The cavities are by no means empty, as the resistance which they offer to the passage of luminous currents shows that they are filled with more or less transparent vapors. They are produced in the luminous exterior envelope of the sun—the photosphere—and are craters therein, filled with dark vapors which cut off the light from the lower strata. They are the result of violent crises in the interior of the solar globe, which sometimes take place over large areas with great rapidity: at other times they occur quite slowly, last for a considerable period, and are seemingly intermittent in their violence. The material which composes the pe-

Fig. 2.

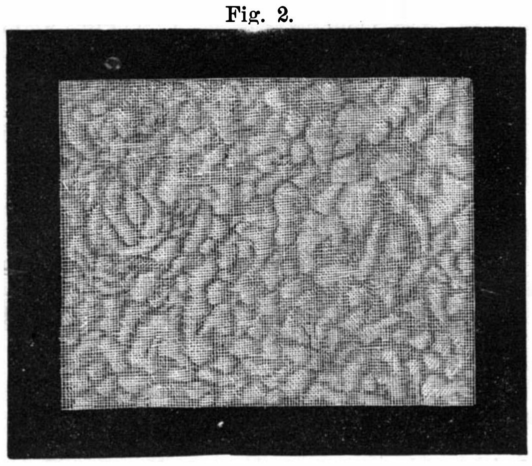


Fig. 3.

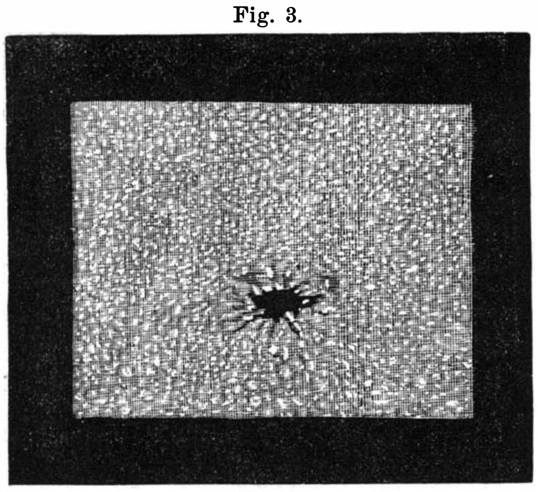
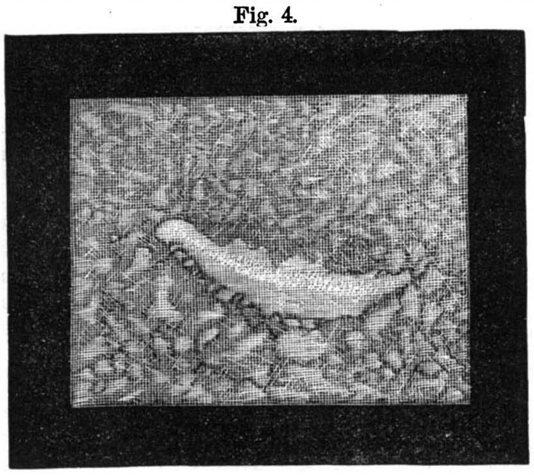


Fig. 4.



numbra of the spots, and the cloudy bridges which cross or float over the dark portion are masses of photospheric matter. These masses are the result of violent action taking place occasionally in the interior of the sun. Sometimes these actions are sudden; at others they take place slowly, and sometimes their action is renewed from time to time; and the interior trouble, of which they are but the manifestation, perseveres for a long period after their first appearances. In fact, in a great number of instances, there is a movement constantly going on, from the interior to the ex-

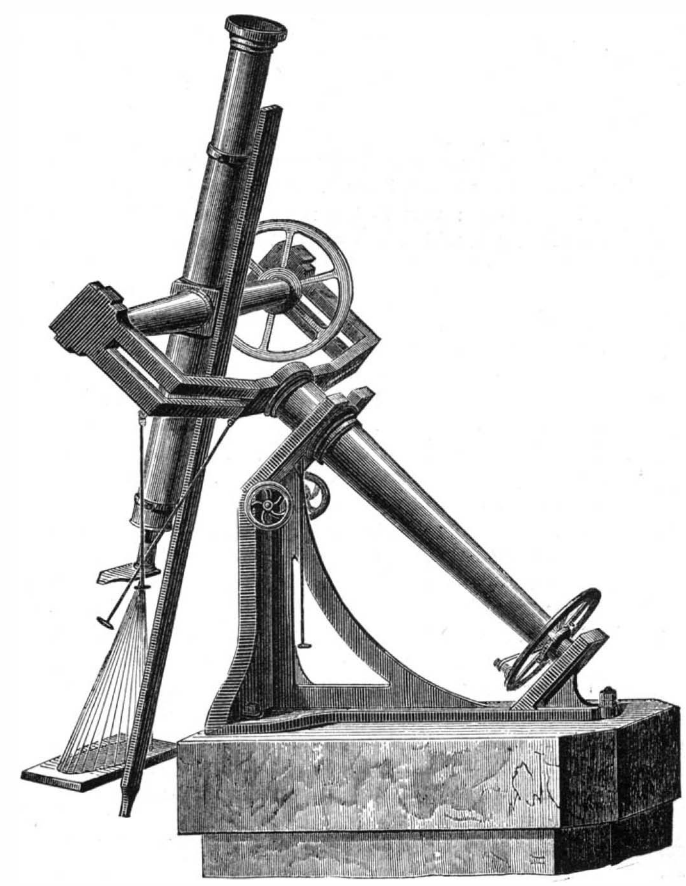
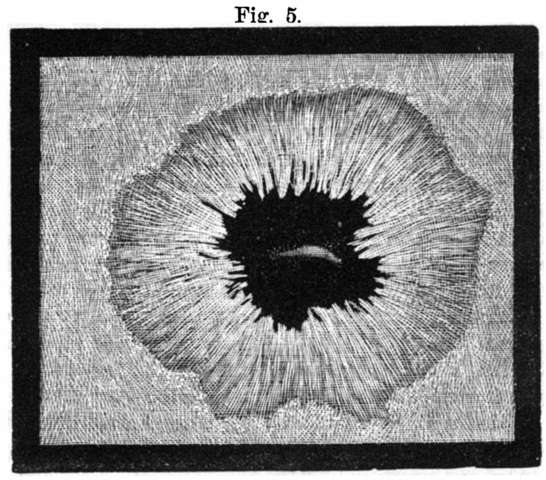


Fig. 1.—SECCHI'S SOLAR PHOTOGRAPHIC INSTRUMENT.

terior of the sun; and this movement is shown to us by the upheaval and the projection of the luminous matter, the latter becoming visible under the form known to us as *facula.* But generally, if we study the luminous masses which are seen as spots, we find that they are comparable to vaporous clouds suspended in a transparent medium. The currents and the

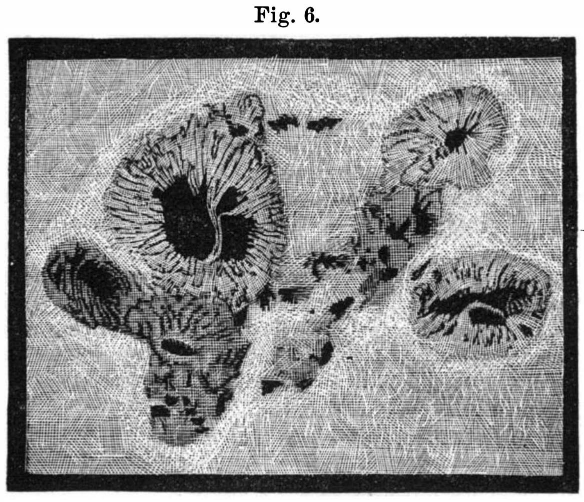
Fig. 5.



particles of the photosphere are driven towards the center of the spots, where they dissolve and cease to be luminous. They are often seen suspended at different heights in the solar atmosphere; and frequently the higher ones hide the lower from our view.

Solar spots are principally seen on two zones parallel to the sun's equator, one on each side of it, between 10° and

Fig. 6.



30° of latitude. The rotation of the sun was discovered by the displacement of these spots; but it is remarkable that this rotation is not similar on all points of the sun's surface. The angular speed is greatest at the equator, and diminishes as the degrees of latitude augment in number. The sun does not revolve according to the laws which we suppose to govern the movements of a solid body, whence it follows that we should regard it as a mass of fluids. The sun's rotation is accomplished in a mean period of 25 1-3 days; and we cannot as yet explain whether this rotation affects the solar atmosphere as well as the globe itself, for the interior regions are entirely hidden from us; but we can cite an indirect proof which has some importance, although it appears at first to be a little singular.

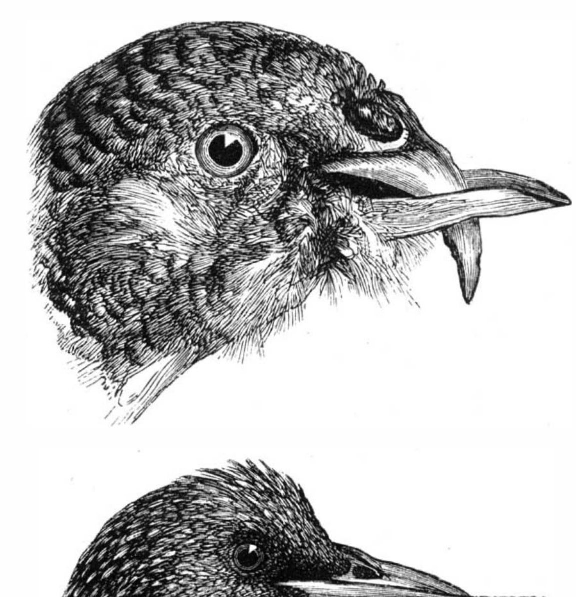
Herr Hornstein, discussing the magnetic phenomena observed at Prague, found in the movement of the magnetic needle a variation of which the period was 26·33 days. On comparing it with certain data, he attributed the phenomenon to the magnetic influence of the sun; and if we admit that the magnetic period above referred to is the same as that of the solar rotation, we find that the sun turns on its axis in 24·55 days. Magnetic phenomena thus give us a new idea of the period of solar rotation, which differs from that which we derived from study of the whole solar surface, but which is similar to that formed on a study of the sun's equatorial region.

Inventions.

Among the general public it is thought that great inventions are the result of what is called "lucky hits," and that chance has more to do with them than brain work. It is undoubtedly true that the most wonderful inventions are the simplest, and that the truths on which they are founded appear obvious. However commonplace some inventions may seem when they have become familiar to everybody's understanding, it must not be overlooked that for centuries their truths had lain concealed from the busy brain of man. If the real nature of great discoveries is fairly considered, as well as the intellectual processes which they involve, none can seriously hold the opinion that such inventions have been the effect of mere accident; but, on the other hand, it must be apparent that such *soi-disant* accidental discoveries never happen to ordinary men. We believe that inventions dawn gradually on the contemplating mind; a certain fixed idea becomes, step by step, developed, by patiently weighing the *pros* and *cons,* until at last a sort of electric spark convulses the brain, momentarily sending a glow of joyful spasm to the heart, and true genius is born to the world.—*British Mail.*

ORNITHOLOGICAL DEFORMITIES.

Mr. W. B. Tegetmeier, a naturalist whose writings on ornithology are widely studied in Europe, asserts that the struggle for life finds one of its best examples in the malformations which are occasionally found in animals of different species. A whale has been known to hurt its lower jaw so that it could not close its mouth; yet it lived and thrived, and when killed it was in excellent condition. He also states that he has in his possession the head of a salmon which weighed 12 lbs., of which the upper jaw had been entirely torn off. Yet it lived, and attained a fair average development. In birds, too, such deformities are not uncommon; and our engraving shows two remarkable instances.

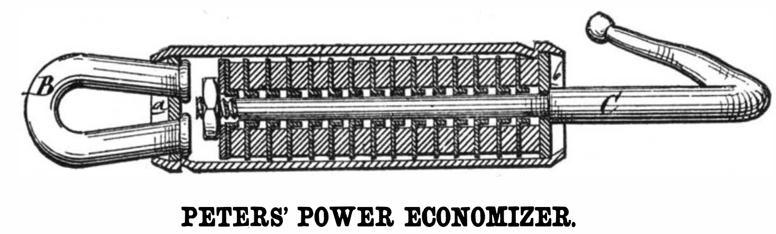


The first specimen is the head of a hen pheasant, of which the upper mandible is so curved that it has cleft the lower mandible in half, and grown down so as to cause the bird to die of starvation. The second instance is that of a starling, of which the lower mandible grew to an inordinate length. The reason of this prolongation cannot be found in any necessity for it; for the bird uses its beak simply to dig for worms in soft earth, and the prolongment was formed entirely of a species of horn. In caged birds, such formations can be accounted for, as the captives do not employ their bills as they do in their native state. Sometimes the protuberance has been clipped off, but it rapidly grows again.

A TRACTILE POWER ECONOMIZER.

It is well known that any effort of traction applied to a rigid non-flexible object is much more arduous than if applied to an elastic body. Thus a carriage hung on springs is easier to draw than one not so suspended, yet of like weight. Herr Schermann, a German engineer, has lately invented an apparatus which he applies, to the collar of a horse, for example, on each side and attaches to it the traces. It consists of an iron cylinder filled with disks of rubber alternating with disks of sheet iron. Through the whole passes a rod having a hook at each extremity of the apparatus. When strain is brought on either end of the rod, the rubber is compressed, and hence the device serves as an elastic medium to pull against. The inventor has made experiments which are said to show an economy in fatigue and tractile power of 17 per cent during travel and of 20 per cent in starting the load.

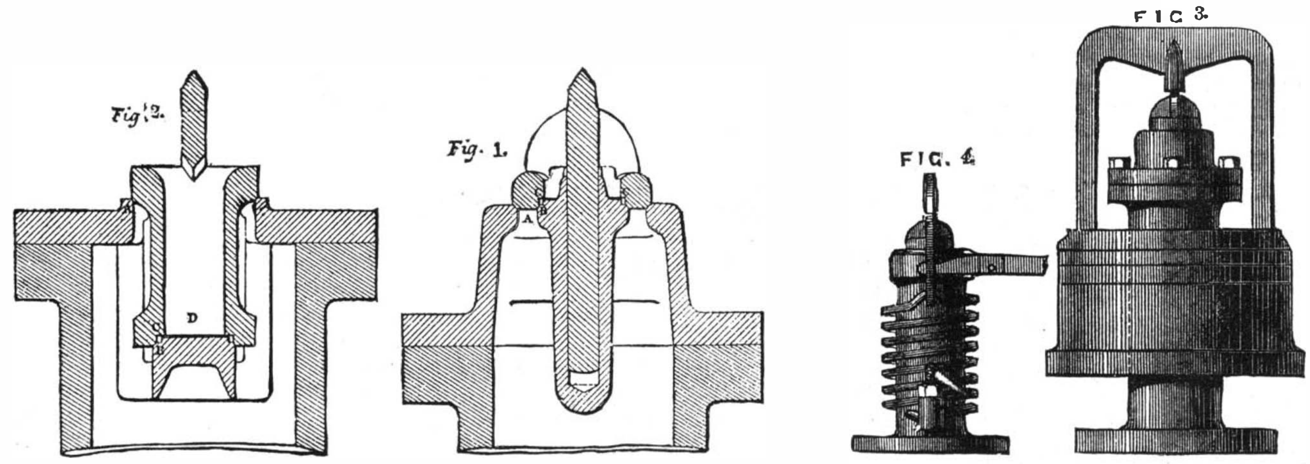
[The foregoing, translated from *Les Mondes*, offers another instance of an American invention advertised abroad as the production of some foreign scientist. The same device was patented here, January 18, 1876, by Mr. August J. Peters. Its construction will be clear from the annexed engraving, in which C is the elongated end of the trace hook, entering the cylinder which contains alternate disks of rubber and metal, as already described. B is the link whereby the device is connected to the trace chain. If the invention is so economical of power as above intimated, it is worth examination by street car owners and others using horses for severe work.—EDS.]



PETERS' POWER ECONOMIZER.

IMPROVED SAFETY VALVES.

We annex engravings of a safety valve designed and patented by Mr. J. W. Melling, of Birkett Bank, Wigan, England, the special feature of this valve being the arrangement adopted to secure a large discharge area. This increase of discharge area as compared with ordinary valves is due partly to the increase of lift and partly to there being two openings through which the escape of steam can take place. The increased rise is obtained by providing a larger area for the steam to act on when the valve is blowing off than when it is closed. This will be seen on reference to the sections Figs. 1 and 2. When blowing off, the steam that passes the inner face, B, acts with effect on the additional surface provided by the part, C, on the valve. The width of the space left between this part, C, and the top of the boss on the seat determines what amount of increase in pressure the valve will allow before rising to its full height; for instance, if a valve was loaded to commence blowing at 60 lbs., it would act something like an ordinary valve until the pressure reached, say 62 lbs., when it would rise at once to its full height; but if the escape was made wide it would allow the pressure to rise to 63 lbs. or 64 lbs. before going to its full height, which is, when loaded by dead weight, about equal to the width of the orifice in the seat, so that the area given for discharge is as much as is required by that orifice. In addition to the outer discharge, there is the inner one that is equal to from 30 to 40 per cent of the outer one, and the combined areas amount to six or eight times as much as would be given by the ordinary kind of valve of the same outer diameter, when working with pressures over 50 lbs. per square inch.



MELLING'S IMPROVEMENTS IN SAFETY VALVES.

It will be seen that the discharge from the outer face is uninterrupted, whilst the inner discharge gives these valves an additional advantage when used as reducing valves, where the difference required in the pressures is small. Mr. Melling's valves also overcome the objection to spring loading, as the increasing resistance of the spring is compensated for by the additional area that is provided for the steam to act upon. These valves also differ from the ordinary safety valves, as the lift is as great with high as with low pressures of steam.

The lift of the valve shown in Fig. 1, when loaded by dead weight, is self-regulating, as the steam lifting the valve has first to pass through the orifice in the seat, but with Fig. 2 the lift has to be limited. These valves may be so proportioned as to give a large discharging area with a smaller loaded or lifting area, which makes them specially valuable when used as combined low water and high pressure valves.

Fig. 3 shows the simplest and most direct mode of loading for stationary boilers, the weights being carried by the crossbar or stirrup, the socket of which fits loosely on the end of the valve spindle.

Fig. 4 is a representation of a spring-loaded valve in which the spring fits round the body of the seat, and at the top is held at each side by the hooked ends of the crossbar or stirrup, which rests on the valve; at the bottom it is held by the projections on the collars that fit round the screw studs by which the tension is regulated. The easing lever bears against two shoulders on the stirrup, and is so mounted that it cannot prevent the valve from rising.

For marine purposes Mr. Melling adopts an arrangement in which a pair of valves are mounted on the same branch seating. The valves are loaded by means of the two springs, one at each end of the crossbar, and the tension of the springs is regulated by means of nuts on the screw studs at the bottom, or in place of the springs two ordinary spring balances are used; in either case the springs are out of the direct current of the escaping steam. The valves when locked up are eased from their faces by the double lever and double cam. We are informed that a number of these valves are now in use, and several very favorable reports of their performances have been received. The need of such appliances is large, and is daily increasing.—*Engineering.*

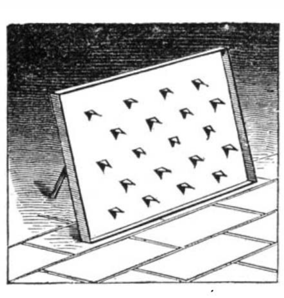
The Latest Advertising Dodge.

This time it is a thoughtful financier in Vienna, who has invented an ingenious method of attracting people's attention to his lottery scheme. He watches the English newspapers, in which it is customary to print "births" with the usual notices of "deaths" and "marriages," and carefully registers the address of each happy mother. In due time the parent receives a letter (photo-lithographed) worded thus: "Dear Madam: Having read in the —— the happy event which lately took place in your family, I beg (although a perfect stranger to you) to congratulate you with all my heart, and to add my wishes that the little offspring may become a source of great pleasure and comfort to the parents. * * It has been for many years the custom on the Continent to endow the little helpless child who enters this world with a fair chance of life in a pecuniary sense of the word. It is almost the universal practice to lay aside for the baby an interest-bearing firstrate Government bond, which also stands the chance of obtaining a large premium prize of thousands of pounds." Then the financier encloses prospectus of the —— loan of the year 1870, descants on the opportunity of the young one's winning £10,000, and thoughtfully adds a blank application for the mother to fill out, which last she is requested to please "return together with the needful cash."

A somewhat similar advantage of family increase was once taken by an enterprising porter brewer of London, who advertised porter for nursing women. New mothers invariably received circulars and full information concerning the beverage.

A Woman's Invention.

All lovers of good toast will be interested in the following useful bread toaster, the invention of Mrs. A. C. Harris, of Granville county, N. C. It is not patented, and can be made by all who wish to use it. It is made by taking a piece of sheet iron or heavy tin, about 18 inches square, and turning up the edges so as to form a shallow tray, to give sufficient stiffness to the sheet. A number of V-shaped openings are now made in regular order across the bottom; and the tongues of the V's are turned up at right angles to the sheet. These sharp points are to hold slices of bread pressed upon them. A short piece of stout wire hinged to the back serves as a prop to hold it at any angle to the fire. After placing the slices of bread in position, by pressing them on the points, the toaster is set up on the hearth before an open fire, where the bread soon assumes a rich brown color, and then the slices should be reversed. If the lower part should brown before the upper, the toaster can be turned upside down, and so bring the underdone bread nearest the fire.



This useful invention costs only a few cents; and when once used, it becomes a household necessity.

Persian Petroleum.

Mr. Churchill, an English consul, states that for hundreds of years naphtha has been extracted by the natives from the pits at Baku, Persia, and the quantity underground appears to be unlimited. At the present moment a well eighty-one feet deep is shown that was dug by the Persians when they were masters of the country 200 years ago. In summer, when gases are generated in the bowels of the earth, the naphtha is thrown up in jets, some reaching 100 feet in height above the soil; it then runs to waste, as no means have as yet been devised to collect such large quantities of this oil. While at Baku Mr. Churchill visited the wells situated on the plateau of Balakhana. Strings of high-wheeled carts were met going to and coming from the wells, conveying in raw skins naphtha to the town. The first well we visited, says the writer, was an artesian well 126 feet deep. It was bored three years ago, and last year rendered from 16,000 to 20,000 poods of naphtha a day. At present, the demand having decreased, it only gives about 5,000 poods (a pood is 36 lbs. in weight). A horse was employed in raising the oil by means of a pump. Each time this pump was set to work a jet of naphtha seven or eight feet high and one foot in diameter came gushing out, and kept on coming for some time. We next visited the well that was sunk by the Persians 200 years ago. With a looking glass to throw a sunbeam down it, the naphtha is seen working away at the bottom, some eighty feet below the surface, like a troubled sea.

In the close neighborhood of these two wells has been formed a lake of pure naphtha, fully a quarter of a mile in circumference and twelve feet deep. It is calculated to hold millions of poods of naphtha that has run to waste, and has now become worthless. In the year 1874 upwards of 180 manufactories were at work in the outskirts of Baku; but owing to the enormous competition of American petroleum, many of the smaller manufactories have been compelled to shut up.

The two largest manufactories are those of Mr. Mirzayoff and Messrs. Kokoroff & Co., at Surakh Khana, a spot situated five miles from Balakhana, and eight miles and a half from the town. This spot was chosen on account of the economy of fuel, as gas issuing out of the surface is used in lieu of coal or naphtha. There is at Surakh Khana the wonderful sight of green fields with waving corn, in the midst of which the removal of a foot or two of earth will reveal a jet of gas that will raise an enormous blaze if set on fire. It is here that the Hindu monastery of fire worshippers is established, where a tongue of flame is perpetually kept up. But if these establishments have the advantage of cheap fuel, the position of Surakh Khana, away from the naphtha wells and at a distance from the town, increases the cost of transport, and consequently adds to the cost of the article produced. The buildings, moreover, erected by Mr. Mirzayoff are too palatial for practical purposes. There may be said to be four distinct operations in the development of this trade: 1st, the extraction of the naphtha from the earth; 2d, its conveyance to the refining manufactories; 3d, its refining processes; and 4th, its transport and its disposal in the markets of Russia.

The quantity of naphtha extracted at the wells is regulated by the demand, as there seems to be an unlimited supply of the raw material. Forty wells produced in 1874 upwards of 4,000,000 poods, besides the quantity that ran to waste. The means employed in the extraction are in some cases most primitive and clumsy, and it is only within the last three or four years that the process of boring has been resorted to, and wells are even now dug in the ordinary fashion at great expense. Then, again, while fuel exists in abundance on the spot, few steam engines are used, and those which are employed are not of the best. A recent visitor did not see a single centrifugal pump in use. After that the carting of the naphtha is both clumsy and expensive. The carts are not calculated to carry more than twenty-five or thirty poods each, and they require a horse and a conductor for every one separately. There is a vast field for economy in this, if in nothing else, and various plans have been suggested for the transport of the raw material to the manufactories; some are for the establishment of a tramway, others of a railway with suitable tanks to hold the oil, while a third party insists upon the laying down of an iron pipe through which the naphtha would, by gravitation, find its own way to the lower level of the town. These two last methods are used successfully in Pennsylvania for much longer distances, and it is only by the use of such plans that the Baku petroleum can possibly compete with the petroleum of the United States.

Communications.

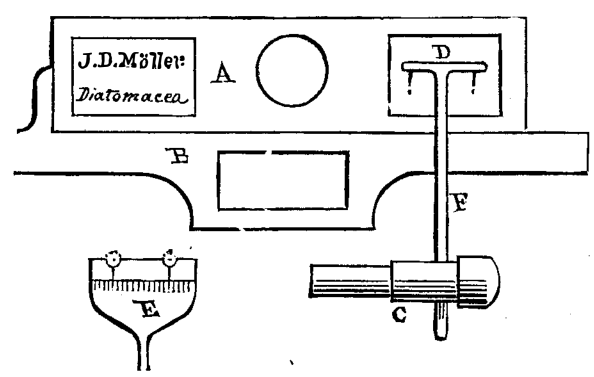
A New Object-Finder for Microscopes.

To the Editor of the Scientific American :

Enclosed I send you a sketch and short description of a finder for minute microscopic objects, a little device of my own, which has worked so well that I thought it might be useful to others.

A represents a microscopic slide *in situ* against the stop, B, of the stage, supposed to contain a diatom, perhaps several. C is a brass pin with the rake, F D, firmly fastened thereto. This pin is to be inserted into a little post fixed on the back part of the stage; or where the bar of the microscope always sustains the same relation to the stage, this pin, with a little modification of the stem, F, of the rake, can be inserted into a hole in the bar, thus avoiding the post. The collar on the pin, at C, always brings the finder to the same position, laterally, and, being fixed to the rake, F D, always has the same position longitudinally.

Having found the object on the slide and brought it into the center of the field, ink the points of the finder and press them on the label. This registers the position of the object at once; and in case the slide contains several objects, this simple process can be repeated for each. Afterward, when wishing to find the same objects, put the finder in place in the post or bar, and, adjusting the rake close to the paper, bring the dots under the points. The object can then be



seen in the microscope. At E is another form for the rake, D. A piece of brass, beveled to a thin edge, containing two semicircular openings, is substituted for the D part of the rake. To register an object, put a pencil in the openings and make the dots. With a high power objective, if the object should be out of the field at first, it can soon be brought into it by moving the stage so that the dots move around in the little circle, one half of which is formed by the semicircular openings. It will take no longer to do this than to find the numbers each time on a Maltwood finder.

The following are some of the points in its favor: 1. All the objects on the slide can be found without removing it, thus avoiding the continuous changing, as with the Maltwood finder. 2. It costs only about one fifth as much as a Maltwood. 3. With decent usage, it is practically indestructible, whereas a slight accident or a careless move shatters the glass finder; and in such a case a new glass finder is entirely useless until the whole collection of slides are re-registered, which in large collections would be no simple task. In case my finder is lost, a new one can be constructed from one registered slide, which would be correct for all. 4. With $\frac{1}{5}$ or $\frac{1}{8}$ objective, it works well. F. L. BARDEEN.

Stevens Institute of Technology, Hoboken, N. J.

A Word About Railroad Disasters.

To the Editor of the Scientific American :

In reading the accounts of the too frequent railroad disasters, I cannot avoid thinking that many of them might in part be prevented. In cases of a locomotive being thrown off the track by a broken rail, axle, or wheel, or of an obstruction on the track, an open bridge draw, or a broken bridge, the whole train is dragged to destruction because there is no mode of uncoupling quickly enough to ensure safety. This evil should be remedied, and directly. The connection between tender and cars should couple automatically, and be readily uncoupled under all ordinary conditions; and in cases of the engine or other portion of the train being thrown from the track by any of the common or uncommon causes, it should disengage automatically, thereby preventing much damage and loss of life.

In cases of collisions of cars being thrown from the track, it frequently occurs that an auxiliary in the shape of fire is on hand to join in and complete the general misery and destruction. Why not avoid this horror by making the cars of steel or iron, using as little as possible of combustible material in building and fitting up, both inside and out? I have no doubt if the ingenuity of inventors should be encouraged by railroad companies, and strongly endorsed by the traveling public, and more especially by the press, plans and models would be brought out, which, if followed up and tried, would solve the problem, and save much property from destruction and many valuable lives.

Stratford, Conn. TRUMAN HOTCHKISS.

Success in Life.

To the Editor of the Scientific American:

I never could understand why a workman should be precluded from making what is known as a success in life. Our young men are constantly told that success lies in application, study, energy, etc., to be used as levers whereby to lift themselves as far as possible and as quickly as possible from the position of the workman. Now since success is thus pointed out as consisting in not making skill in a handicraft the objective point: and since a large majority of those who learn a trade must of necessity remain workmen, the advice, *per se*, is valueless to the greater part of those to whom it is tendered, and is therefore, upon general principles, bad. What young man starting out with the determination to achieve that which he is taught is success in life, and bending every energy to that end, can help feeling, when after a number of years of toil he finds himself still working with his tools, that his life has been a failure? And how many of us pause to think of the disappointment and indifference that such a feeling must produce in the mind of a thoughtful man? Now where is the justice, not to say the philosophy, of a doctrine which thus compels, by force of circumstances, most of those to whom it is addressed to make a failure in life?

The striving of workmen to rise out of the ranks undoubtedly raises the general standard of excellence, and the best qualified to rise are almost sure to do so. Both these premises may be allowed; but should not the many of those who have raised that standard be entitled to some consideration and to be accredited with a measure of success? If in the race to govern others, a workman is outstripped, should he not be able to turn to his tools and feel that he can earn with them a degree of success that his fellows will regard to be as meritorious as that achieved in managing a shop or bartering the products of his skill? It may be advanced that such an idea of success would tend to destroy the ambition to rise; such, however, is not the case, because the incentive of personal comfort and even the personal cleanliness incidental to superior positions may always be relied upon to render such positions desirable.

If we examine into the circumstances of the ninety and nine, as the operative workmen may aptly be termed, we shall find that success, that is to say, the financial success to which men bow, is to them utterly unattainable through any existing avenue except it be through piecework. The system of piecework is not, however, so largely introduced in this country as it is in England; and its benefits, both to employer and employed, are not so well understood. Once let the workman see that it is to his advantage to work by the piece, and the love of gain will make him independent of the arbitrary rules laid down by trades' unions, which have done so much to hinder men from rising in the social scale and to make them dependent on the class to which they belong. The ninety and nine, if once convinced of the difficulty of individual progress, will fall back on what they consider the next best thing, the protection afforded by the unions, which, under existing circumstances, are, while their energies are directed to maintaining or increasing the existing rate of wages and other not illegal ends, as justifiable as are the laws and usages by which lawyers and other professional gentlemen protect their interests, or the agreements by which commercial combinations regulate the prices of commodities. There is this difference, however, between the two: commercial men may achieve success in life independently of such combinations, and the extra measure of success, attained by a combined effort to unnaturally advance the price of a commodity, is therefore far less excusable than the effort to improve a career which, as everyday experience proves, cannot end in what men as a rule regard as a success in life, and such a career that of the workman must be conceded to be.

New York city. J. R.

Something on Violins.

To the Editor of the Scientific American :

I notice that some of your correspondents ask as to what purpose the twofold division of the back and belly of a violin serves. Some makers are inclined to the belief that it gives the instrument a better tone, but this I do not think is the reason that it is done, for some of the finest violins which Joseph Guarnerius ever made had whole backs. My opinion is that it is because the wood can be used to better advantage this way than it could if the back and belly were made whole. To give you a clearer idea, I will illustrate the two modes of cutting the log:

Fig. 1 represents the mode of cutting the log to get the back in two pieces, the piece which is separated from the log being afterwards divided. Fig. 2 shows the method of obtaining the whole back or belly. It will thus be seen that,

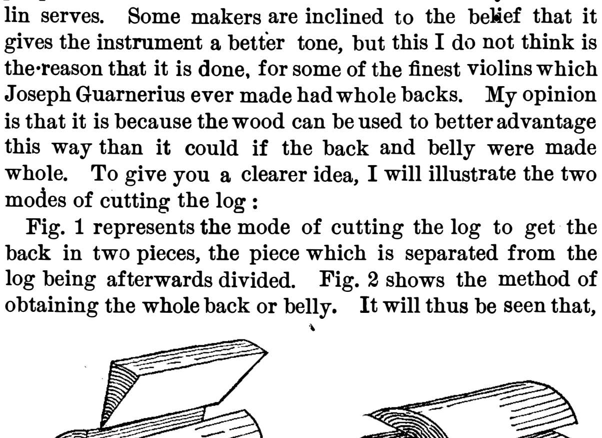


Fig. 1 Fig. 2

by dividing the log as in Fig. 2, we could get but four backs at the most, therefore most of it would be wasted; while by the method adopted in Fig. 1 the whole can be used, which is a great advantage where one has a fine log to cut. The two pieces are glued together with the edges that were next to the bark inwards; the under side is planed flat, and the upper or outside is planed down somewhat like the roof of a house, that is the highest in the center and sloping gradually towards the edges. The form is then scooped or worked out to the taste of the artist, in doing which a pair of double caliper compasses are used in order to maintain a due thickness in the respective parts. In Germany and France, where the manufacture of cheap violins is carried on to a large extent, the backs and bellies are formed by steaming and then compressing them in hot iron moulds. This is done only for very cheap and toy violins, it being impossible for an instrument with the back and belly so formed to produce a good tone.

Rockland, Mass. E. P. WHEELER.

Ideation in Utero.

To the Editor of the Scientific American :

In answer to B.'s objections, I would say:

(1) Upon thinking a moment, it will readily appear to any one that, the greater our experience in a certain branch or subject, the more readily do we comprehend anything in reference to it; and the better we comprehend it, the better and easier is it impressed upon our memory. For instance, a child might read a few pages in a book, say of chemistry, and lay it aside without remembering a word of it, simply because its experience on this subject is not sufficient to enable it to comprehend what it reads. But if the book contained stories, or some other such reading, which the child's experience allowed it to understand, it might remember the several pages for a long time afterwards. Hence experience lays the foundation for comprehension, and comprehension is the great and deep impresser of our memories.

Now if the mind of the mother has connection with and influence over that of the embryo (as it no doubt has), anything which should strongly affect her mind might implant an impression upon its mind which would be deeper and hence more lasting than any conveyed there during the first few months after birth, when its experience, and therefore comprehension, is small and insignificant. This may seem incongruous; but if such strange cases of recognition of localities as you mention in the SCIENTIFIC AMERICAN for January 27th, 1877, do occur, this, it seems to me, is the only way to account for them.

(2) B. must remember that we are all twins in one sense—that is, we have two brains (lobes), arms, legs, etc.; but all, however, supplied with one set of vital organs. Hence they bear a closer relation to each other than did the Siamese twins, but yet they are capable of acting independent of each other. In both cases, though, neither was born of the other.

Philadelphia, Pa. H. M. S.

Dangerous Bridges.

To the Editor of the Scientific American :

Your last issue contains an article suggesting, as a safeguard for dangerous bridges, the bracing of two or four wire cables tightly drawn under each span. The idea is a good one; but it is often the case that the truss bridge, which is the form generally to be so aided, is above navigation, and the deflection necessary to the strength of the cables could not therefore be allowed. Even if this difficulty were overcome, by attaching the cables to the tops of the end posts of the truss and limiting their deflection to its height, the objection remains that a faulty proportion of strains is communicated through the truss from the supports of the cables. If, therefore, cables are to be added, they must be supplemented by additional posts and chord. The expense attending this safeguard would be far greater than that necessary to render the bridge safe at first.

I would suggest that the merits and choice of a bridge should be in all cases determined by the chief engineer, and not limited by a board of directors, who may be ignorant of the principles of bridge construction and who have no real responsibility, although the engineer may declare the structure to be unsafe. H. V. HINCKLEY.

Marston's Mills, Mass.

The New President of Dartmouth College.

In consequence of declining health, the venerable Asa D. Smith, D.D., LL.D., has resigned the presidency of Dartmouth College after fourteen years' active and faithful service. The trustees of the college have passed resolutions very complimentary to the retiring president, and this is simple justice; for no officer of any educational institution ever worked more assiduously or accomplished greater results in raising its standard, or was more successful in obtaining funds for carrying on its work, than the wise and good Dr. Smith, who labored so long and so earnestly for Dartmouth College.

While we join the trustees in regretting the necessity of Dr. Smith's retirement, we congratulate them on their wise selection of a successor in the person of Rev. Samuel C. Bartlett, D.D., who was elected president of Dartmouth College a few days ago. Mr. Bartlett graduated in the class of 1836, and was once tutor in the college, afterward pastor of the Congregationalist church at Monson, Mass., and was for six years since Professor of Intellectual Philosophy and Rhetoric at the Western Reserve College in Ohio. He is now Professor of Sacred Theology at the Chicago Theological Seminary, where he has been for eighteen years. Professor Bartlett is one of the ablest men in the West, and his influence has been felt all over the country. His published addresses are numerous, and he is a vigorous contributor to several leading journals.

We have known both the retiring and incoming presidents for a quarter of a century, and the citizens of New Hampshire can rely upon the success of their college as long as they have such men as either at its head.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NEW SERIES—NO. XX.

PATTERN MAKING.

Economy in timber and in the cutting must be studied as much in the core box as in the pattern; hence, when the pattern is of such a size as to render it economical to build it in pieces, it will be equally desirable to build the core box in like manner. For the bend itself, however, it is scarcely necessary to speak, for the core can be made with a simple contrivance; whereas the building of a half box, though not offering any elements of difficulty, demands so much labor in the cutting out, compared with the extra labor devolving upon the core maker employing the contrivance referred to, that such boxes are for large work seldom or ever constructed. We proceed, therefore, to describe the contrivance with which the core maker is usually supplied. It is applicable to all sizes where loam cores are used: but the core box is preferable when its construction involves no great outlay.

Having determined upon the size of the core from end to end of the prints, we proceed to make a pattern from which one or two iron plates may be cast. Upon these plates the core, in separate halves, is made and dried. The plates are generally about $\frac{5}{8}$ inch thick, and of such a width as to leave a small margin around the core to support what is called the strike. In Fig. 141, P represents the plate, C the core, and

Fig. 141.

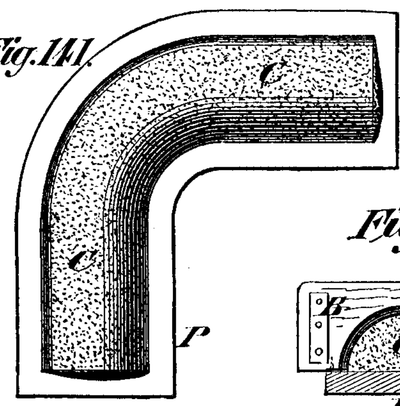
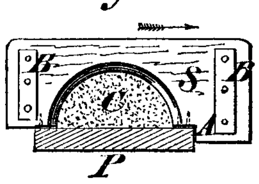


Fig. 141 a.

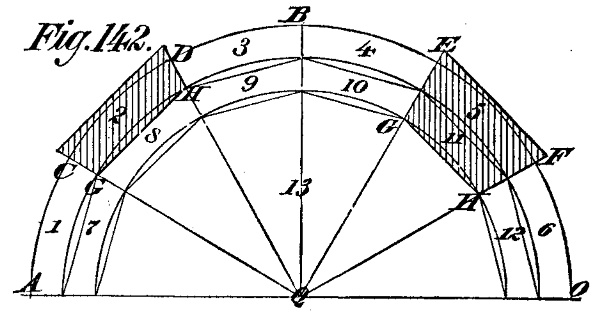


S the strike: this latter is cut from a piece of board from $\frac{5}{8}$ to 1 inch thick, the semicircular hole cut in it being the size of the required core. The grain of the wood may run in the direction of the arrow. It is strengthened, if necessary, by the two battens shown in Fig. 141 *a*, at B B. The edges of the semicircle are beveled off, which causes the strike to work more smoothly and correctly over the composition forming the core.

A few flat-headed tacks should be driven into the surfaces of the strike that come into contact with the iron plate, so as to prevent the wood from wearing rapidly away, and thus altering the shape of the core and causing it to be oval. The core maker places upon the iron plate enough material to make the core, and, taking the strike, places it so that the edge or shoulder, A in Fig. 141 *a*, contacts with the edge of the plate. He then sweeps the strike over the material; the semicircle leaves the core upon the plate, and sweeps off the surplus material, the sweeping process being completed until the perfect half core is formed. In Fig. 141 *a*, P represents the plate, S the sweep, and C the material or core, the figure being an end view, and the tacks referred to being shown so as to mark their location.

We have hitherto treated of building patterns of such size that they could be made cut of the solid; it often happens, however, that the pattern maker is required to build up a pattern by what is called staving or lagging. As an example of this kind of work, let it be required to stave up a pipe, 18 inches diameter inside, with 1 inch thickness of metal. We proceed by taking a clean board and drawing on it the line, A O, in Fig. 142; and then we describe upon it the semi-

Fig. 142.

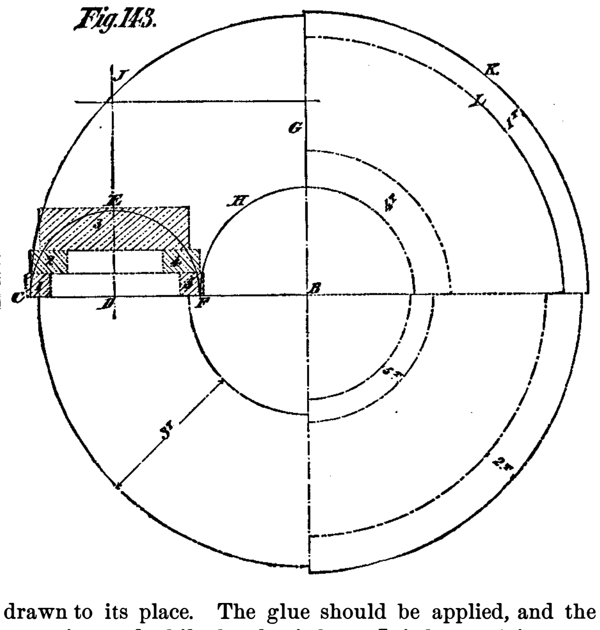


circle, A B O (for we will suppose the pattern to be made in halves), of the required finished size of the pattern, the shrinkage being allowed for. This semicircle we divide off into as many equal parts as it is intended to have staves; and we next draw radii from the points of division to the center of the semicircle. We then take any one of these divisions, of which there are six shown in Fig. 142, and draw the line, E F, parallel to an imaginary line joining the points of division, C D. The distance of the line, E F, from the arc is the amount allowed for the lathe turning, say, in this case, $\frac{1}{8}$ inch. We next draw the line, G H, parallel to E F, and the figure, E F G H, is the exact size and form required for each stave. From the center, Q, we then describe a semicircle passing through the points, G H, and cutting each of the radii, and by joining all these points, we form the half polygon shown by the whole figure. This shows the exact size and shape of the disk to which the staves are to be fixed. In Fig. 142, this whole process is drawn twice, showing thick staves and thin ones, from 1 to 6 representing the thick, and from 7 to 12 the thin, staves; while 13 represents the disk of wood. The thin staves are to form the body of the pipe; but when it is desired to have the points solid with the body, we must use the thick staves. The first procedure is to prepare the requisite number of disks, making them of the form shown; and some pattern makers do this by turning the disks and then flattening them off to form the sides of the polygon. But when a band saw is accessible, the turning is unnecessary; and we may simply draw them out and saw almost to the line, allowing, say, $\frac{1}{16}$ inch for finishing. Each half disk should be pegged to its mate, and a template, like the figure, E F G H, is useful in preparing the staves and verifying their sizes. To prepare the staves, we cut out with the rip saw the required number of pieces, a little wider than E F in Fig. 142; or if there is a circular saw at hand, we use it in preference, and it will save time to resaw the pieces to give them the required bevel, which may be done by canting the saw table. In the absence of any provision for canting, we may fix a packing piece to the table so as to elevate one edge of the stave. After sawing, we plane the bevel edges to correspond to the template, leaving just a shade of stuff to allow for jointing the staves at a close fit together.

Having prepared the staves, we set up the pattern as follows: On a planed board, the requisite number of half disks are placed, perfectly in line with each other; and the outer ones must be at such a distance apart as to allow for turning up the ends of the staves. The intermediate disks, if any (and they should occur about every 2 or $2\frac{1}{2}$ feet), are to be distributed at equal distances in the space that intervenes. These disks we then fix temporarily to the board, paper being laid at the ends of the disks to catch the surplus glue.

The staves are glued and each screwed with one screw to the disk. The boring of the stave to receive the screw should be performed before applying the glue, and the head of the screw should be well sunk beneath the surface, so as to admit of a wood plug being glued in on top of it. First a hole is bored in the stave, a little larger in size than the head of the screw, and nearly as deep as the screw head is to be sunk; for in tightening the screw, the head will be sure to be driven $\frac{1}{8}$ or $\frac{1}{4}$ inch deeper than the hole is bored—that is, providing the material is a soft wood, as is usually the case. The stave is now to be completely pierced with a hole just fitting the plain part of the screw. If it is larger, the head of the screw will sink deeper; while, if it is smaller, a thread will be cut in it by the screw, and it may prevent the stave from being

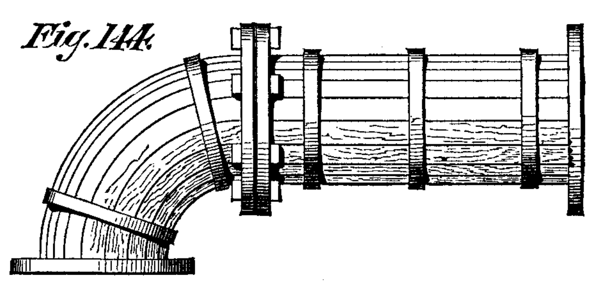
Fig. 143.



drawn to its place. The glue should be applied, and the screw inserted while the glue is hot. It is best to joint on a stave back and front; that is, at each end first, and to then put in the middle or connecting stave, thus completing one length of the staves, the top one being, preferably, the first erected. In putting on the succeeding staves, each one should be properly jointed to its fixed neighbor; a little chalk being rubbed on the fixed stave will show if its fellow bears or joints properly. When one half of the pattern is finished, we may dispense with the board, using the finished half in its stead, and taking care to insert paper between the two to prevent the glue from sticking them together.

In lagging up a branch for a T, the disk at one end should be set back sufficiently far to allow for the part to be cut away in fitting the branch to the body of the T, as explained when treating that subject. This method of staving is that regularly employed for cylinders, pipes, rollers, and similar jobs; and though sufficiently simple for straight pieces, it becomes very complicated when applied to a bend. It is not, therefore, usual to stave up a bend, but to build it in the manner illustrated in Fig. 143. The operation is to first draw the bend in plan, of the full size, upon a board. Let B, in Fig. 143, represent the center from which it is struck, the plan in this case being a quarter circle bend denoted in Fig. 143 by the line, C D F, the line, G, and the sections of a circle, H and J. We have decided to build up our pattern with five pieces, an end view of the half pattern being denoted by the circle, C E F, and the five pieces or layers being denoted by dotted lines, so that by adopting this method we show the plan and end view of the bend in one drawing. It would be well now to cut out forms, in card or in very thin wood, as templates, one for each of the pieces, marked from 1 to 5 respectively. To obtain these templates, we draw the line, C B; and from the center, D, we describe the semicircle, C E F, representing the diameter of the half bend. We then lay off the tiers from 1 to 3, as shown by the dotted lines; and to find the bend necessary for each respective piece, we proceed as follows: Setting our compasses at a distance equal to that between the center, from which our bend is struck (B in Fig. 143), and the extreme outside of the piece marked 1, we draw the quarter circle denoted by the dotted line, K. Then setting our compasses from D to the inside of piece 1, we draw from the center, D, the quarter circle denoted by the dotted line, L. The space included between those quarter circles, and denoted by I T, is the sweep for the piece 1; and we may cut it out for use as a template wherefrom to mark out piece 1. By setting the compasses in like manner for each respective piece, 2, 3, 4, and 5, we obtain the templates, 2 T to 5 T, respectively, for use in marking out the pieces upon the board from which they are to be sawn. In building the pieces up, we lay those forming the lower tier on the plan previously drawn out on the piece of board, putting them a little outside the lines to allow for finishing. We then temporarily fix them in that position, the faces being of course planed up. We now glue on the next tier. It is well, however, to have a semicircle made of a piece of thin wood and of the size of that shown in Fig. 143, by C E F, which we may place upright against the ends of the first tier as a guide in adjusting the position of the second and succeeding tiers. The num-

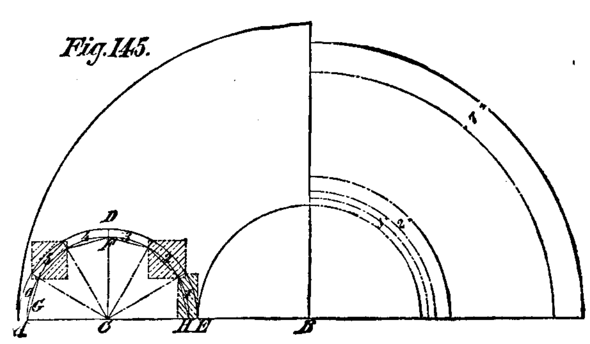
Fig. 144.



ber of tiers is discretionary; but it is well to have the top piece comparatively thick, so that it shall not be liable to curl, as it would be apt to do if the turning left it thin. If the joints of the tiers are well surfaced and well glued, neither nails nor screws will be needed. It is not compulsory to make each layer a continuous piece, and it will save stuff to make every alternate layer of two pieces; but the bottom and top layers are better if each be made in one piece.

It will be observed that this staving up a bend is both laborious and wasteful; yet there are cases in which it becomes imperatively necessary to make it in this manner. A very common job of this kind is lagging up a steam pipe, such as is shown in Fig. 144. The pipe is usually covered with felt or some other non-conducting material, and covered round with mahogany or walnut. Now it would be very unsightly to have the joints in the bend out of line with those on the straight part of the pipes. A hollow bend of wood has therefore to be constructed, having in it the same number of staves as there are for the straight pipe. To get out the pieces for such a bend, we proceed as illustrated in Fig. 145, in which there are shown 6 sections or staves, the semicircle, G H, representing the required inside diameter of the bend; while the semicircle, A E, represents the required outer diameter. We then divide off one of the semicircles into the required number of divisions; and we draw radii and then form rectangles around each division or space representing a stave, as shown by dotted lines in Fig. 145 at 2, 3, and 5. The method pursued in getting out these staves is precisely similar to that pursued in building up in our last example. In this case, however, as each stave is fitted to its fellow, it should be held to its place by dowels—that is, small pins of wire placed at frequent intervals, which will serve instead of glue, which would not answer by reason of the heat from the steam pipe. The disks upon which the bend is built, and of which there should be at least three, are merely temporary; and therefore the staves are not to be

Fig. 145.



fastened to them except for convenience, so as to keep them in position. For this purpose, a piece of paper with a little hot glue on each side should be placed between the stave and the disk; it will make a fastening sufficiently strong, if a little pressure be applied during the drying. Neither nails, screws, nor staples are admissible on this kind of job, as they would mar the appearance of the work when finished and polished. The two halves of the bend being completed, they are made to go together with loose pegs—that is to say, pegs that do not fit the holes tightly, as the dowels do. The halves should be held together by polished brass or plated bands; and the neatness of the finished appearance will amply repay the cost and trouble, for the polished wood forms a pleasing contrast to the contents of an engine room, where almost everything the eye can rest on is iron.

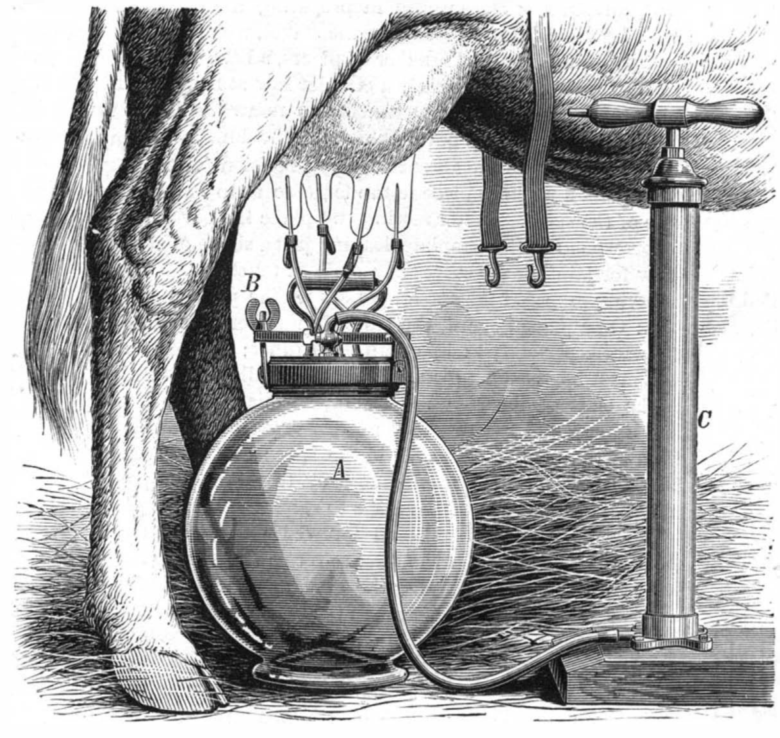
IMPROVED COW MILKER.

We illustrate herewith a new cow-milking machine, which, the inventor says, will do all that can be done in milking by hand, faster and easier. It is a useful device, especially where cows have sore teats or are hard milkers. It prevents any loss of the milk through spilling, it renders milk or straining pails unnecessary, and prevents entrance of dirt. Finally, it can be easily manipulated by anybody.

The apparatus consists of a glass globe, A, sufficiently large to contain the average yield of a cow at a milking. To the top is cemented a metal cover, which is secured by a pivoted bar and thumbscrew, B, so that all the pressure is brought on the thumbscrew and not on the globe flange. Connected with the globe by a flexible tube is the air pump, C. Also rising from the cover are small pipes which terminate in metal tips, which, as shown in the illustration, are inserted in the teats. A hard rubber holder or cut-off is made to fit over the end of each tip after the flexible tube is adjusted so as to form an air-tight joint.

The mode of operation consists simply in forming a partial vacuum in the globe by the air pump. The vessel is then suspended under the animal by straps, or is placed upon the ground, and the tips are inserted in the teats. The suction is then turned on, and the milk is drawn from the bag into the chamber. By having several of these globes, while the attendant is emptying, exhausting, and applying one, others may be kept in operation, and thus the milking of several cows may be quickly accomplished.

Patented October 3, 1876. For further particulars, regarding rights, etc., address the inventor, Mr. Edward M. Knollin, Sandy Creek, Oswego county, N. Y.



KNOLLIN'S COW MILKER.

Rejuvenating Old Butter.

It frequently happens that butter dealers and butter manufacturers have a quantity of butter which becomes rancid and unfit for sale, either through improper handling or carelessness in its manufacture. Such butter can be worked over and be made to appear fresh by the following method, communicated to the Ohio *Farmer* by a Mrs. B. Smith: "In a perfectly clean water barrel, filled with water, put half a pound of alum and allow it to stand until the impurities in the water have all settled to the bottom of the barrel. Fill a large boiler half full with the alum water; heat as warm as the hand can bear—but not boiling—and then add what butter the boiler will hold conveniently. Stir it thoroughly for fifteen or twenty minutes and put the butter into a churn, adding one gallon of new milk for each ten pounds of butter. Add butter coloring enough to give a rich, yellow color and churn the whole. When the butter is gathered in the churn add salt; wash and work it well, and it will have the taste, smell, and appearance of fresh butter. It is hardly necessary to add that when butter has been worked over in this way the sooner it is sold the better."

[The last assertion of the writer renders the value of the recipe, which is otherwise reasonable, rather suspicious.—EDS.]

HYDRAULIC PUNCHING MACHINE.

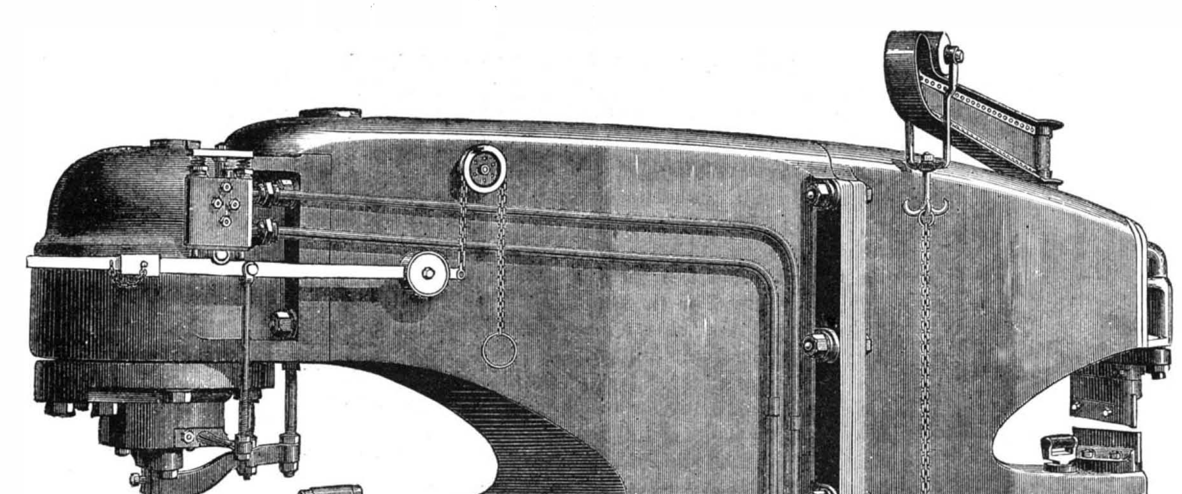
The powerful hydraulic punching and shearing machine we illustrate this week forms part of an entire plant of hydraulic machine tools on Mr. Tweddell's well known system at the French Government dockyards, at Toulon. M. Berrier Fontaine, of the engineering staff at Toulon, having gone into the whole question of economical working very closely, furnished the patentee with his requirements and the general arrangement of the shops; and when we state that there is a 50 horse power pumping engine to force water into two accumulators, each 20 feet stroke and loaded to 1,500 lbs. per square inch, the extensive nature of the application is apparent.

The whole machine weighs about 28 tons. Although shown as one combined machine, there are really two entirely separate tools, and no breakdown in the one affects the other; or, if desired, they can at any one time be placed apart if required for the better working of the shop, or, as is often done, to have a third cylinder inserted for angle bar shears. The machine will punch $1\frac{1}{4}$ inch holes in $1\frac{1}{4}$ inch plate at a distance of 5 feet from the edge, and it shears $1\frac{1}{4}$ inch plates 5 feet from the edge, taking at each cut a length of 18 inches; this long cut is a great advantage in straight work, and reduces the number of strokes to cut the same length of plate fully one third as compared with the ordinary geared machines; the knives also can be turned round, so as to cut at right angles to center line of machine at an angle of 45° either way, or in a line with center line, thus enabling bars of any length to be cut to the length required.

The drawback motion is self-acting; and by means of tapped rods and nuts, as shown on the punching end in the engraving, the length of stroke, and consequently the consumption of water, can be regulated so as to be proportionate to the thickness of plate punched or sheared.

The levers admitting the pressure and opening to exhaust can either be worked by the man in front of the plate being operated upon or from behind by the chain as shown. It may be added that no stop motion is required in these machines, as the machine becomes stationary at any point of stroke the moment the man working it releases the handle; and as the first impulse of a man on discovering an error is to do this, it is found to answer admirably, and to insure extremely accurate work.

The machine requires no foundation; and as the pipes from the main are all underground, the whole space above and round the machine is clear of belts, etc., and thus the cranes fixed on the machine itself can travel all round; and the traveling crane overhead, which works the whole shop, has a traverse clear of all belts, and over the whole area of the shop. The workmanship is of a very high order, and the castings are an especially clean and well finished job. The machine was manufactured by the Hydraulic Engineering Company (Limited), Chester, England, and the results of its preliminary working in their shops was most satisfactory to all concerned.—*Engineering.*



HYDRAULIC PUNCHING MACHINE.

The Young Should be Taught to Think.

We have often suggested in our columns the importance of parents and teachers drilling the young people under their charge to think. The greatest difficulty which the teacher has to contend with is not in accustoming the pupil to repeat the rules in grammar, arithmetic, and other studies, but to induce him to reflect on the reason why the rules are laid down, and why following the rule produces a correct result: in other words, to teach the pupil to think. A correspondent, Mr. R. K. Slosson, reflects in the *Western Rural* our thoughts on this subject in a somewhat lengthy article, from which we make the following extracts:

The world is indebted for nine tenths of its valuable knowledge, its improvements and progress generally, to men and women who have trained themselves to think in a systematic and consecutive manner. No man has ever become eminent in science, art, literature, or farming, who was not a profound thinker—who did not well examine and compare all the items pertaining to the subject—to know whether, in their various relations, they sustain the principle which public opinion upholds as being true. It is not a very uncommon thing that a principle has been enunciated by men who have pet theories to support, and where it is plain to a thinking, unbiased mind, that some of the important items of the theory are in direct antagonism to the principle, and therefore false; or otherwise, the principle itself has no foundation in truth.

The earlier, consistent with health, that youth learn to think, the more massive and powerful will be the brain in maturity—the better prepared will be the mind to shed a glow of interest and happiness on all around, and fill itself with an intense sense of enjoyment unknown to the undisciplined mind. This process of thinking should be systematized, so that the mind can bend its energies in full force on one point at a time, and after having examined in this manner the whole ground, the facts elicited can be classified, managed, and put in a position to be easily understood and appreciated, because they are forcibly and logically brought to bear. If you once acquire the ability to concentrate the mind, so as not to be diverted from the main question or object in view, you have made a long stride in the right direction, and the vigorous use of individuality, comparison and causality will be pretty certain to enable you to reach satisfactory and demonstrative ones.

To assist yourselves very materially you need specially to cultivate memory; and we believe this can best be done by the association of things and ideas. If you wish to retain an idea, you have only to specify in your mind a familiar idea, analogous in some particular to the one you wish to remember; so all you have to do is to recall the familiar idea and the new one immediately pops into your mind. A little practice in this way will convince you of its utility, and remember the longer you practise a thorough analysis of the subjects submitted to your investigation, the more speedy, perfect and satisfactory will be your work. We believe, therefore, that all high schools should have a professor whose business shall be to teach pupils to think, and even our common school law should require elementary instruction in the science of thinking.

Carbonic Acid Exhaled by Animals.

A German chemist has made a long series of careful experiments to ascertain the quantity of carbonic acid given off in respiration and perspiration by different animals. From among his most important conclusions printed in the *Journal of the Chemical Society*, we select a few which appear worth wider notice. In proportion to their weight, the largest quantity of carbonic acid is given off by birds—mammals come next—and worms, amphibia, fishes, and snails form another group in which the excretion of carbonic acid is much smaller; of these, worms give off the most, and snails the least. Those that live in water give off more carbonic acid to the air than they do to the water; and young animals more than old ones. Experiments with colored light show that under the green and yellow more carbonic acid is excreted than in ordinary daylight; and on comparing light and darkness, it was found that much less carbonic acid is given off during the night than during the day. Among the rays of differently colored light, the milk-white and blue rays come next to the green and yellow in activity; and the red and violet are the least active of all the hues of the spectrum.

FAIENCE WARE.

The term *faience* is properly applied to pottery which is decorated on the surface by an enameling process after the object is made and partly baked. The name is derived from Faenza, in Italy, where decorated pottery was made in the sixteenth century; and although for a long time it was given, in France, to porcelain and china, such use must be considered erroneous. M. F. de Lasteyrie, in writing on the subject, states that forty years ago hardly any one in France was acquainted with this beautiful ware. Porcelain, which alone was used on the tables of the wealthy, enjoyed all the popularity; and faience was hardly reckoned in the same category as its more refined relative, and was found, chiefly in cheap wine shops, etc., in the form of plates and dishes of white color coarsely ornamented with military and other subjects printed on the ware by a kind of lithographic process. However, as taste developed and specimens of old pottery were studied, it was found that the art of Palissy and Lucca della Robbia was not without its uses, and that those great men did not give their lives to the perfection of processes merely for the enrichment of the collections of curiosity seekers. Now faience ware occupies the attention of the best manufacturers of ceramic art objects; and in France, where the revival of taste is most marked, the enameled pottery processes are being used in the production of the finest works of art. But the details of the old processes were not known; and the potters had chiefly to depend on the study of objects in museums for the means of carrying out their ideas. Soon, however, the art made great strides, and faience ware became common in the better class of houses and was accessible to men of moderate means.

Among the manufacturers and artists who brought about this result were Count Adalbert de Beaumont, a gentleman whose taste had been formed by study of the art in the East, and M. Collinot, a potter who spent many years in the study of enamels and in attempting to rival the works of the old masters. Our engravings, selected from the pages of *La Nature*, show two specimens from the *atêlier* of M. Collinot; and it may be interesting to know how such superb vases, 8 or 10 feet in height, are produced, the enameled decorations being in inalterable colors.

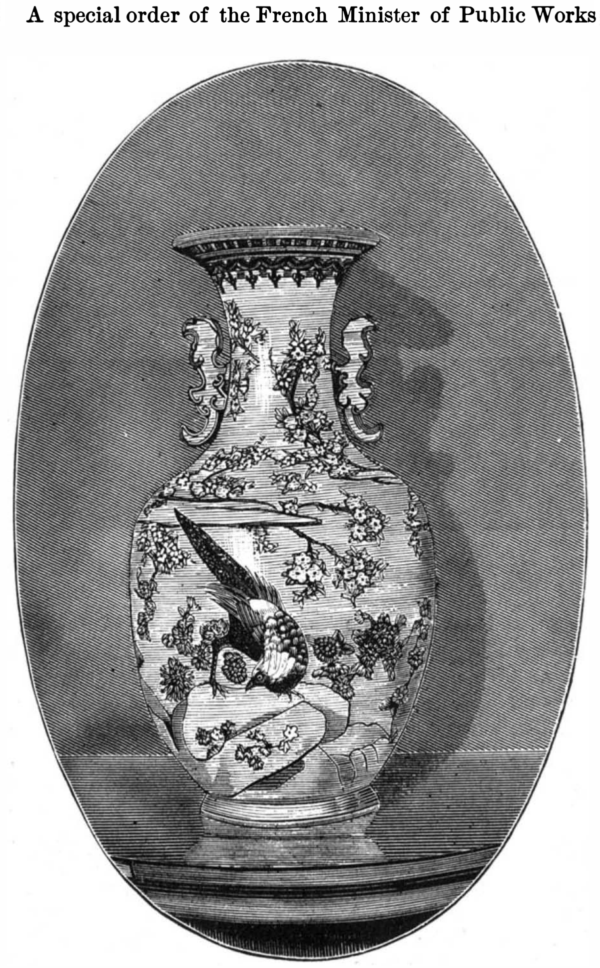
The clay suited to the potter's art has one of two origins: it is either deposited by a decantation process or is a volcanic formation. The first is either marl or fuller's earth; and when baked, it possesses a rough surface to which the enamel adheres. If the ware is polished a little too much, the enamel sooner or later chips off. The clays of igneous origin, however, formed from felspar, quartz, sand, etc., take the enamel by the fusibility of their surface and form with it a homogeneous whole; but, unfortunately, they are very difficult to work and to bake, and the homogeneity will vary in different parts of the same vase or other article. These difficulties have to be overcome by mixing the clay so that the enameled surface shall be uniform all over when the ware is withdrawn from the oven; a rather difficult problem, as it will be acknowledged when it is remembered that the conditions are never alike in two instances. But when the proportions of the ingredients are once settled, and the vase is formed, it is coated with a preliminary glaze of salt and sand, or frit, as it is termed in the trade; and a first baking yields a true biscuit ware, with a surface having an affinity for the enameling materials with which it is to be treated. But in mixing the clay, it must be borne in mind that all oxides of iron must be excluded, as their presence is fatal to the brilliancy and purity of nearly all the enameling colors. The forming of the vases is done by the potter's wheel and by moulding, two methods which are almost as old as the human race.

The enamels in relief are sometimes apt, when subjected to the intense heat of the furnace, to melt and spread over the adjacent parts of the surface, making the design appear smeary and devoid of sharpness. The Egyptians and Chinese avoided this by using a kind of *cloisonnage* process, the term signifying "partitioned work." It is extremely expensive, but gives great durability and permanence to the ornamentation, especially when employed, as it frequently is, on metal. Messrs. de Beaumont and Collinot used a simple and rapid method of doing this work, which is one of the most curious discoveries of the modern ceramic art. The design is outlined on the object with a brush dipped in a mixture of copper and iron in fine powder. In the baking, the metallic mixture oxidises, and forms hard lines which prevent the overflow of the enameling material when it begins to melt under the heat. A second and a third baking give the finish to the ware, and produce the glaze, which is then uniform all over the object.

Of the two beautiful specimens illustrated, the first was exhibited at Vienna in 1873; and the Chinese Imperial Commissioner remarked: "I thought that exhibitors were allowed to show only their own productions; but here is a Frenchman who does not hesitate to place among his own wares a Satsuma vase." To deceive an educated Chinaman with a vase of European manufacture was a real triumph for M. Collinot.

Freight Charges to the French Exposition.

A special order of the French Minister of Public Works



SATSUMA VASE IN FAIENCE WARE.

has lately been published, in which it is stated that all objects for the Exposition of 1878 (except objects of art and valuables), will be transported by all French railway companies for half the regular rates. The price, however, is in no case to be reduced below the basis of $\frac{1}{8}$ of a cent per ton

ASSYRIAN VASE IN FAIENCE WARE.

per kilometer (0.6 mile). Objects of art, valuables, very large articles, such as locomotives, cars, etc., if they cannot travel on French tracks, are subject to special rates, to be agreed upon.

A PINK efflorescence has been removed from a stone wall where the Rosendale cement was used. It contained manganese, magnesia, alumina, iron, soda, and sulphuric, carbonic, and silicic acids.

Whales on the California Coast.

Last week, says a recent number of the *Monterey Californian*, our Portuguese fishermen killed a large female whale of the California gray species (*rhachianectes glaucus*) about sixty feet in length, being some twenty-two feet larger than has ever been killed here before—the average of females killed being about forty-two feet. After cutting off the blubber, they found inside a nearly full-grown male calf, which measured eighteen feet from the end of its nose to the tip of its tail, or fluke, as the whalers call it; the circumference of the body at its center, nine feet; the head about four feet in length; pectoral fins, three feet; breadth of tail, three and a half feet; and it had two ridges on the lower jaw. When brought on shore it still had three feet of the umbilical cord attached to it. The whalebone on its upper jaw was soft and white; the tongue, large and soft; the eyes, nearly full size, about as large as a cow's; and the skin was of a dark brown, mottled white. It had no dorsal fin. The females, when with young, generally keep off shore when on their way down south, to bring them forth in the warm waters of the bays of Lower California, where they remain all winter and go north in the spring. The females, when with calf, are dangerous, as they often attack the boats of the whalers. The writer once saw a boat cut completely in two by the flukes of one of these whales, and it looked as if it had been chopped in two by a dull axe; and several of the men were wounded. The term of gestation is about one year. Formerly these marine monsters were so numerous in Monterey Bay that whalers would fill up lying at anchor. Oftentimes they would be seen playing in the surf and rolling the barnacles off of their sides and backs on the sand beach—an odd way of scratching themselves.

Health Improvements.

On this subject Dr. Richardson, F.R.S., has recently delivered a lecture at the London Institution, in which he gave further illustration of the high views he entertains in regard to house sanitation. He considered that for purposes of health the houses in Great Britain require to be rebuilt, or remodeled, from Land's End to the Hebrides. Dr. Richardson entered into the history of ventilation, from the time of Stephen Hales, in 1733, to the present day, and explained the different discoveries that had been made in the various branches of science bearing on the health of towns, showing that, till these were understood and appreciated, all modes of construction were of necessity imperfect. He called attention to the influence of water, dampness, light and darkness, etc. The effects of light deserve special notice. Having got from India some poison of the cobra, on ivory points, he discovered that, on some of those which had been exposed to the light in a glass bottle, the poison had become inert; while on others that had been wrapped in paper, in the same bottle, the poison retained all its deadly activity. He hence argued that, if sunlight exercised such power on the poison of the cobra, it might by analogy destroy the poison of smallpox, scarlet fever, and typhoid. He considered that pure air and water, freedom from damp, pure daylight, and equal temperature were essential. He then entered into a variety of details of the required modifications of our present house architecture, foundations, closets, and other offices, which may possibly be excellent if practicable. From the amount of expense that would be incurred in erecting such model houses, we imagine that the worthy doctor would justly entitle himself to the thanks of every architect and builder, if not of the owners of such houses.

An Intelligent Watch.

Mark Twain has been examining a curious watch at a jeweler's in New Haven, Conn., which he describes as follows:

"I have examined the wonderful watch made by M. Matile, and it comes nearer to being a human being than any piece of mechanism I ever saw before. It knows considerable more than the average voter. It knows the movements of the moon and tells the day of the week, the month, and will do this perpetually; it tells the hour of the day, the minute, and the second, and splits the seconds into the fifths and marks the division by stop hands; having two stop hands, it can take care of two racehorses that start one after the other; it is a repeater, wherein the voter is suggested again; musically chimes the hour, the quarter, the half, the three quarter hour, and also the minutes that have passed of an uncompleted quarter hour—so that a blind man can tell the time of day by it to the exact minute.

"Such is this extraordinary watch. It ciphers to admiration; I should think one could add another wheel and make it read and write; still another and make it talk; and I think one might take out several of the wheels that are already in it, and it would still be a more intelligent citizen than some that help to govern the country. On the whole, I think it is entitled to vote—that is, if its sex is the right kind."

THE NEW SUN AND ITS DISAPPEARANCE.

The phenomenon of the appearance of a new star in the heavens is rare enough to arouse the greatest interest among astronomers and other scientific persons. It is not merely an occurrence appalling in its mystery and immensity; but even in the minds of those accustomed to contemplate the majesty of other worlds, it tends to arouse questions of the gravest importance relative to the physical and chemical constitutions of the stars, and to the comparison of our own sun with other far distant ones.

On November 24 last, M. Schmidt, Director of the Observatory at Athens, Greece, at 5h. 41m. in the evening, saw a star of the third magnitude in the constellation *Cygnus*. No record of the existence of any such star was in existence. No such star was visible on November 20; but whether it appeared on one of the intervening days between that date and the 24th, M. Schmidt cannot say, as cloudy weather had then prevailed in Athens. The news was at once telegraphed throughout the world, and the astronomers watched the new star gradually wane until, on December 8, it was scarcely of the sixth magnitude. The position of the star is shown in Fig. 2, which we take from *La Nature*.

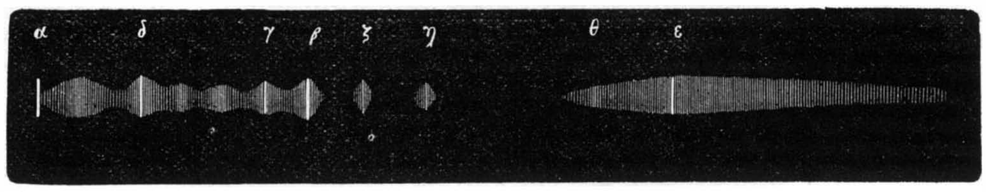


Fig. 1.—SPECTRUM OF THE NEW STAR IN THE CONSTELLATION CYGNUS.

By comparing the observations of the discoverer, M. Schmidt, with those of M. Prosper Henry, we find two important facts: First, that within eight days the star diminished from the third to the fifth magnitude; and secondly, that the color changed from a marked yellow to a bluish green. On December 2, spectroscopic observations at different observatories were made; and the general conclusion was that the spectrum, being formed in large part of brilliant lines, was that of an incandescent vapor or gas. On December 4, M. Cornu obtained a very satisfactory observation, which enabled him to identify three lines as the lines C, F, and 434 of hydrogen. A fourth appeared to him to correspond to the line, D, of sodium, and another with the characteristic line, *b*, of magnesium. Finally, two lines, of which the wave lengths are 531 and 451, appeared to coincide, one with the famous line 1474 (Kirchoff's scale), observed in the solar corona during eclipses; the other with a line of the chromosphere. M. Cornu's own account of his investigation is as follows:

"The spectrum of the star is composed of a certain number of brilliant lines on a luminous background, completely interrupted between the green and the indigo, so that at first sight the spectrum seems to be in several detached parts (see Fig. 1). . . . The brilliant lines, arranged in the order of their brilliancy, are eight in number, with the following wave lengths in millionths of millimeters: α, 661 (hydrogen, C, is 655), δ, 588 (between sodium D, 589, and chromosphere band, 587), γ, 531 (corona band, 532), β, 517 (identical with *b*, 517, of magnesium), ζ, 500 (no correspondence), η, 483 (hydrogen, F, 486), θ, 451 (chromosphere band, 447), and ε, 435 (hydrogen, 434)."

It thus appears that the light of this new star is exactly the same in composition as that of the solar chromosphere; and thus we are told that the new comer is a sun, doubtless in general respects like our own, which has met with some great catastrophe whose cause we cannot at present determine, but whose real nature is unmistakable. "Our sun," says Professor Proctor, commenting on the phenomenon, "is one among hundreds of millions, each of which is probably, like it, the center of a scheme of circling worlds. Each sun is rushing along through space, with its train of worlds, each bearing perhaps, like our earth, its living freight, or more probably each, at some time or other of its existence, becoming habitable for a longer or shorter period. Thus the suns may be compared to engines, each drawing along its well freighted train. Accidents among these celestial engines seem fortunately to be rare. A few among the suns appear suddenly (that is in the course of a few hundred years, which in celestial chronometry amounts to a mere instant) to have lost a large part of their energy, as though the supply of fuel had somehow run short. Mishaps of that kind have not attracted much attention, though manifestly it would be a serious matter if our own sun were suddenly to lose three fourths of his heat, as has happened with the middle star of the Plow, or ninety-nine hundredths, as has happened with the once blazing, but now scarcely visible, orb called η, in the keel of the star ship *Argo*. But when we hear of an accident of the contrary kind—a sun suddenly blazing out with more than a hundred times its usual splendor—a celestial engine whose energies have been overwrought, so that a sudden explosion has taken place, and the fires, meant to work steadily for the train, have blazed forth to its destruction—we are impressed with the thought that this may possibly happen with our own sun. The circumstances are very curious, and though they do not show clearly whether we are or are not exposed to the same kind of danger which has overtaken the worlds circling around those remote suns, they are sufficiently suggestive.

"Now, a point to which I would call special attention, is that all the elements of the catastrophe, if one may so speak, which has befallen the remote sun in the Swan exists in our own sun. At times of marked disturbance parts of our sun's surface show the lines of hydrogen bright instead of dark, which means that the flames of hydrogen over those parts of the sun are hotter than the glowing surface of the sun there. We have all heard, again, how Tacchini and Secchi, in Italy, attributed some exceptionally hot weather we had a few years ago to outbursts of glowing magnesium. And, lastly, our sun is well supplied with that element, whatever it is, which gives the bright line of its corona during eclipses; for we now know that the whole of the streaked and radiated corona occupying a region twenty times greater than the globe of the sun (which itself exceeds our earth one million two hundred and fifty thousand times in volume) belongs to the sun. Again, though the sun has shone steadily for thousands of years, yet, so far as can be judged, the stars which, like this one in the Swan, have burst out suddenly, blossoming into flames of hydrogen, within which the star's heart core glows with many hundred times its former heat, have also been for ages shining steadily amid the star depths. We know that the one which blazed out ten years ago in the Northern Crown was one of Argelander's list, a star of the tenth magnitude, and that, after glowing with eight hundred times its former brightness for a few days, it has resumed that feebler luster. We have every reason which analogy can furnish for believing that the new star, which was not in Argelander's list, simply escaped record by him on account of its faintness. It is now fast losing its suddenly acquired luster, and is already invisible to the naked eye. It appears, therefore, that there is nothing in the long-continued steadfastness of our sun as a source of light to assure us that he, too, may not suddenly blaze forth with many hundred times his usual luster (the conflagration being originated, perchance, by some comet unfortunately traveling too directly towards him). Though he would probably cool down again to his present condition in the course of a few weeks, no terrestrial observers would be alive at any rate to note the fact, though the whole series of events might afford subject of interesting speculation to the inhabitants of worlds circling round Sirius or Arcturus. Fortunately we may legitimately reason that the risk is small, seeing that among the millions of suns which surround ours, within easy telescope distance, such catastrophes occur only ten or twelve times per century."

A New Method of Fireproof Construction.

We have repeatedly pointed out, says the London *Building News*, the futility of relying on iron as a fireproof material, when used in construction in the form of girders or columns, unless duly protected. Of course the most perfectly fireproof structure would be one built entirely of bricks, but the impracticability of employing these materials in sufficient masses to resist the immense thrust exercised by brick arches of any span, if required to carry any weight, has been universally admitted. Messrs. Evans and Swain, the patentees of a new system of fireproof construction, prefer to rely on wood and plaster, and there is little doubt but that by the judicious application of these two materials a large amount of resistance to the action of fire may be obtained. Captain Shaw some time ago conducted a series of experiments on the fire-resisting qualities of a stout wooden post, which set many people thinking whether, after all, we had done well to abandon the use of timber in favor of cast iron; while common plaster, as we have more than once had opportunities of witnessing in great conflagrations, is unequalled as a protecting material, remaining intact when wrought iron melts and stone shivers into fragments. In the construction of their new fireproof floor, Messrs. Evans and Swain take ordinary timber joists of any uniform depth, generally 9 inches or 11 inches for ordinary floors and spans up to 25 feet, but deeper where greater span or strength is required, and of any thickness (the thinner the better, as there is less chance of shrinkage and an open joint forming). These joists they place on the walls in the ordinary way, only, instead of placing them, as is usual in constructing an ordinary floor of wood joists and boards, with a space between the joists, they are placed together without any intervening space. The ends of the joists are allowed to bear on the walls in the usual way (only no plate is required), and the last joist at each end of a series of joists is also allowed to bear upon the walls. The sides of the joists are brought into intimate contact by being bolted up close at intervals with screw bolts, or spiked together with strong spikes, or screwed with ordinary screws, or any other similar method; and the result is a solid slab or floor of timber of the size of the room, bearing on the walls on all four sides, of enormous strength, and capable of bearing almost any weight that may be put on it, and yet exerting no outward thrust upon the walls. After the floor has been thus constructed, the inventors drive, at close intervals, into the under surface of the floor forming the ceiling of the room below, a number of flat-headed nails; this forms a key for the plaster, and the ceiling is then plastered in the ordinary way, with a good thick coat of common plaster, care being taken to use a rough plaster that will not shrink and crack, rather than a hard and brittle one. This coat of plaster would resist an immense heat, until it became calcined and red hot itself, but even then the under surface of the wood becomes only charred with the heat of the plaster, and its strength remains unimpaired for a very long period. In addition to its other advantages, it is noiseless in use, and in any room or building where it is applied as a floor the sound of feet is scarcely heard, whilst in the rooms below the sounds made above are unheard, the floor being practically sound-proof.

Under ordinary circumstances, it is only necessary to plane off the top surface of the joists, no flooring boards or other covering being required; but if the floor above is intended for the storage of highly inflammable goods, such as oils, spirits, varnishes, paraffin, etc., the patentees recommend that the upper surface of the floor should be floated with cement, or covered with stone or tiles, or some other similar material; before the cement is laid, it is advisable to cover the top surface of the joists with a thin layer of loam and sand, or fine concrete, to receive the cement. This will prevent any cracking in the surface of the cement caused by shrinkage, which might occur in the timber. As an additional precaution against any shrinkage in the timber, causing an open joint, a wood tongue may be introduced between the joists: but this, it is asserted, is not absolutely necessary, as, should any shrinkage occur at any time, and show a gaping joint in the floor above, a little fine plaster or cement run between the joists would effectually stop all draught, and answer the same purpose as the tongue, and with very much less cost; but of course, when the upper surface is covered with cement or paving, neither precaution would be required.

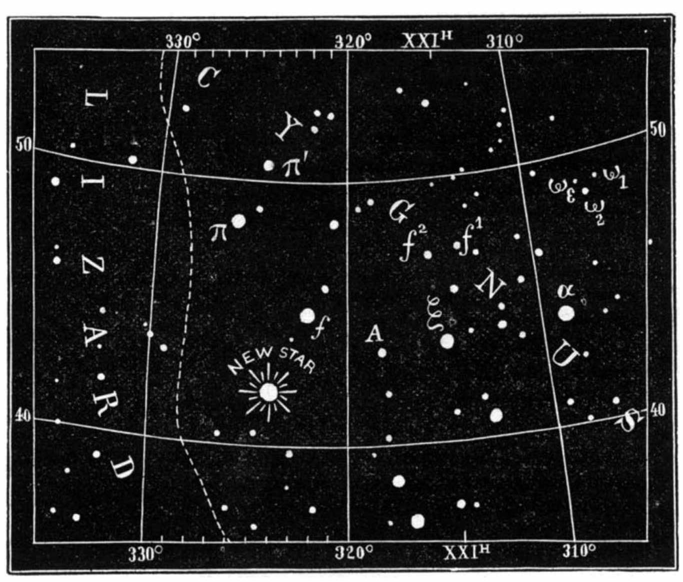


Fig. 2.—THE NEW STAR IN THE CONSTELLATION CYGNUS.

Rapid Transit in Paris.

The Paris Municipal Council has before it a scheme prepared by the engineers of the city, after an inspection of the London Metropolitan and District Railways, for the construction of underground railways in Paris. It is proposed by this scheme that there shall be two main lines running east and west. The first, starting from the Vincennes Station, will pass under the Lyons station, the Château d'Eau, the Halles, the Palais Royal, the Bourse, the St. Lazare terminus of the Western Railway, and terminate at Les Batignolles. The second, starting from the Orleans terminus, will follow the left bank of the Seine, and run beneath the whole length of the Boulevard St. Germain. This line will also have a junction with the first by means of a railway passing under the Seine and the Louvre, and terminating at the Palais Royal. The first line will also have a branch from the Halles to the Northern and Eastern railway stations. The central station of the whole system, that of the Palais Royal, will be 23 feet below the level of the pavement, and the approach to it will be from the Galérie d'Orleans, the buildings upon the north side of which will be utilized as booking offices and waiting rooms. The total cost is estimated at $31,800,000 for 17 miles, which gives an average of $1,870,585 per mile.

Illumination by Reflection.

In our issue of June 10, 1876, we described and illustrated a system of illumination introduced in Italy by Signor Balestrieri, of Naples, and stated that it was identical with that used in the locomotive head-light patented to Messrs. Lee & Baldwin, of Troy, N. Y., on July 18, 1871. We are now in receipt of a long communication from Signor Balestrieri, stating that his invention was exhibited at the Maritime Exposition held at Naples in the beginning of 1870, and citing evidence in support of his claim to the origination of the idea.

MR. M. W. WALKER, of Warm Springs, Oregon, writes to us to say that the mean daily temperature at that place ranged between 23° and 48° Fah. during the month of December, 1876. On 25 days of the month, it was between 30° and 40°. This is remarkably mild weather for winter; and it would seem from this that Oregon is a good locality for invalids.

THE RESOURCES OF THE PACIFIC COAST.

The Pacific Coast States and Territories—namely, California, Oregon, Nevada, Colorado, Utah, New Mexico, Washington, Montana, Idaho, Arizona, and Wyoming—have an aggregate area of 1,218,385 square miles, amounting to about one third the total area of the United States, and equal to that of China proper. While China, however, contains over four hundred million inhabitants, the total population of the above States is but little over a million and a half. Hence they are practically undeveloped, and their magnificent resources lie comparatively idle, inviting the industry and the enterprise of the emigrant from the overcrowded East. On the southern borders of this great region, which extends for 1,500 miles along the shores of the Pacific, are found the olive, the vine, the lemon, the mulberry, the cotton plant, and the sugar cane; further north, wheat and other cereals, with all the fruits of the temperate zone, flourish; and still further northward, the wheat and flax indigenous to cold latitudes are encountered. From an industrial point of view, the area may be divided into two sections, the mineral and the agricultural. The purely pastoral districts are scattered over the whole of it, from the Colorado to the Fraser river, and from the borders of Nebraska to the Pacific. The agricultural districts are mainly found between the base of the Sierra Nevada chain and the ocean. In Nevada, Utah, Colorado, New Mexico, and Arizona, there are great tracts capable of being rendered fertile by irrigation. The mineral section is the largest of all, embracing three fourths of the territory under consideration, and stretching eastward from the western foot hills of Dakota, Nebraska, Kansas, Indian Territory, and Texas. We have before us an annual review of commercial and industrial progress in the Pacific States, prepared by the San Francisco *Journal of Commerce*. From this splendid piece of journalistic work, which covers eight huge newspaper pages, we extract the facts on which this article is based.

Taking first the agricultural products, it appears that there are at least one hundred million acres of land suitable for the culture of

WHEAT.

It is estimated that this territory is capable of producing, when scientifically cultivated, yearly some 2,500,000,000 bushels of wheat, worth, at 50 cents per bushel, $1,250,000,000. The actual value of the wheat yield for 1876 was but $33,000,000. The wheat lands of the coast are extensive enough to supply a million farmers and their families each with a 100 acre farm. Reckoning in workmen and their families, the wheat lands can give employment in their cultivation to a population of 15,000,000; while, taking into account tradesmen, merchants, manufacturers, etc., they can support fully 35,000,000 people, or a population equal to that of France.

COTTON

culture is greatly neglected. The production during the past year was very small, and the cotton sold at the low rate of 14 cents per lb. There are some 8,000,000 acres of good cotton land in the territory under consideration, capable of producing a crop worth $200,000,000 annually. In this connection planters skilled in cotton cultivation are required, as the plant, it is said, grows better in California and Arizona than on the Atlantic coast.

There are few regions in the world better adapted to

THE VINE.

Some 30,000,000 of acres are peculiarly suited to the culture, and these are capable of a yield worth $6,000,000,000 a year. Vine growing offers the strongest inducements for immigration of the skilled laborers from the vineyards of France, Germany, Switzerland, Italy, Portugal, and Spain. The country needs their experience and intelligence; and, in return, it offers them homes and the means of fortune. The total area available for fruit culture is 50,000,000 acres, all capable of being planted with orchards and orange, lemon, and banana groves. At the same time all the fruits of the temperate zone are cultivated with wonderful results; the aggregate possible value of the fruit yield is $2,500,000,000 yearly.

There are favorable localities for the cultivation of the sugar cane and rice in quantities sufficient to supply the population of the region and their immediate neighbors. Coffee can be profitably grown in the southern part of Arizona. Jute, hemp, and ramie may also be cultivated.

Turning now to the pastoral capacities of the territory, it appears that over one third the whole area, or 250,000,000 acres, are suited in a high degree to

WOOL GROWING.

Even the Angora goat has been successfully raised; and it is thought that the alpaca and the Thibet and cashmere goats can also be acclimated. It is estimated that 250,000,000 of sheep can yearly be raised on the coast, producing wool worth at its very lowest $180,000,000 annually.

One of the greatest sources of wealth of the Pacific coast in the future will be its magnificent array of woodlands, which are probably the finest in the world. The quantity of

LUMBER

contained is estimated at 4,000,000,000,000 of feet, worth at the present mill price of lumber $40,000,000,000. There is no species of lumber that may be required for any useful purpose that may not be found somewhere on the coast or islands; while ornamental woods of the finest kinds abound.

Lastly we have the mineral resources. The principal

GOLD DEPOSITS

are and have been found in the valleys of the rivers flowing from the high mountain ranges; hence California, Colorado, Idaho, and Montana, and the sides of the valleys in them, adjacent to the great ranges, have become the chief ources of gold. The western side of the Sacramento and San Joaquin valleys have yielded little, if any, of the precious metal. Most of the known superficial deposits have been worked out; but there are still vast beds, that are treated by the hydraulic process, that will last for a score of years. Besides these, there are the ancient river beds, one of which, the Blue Lead, has been traced for hundreds of miles. The present production of gold is about $53,000,000 on the Pacific Slope, of which California produces some $23,000,000. The production of

SILVER

is principally confined to the States of Nevada and Colorado and the territories of Utah and New Mexico. The deposits are practically inexhaustible, and their extent has never been determined. The yield of the metal for 1876 was about $50,000,000.

The quicksilver mines of California and Arizona have produced in 1876 between 60,000 and 70,000 flasks. They are capable of yielding 120,000 flasks yearly, worth at the lowest $3,600,000. Lead is found united with silver and in immense quantities. The amount supplied to the United States from the Pacific coast is about 8,000 tons yearly. Copper is mined in small quantities now; but is present in large amounts, and eventually will become an article of export.

COAL

is found in great abundance. That on the Pacific slope is nearly all lignite. The great Rocky Mountain coal field covers some 300,000 square miles; and there are other immense deposits in or near the coast ranges. Iron exists in large amounts in Oregon, the deposits having been traced for a distance of 25 miles; the mines are yet to be developed. The California and Nevada borax deposits are the most extensive in the world; and although they are of comparatively recent discovery, they have already greatly affected the price of the product. In Nevada, there are a mountain of rock salt and illimitable soda deposits. There is also a fine deposit of tin, and extensive beds of antimony and manganese in Nevada and Utah. The petroleum wells of southern California are capable of yielding 20,000 barrels of oil per day, or nearly as much as the present Pennsylvanian product. Sulphur is also found in Nevada in large amounts, and is shipped to San Francisco.

The Scarlet Fever Epidemic.

Scarlet fever is reported as being epidemic at present over a large portion of the country, especially in the Western States. In Chicago, the prevalence of the disease has excited considerable alarm, and several meetings of the medical faculty of the city have been held for the discussion of the best modes for its prevention and cure. In Boston, also, the disease is being closely watched by the health authorities of the city, and they have issued very admirable instructions for its avoidance and treatment, which will be found quoted below.

Scarlet fever is highly contagious, and at the same time exceedingly fatal; so that there should be no halfway measures taken to prevent its spread. Wherever the disease has manifested itself, the utmost vigilance is imperative to prevent clothing or other infected articles communicating the malady to other persons. There is even danger of disseminating the poison by funerals, the *Medical Record* tells us; and the same authority counsels the greatest care on the part of physicians lest they themselves, coming from the bedsides of patients, carry the disease to non-infected houses. The protection of school children will also require great care; and our contemporary strongly recommends that a thorough system of medical inspection be organized in our now crowded public schools.

As a recent meeting in Chicago, the physicians discussed at considerable length the value of belladonna as a specific for the malady. The daily use of this drug as a prophylactic against scarlatina is "emphatically recommended;" "but," continues the resolution passed, "only in doses so attenuated as not to produce visible effects upon the organism, and always under the advice of the family physician." The other resolutions agreed upon are "that isolation is the next only means that we know of to prevent the spread of the disease, but we deprecate arbitrary interference with the rights of families;" and "that we have every reason to believe that such a course would reduce the frequency, the severity, and the mortality of this disease, but will not wholly eradicate it, nor do we know of any means that will."

The following is the Boston Board of Health's circular: "Scarlet fever is like smallpox in its power to spread readily from person to person. It is highly contagious. The disease shows its first signs in about one week after exposure, as a general rule, and persons who escape the illness during a fortnight after exposure may feel themselves safe from attack. Scarlet fever, scarlatina, canker, rash, and rash fever are names of one and the same dangerous disease. When a case of scarlet fever occurs in any family, the sick person should be placed in a room apart from the other inmates of the house, and should be nursed as far as possible by one person only. The sick chamber should be well warmed, exposed to sunlight, and well aired. Its furniture should be such as will permit of cleansing without injury, and all extra articles, such as window drapery and woollen carpets, should be removed from the room during the sickness. The family should not mingle with other people. Visitors to an infected house should be warned of the presence of a dangerous disease therein, and children, especially, should not be admitted. On recovery, the sick person should not mingle with the well until the roughness of the skin, due to the disease, shall have disappeared. A month is considered an average period during which isolation is needed. The clothing, before being worn or used by the patient or the nurse, should be cleansed by boiling for at least one hour, or, if that cannot be done, by free and prolonged exposure to out-door air and sunlight. The walls of the room should be dry-rubbed, and the cloths used for the purpose should be burned without previous shaking. The ceiling should be scraped and whitened; the floor should be washed with soap and water, and carbolic acid may be added to the water—one pint to three or four gallons. The infected clothing should be cleansed by itself, and not sent to the laundry. In case of death from scarlet fever, the funeral services should be strictly private, and the corpse should not be exposed to view. Because children are especially liable to take and spread scarlet fever, and because schools afford a free opportunity for this, the Board of Health has excluded from school every child from any family in which a case of the disease has occurred, and has decreed that the absence shall continue four weeks from the beginning of the attack, except in cases subject to the discretion of the Board, and that the scholar, to be re-admitted to his schoolroom, must have the certificate of a physician that the required time has passed."

As regards this last provision, in localities where authorities do not promulgate similar instructions, parents will do well to take the precautions noted; and after the disease has shown itself in the family, the attendance of any of the household at school, until the period stated has elapsed, should be prevented.

Chloroform and Dentistry.

We have repeatedly noted accidents produced by the use of chloroform in minor dental operations. A very sad case recently occurred in Rahway, N. J., in which, by the improper administration of the anæsthetic, a robust, healthy boy lost his life. The New York *Medical Record*, commenting on the casualty, offers the following valuable suggestions:

In regard to the use of chloroform in dentistry there is but one opinion, namely, that it is always dangerous. As a general rule, it should never be administered at all for purposes of tooth extraction. In the present state of professional opinion upon the subject, the dentist who chooses to administer it, even in a special case, assumes a responsibility of which he should not be ignorant. So great is the prejudice against this anæsthetic among leading dentists that many will not allow it to be administered in their offices, even when the direct professional responsibility is assumed by an experienced physician.

Although the fact cannot be very well explained, chloroform has taken more victims from the dentist's chair than from any other place. Indeed, it has gained its reputation as a dangerous article more in connection with simple tooth drawing than with any other operation, however grave or formidable. A very good reason for the liability to accidents is the erect position of the body of the patient while in the operating chair. Taking this into account, authorities are unanimous in advising that chloroform should never be given except the patient is recumbent.

No surgeon cares to assume the responsibility of giving chloroform unless he knows that the stomach of the patient is empty, that the circulatory apparatus is in good condition, and the lungs free from disease. A previous inquiry into these conditions is as much a part of the administration of any anæsthetic as in the placing of the napkin to the nose. It appears in the Rahway case that all these preliminaries were neglected. The patient came into the office immediately after having eaten a hearty meal, and, without any questions being asked, was at once placed in the operating chair. There was no loosening of waistband or shirt collar, no examination of the chest—in fact, nothing was done except to order the little fellow to take long and deep inspirations, while the napkin was held closely against the nose. The result could easily have been foreseen. The overwhelming effects of rapid anæsthesia and the crowding impediment of a full stomach, in the most unfavorable of all positions of the body, did not invite death in vain.

The examination of the bodies of patients dying from the effects of chloroform have not thus far given us any satisfactory pathological explanation. The lesions have varied with each individual case, and have given rise to as many different theories. The careful and thorough examination of the body of the victim of the Rahway tragedy still leaves the question an open one. It may be, however, that both asphyxia and asthenia operated together in producing the effects observed; but the precedence which should be given to either involves the discussion of some questions, for which, in the present state of pathology regarding deaths from chloroform, we are not yet prepared.

Death of the White Whale.

The white whale at the New York Aquarium recently died. He was captured with much difficulty off the coast of Labrador, and has seemingly enjoyed good health during his five months' sojourn in the aquarium tank. Lately, however, the experiment of giving him fresh instead of salt water was tried, and the change disagreed with him, producing his death.

NEW BOOKS AND PUBLICATIONS.

AERIAL NAVIGATION. By the late Charles Blachford Mansfield M. A. Edited by his brother, R. B. Mansfield. Price $5.00. New York city. Macmillan & Co., 21 Astor Place.

This is a curious book. It is probably the most elaborate treatise on its subject extant; yet it is written by one who never made a balloon ascension in his life, never saw more than half a dozen balloons, never made any long study of the question, and so on through a series of negatives which would imply utter ignorance of the whole subject attempted to be considered. The work is, therefore, due to a kind of inspiration, an inventive frenzy it would appear, and the author says he writes it "simply to deliver my brain of a burden which came upon it uninvited." The volume is divided into two parts; the first is devoted to the statement of the problem of aerial navigation, the second to suggestions for solving that problem. Some of the author's opinions we reserve for more extended review. As a whole, the book is dissatisfying. Its writer died before completing it. Hence the most important (concluding) part is but in fragmentary state, while the text is written with a diffuseness and redundancy of language which shows the absence of the final condensing and pruning which it would doubtless have received at his hands. Mr. Mansfield moreover died twenty-five years ago, and the volume takes no account of recent progress in aerostation. The work, however, contains much that may be read with profit, especially those parts relating to form and propulsion of balloons, while its appendices include much valuable information relative to weight of materials, buoyancy of gases, etc.

THE APPLICATIONS OF THE PHYSICAL FORCES. By Amédée Guillemin. Translated from the French by Mrs. Norman Lockyer; Edited, with Notes, etc., by J. Norman Lockyer, F.R.S. Illustrated. Price $12.50. New York city: Macmillan & Co., 21 Astor Place.

This work is devoted to the popular exposition of the practical applications of the laws of physics; and the publishers have left nothing undone, in the way of exquisite engravings (some beautifully colored), elegant paper, binding, and printing, to make the volume thoroughly attractive. The translator's work is excellently done; the editor's, with the exception of a few oversights such as "Nero's" fountain for "Hero's," with judgment and care. The volume is divided into five books, respectively relating to phenomena and laws of weight, acoustics, light, heat, and magnetism and electricity, the information given being brought up to very recent dates. To readers who, not having had the advantages of a scientific education, desire a good general idea of practical physics, we can cordially recommend this work. It has few technicalities, goes over an immense field, and neglects nothing that is important; and it is plainly and pleasantly written. It is especially well adapted to meet the needs of young students of Science.

RECENT ADVANCES IN PHYSICAL SCIENCE. By Professor P. G. Tait. Second Edition, revised. Price $2.50. New York city: Macmillan & Co., 21 Astor Place.

The lectures of which this volume is composed were delivered by Professor Tait before a number of professional men of Edinburgh, who wished to obtain a notion of the chief advances made in natural philosophy since their student days. The present is the second edition of the work, and has been subjected to careful revision. The volume is chiefly to be recommended on account of its containing a thoroughly admirable disquisition on the nature of energy, from the time of Newton up to the very latest modern researches; the whole being explained and elucidated in a masterly manner. The chapters on transformation of energy and transformation of heat into work are exceptionally good; and we commend them to the careful perusal of all engineers who would be well grounded in the theoretical part of their profession. The new chapter on force, added to this edition, we have already reviewed in detail.

Messrs. Slote, Woodman & Co., 119 and 121 William street, New York city, are the publishers of Mark Twain's new "adhesive scrap book." The erudite author, explaining his production, says: "I have invented and patented a new scrap book, not to make money out of it, but to economize the profanity of this country. You know that when the average man wants to put something in his scrap book he can't find his paste—then he swears; or if he finds it, it is dried so hard that it is only fit to eat—then he swears; if he uses mucilage, it mingles with the ink, and next year he can't read his scrap—the result is barrels and barrels of profanity. This can all be saved and devoted to other irritating things, where it will do more real and lasting good, simply by substituting my self-pasting scrap book for the old-fashioned one." This is very true so long as the purchaser does not meditate over the title of the work; but if he does, and misled by the same tries to make the book adhere, he will miserably fail. The pages are exceedingly sticky and the postage stamp paste is excellently put on. The work will hold scraps with intense tenacity, and generally is commendable in all respects; but still there is that subtle confusion in the title which might lead the unwary to try to cause the volume to adhere to a wall or desk, and, on failing, to make the cursory remarks which Mr. Twain hates to see misapplied. Price from $1.25 to $3.50, according to binding.

Inventions Patented in England by Americans.

From December 22, 1876, to January 15, 1877, inclusive.

BOILER.—C. V. Lloyd, Decorah, Iowa.
BOILER FURNACE.—A. F. Upton, Boston, Mass.
BOOT, ETC.—L. R. Blake, Boston, Mass.
BREECH-LOADING GUN.—C. H. Pond (of Bridgeport, Conn.), London, Eng.
BUTTON HOLE SEWER.—E. Remington & Sons, Ilion, N. Y.
CAR TRUCK.—E. H. Horsey, Chicago, Ill.
COMPRESSING INGOTS.—D. McCandless, Pittsburgh, Pa.
DRYING BONE-BLACK.—L. Colwell, New York city.
ENGRAVING MACHINE.—A. H. Watkins et al., Boston, Mass.
FASTENING BOOT SOLES, ETC.—G. V. Sheffield, Brooklyn, N. Y.
HORSESHOE NAIL, ETC.—J. M. Laughlin, Boston, Mass.
KNITTING NEEDLE.—W. Corey, Manchester, N. H.
MAKING BUTTONS.—C. Radcliffe, Newark, N. J.
MAKING FARINA, ETC.—C. Morfit (of Baltimore, Md.), London, England.
MAKING HOSE.—J. V. D. Reed, New York city.
MALT SYRUP, ETC.—O. F. Boomer et al., Brooklyn, N. Y.
MULTIPLEX TELEGRAPH.—G. B. Prescott, New York city.
OXYGEN FOR COMBUSTION.—C. Hornbostel, New York city.
PLOW HANDLE, ETC.—W. S. Babcock, Windham, Conn.
PRINTING PRESS.—I. L. G. Rice et al., Cambridge, Mass.
PULLEY.—A. Montgomery, New York city.
REDUCING ORES, ETC.—T. S. Blair, Pittsburgh, Pa.
REMOVING BOILER SEDIMENT.—T. F. Strong, Brooklyn, N. Y.
ROCK DRILL.—W. Weaver, Phœnixville, Pa.
SAFETY LATCH.—G. C. Setchelly, Greeneville, Conn.
SCHOOL DESK.—W. Rose, New York city.
SEWING MACHINE.—S. W. Johnson, New York city.
SHUTTLE.—W. E. Whitehead et al., Lowell, Mass.
SKIRT ADJUSTER.—A. S. Gear, Boston, Mass.
SPRING MOTOR.—I. Solomon, Solomon's Island, Md.
STEAM HEATER.—J. Wilcox, New Haven, Conn.
STONE DRESSING TOOL.—J. Hartnell, N. H.
STRAIGHTENING BARS, ETC.—D. McCandless, Pittsburgh, Pa.
TABLE CUTLERY.—W. Eccleston, New York city.
WASH BASIN, ETC.—A. G. Myers, New York city.
WATCH CASE SPRING.—J. Britton, San Francisco, Cal.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED BALE TIE.

Peter Harden, New York city.—The free end of the band is coiled upon itself by means of a turning key or other suitable device, and the coil being on the under side of the slotted buckle, it serves to hold (by friction) the other end of the band which is looped around the buckle, but not riveted. Thus, both ends of the band are locked by the coil. The band can be drawn very tight, and all slack taken up, so that the bale is held compressed in place of being allowed to expand so soon as released from the press, as usual heretofore.

IMPROVED SPIKE PULLER.

Joseph Douglass, McConnellstown, Pa.—This invention relates to an improved device for extracting railroad spikes. It consists in a sliding fulcrum arranged to rest upon the surface of the rail, provided with legs to prevent it from turning, and having upon its upper surface graduated steps of increasing elevations arranged part upon one side and part upon the other of the plate, and in connection with which a lever carrying a pivoted grapnel is adapted to operate; the grapnel being arranged to clutch the heads of the spike, while the lever is operated upon the different steps of the sliding fulcrum, beginning with the lowest near the spike and working toward the highest until the spike is extracted.

IMPROVED SOLDERING MACHINE.

Peter Dillon and John Cleary, Sherbrooke, P. Q.—The two plates comprising the body of the can are bent into suitable shape by a divided die. The solder is discharged through the hollow soldering tool as its valve opens when the bath of molten solder moves forward and the soldering tool passes over the side seam of the can. The bottom of the can is soldered by a hollow tool when the can is raised and rotated in suitable manner.

IMPROVED PEG FLOAT.

Tilghman F. Lippengood, St. Louis, Mo.—The cutter proper is reciprocated by a vibrating lever operated by a crank. The cutter is reversible on its bearing to adapt it to rasp and remove the ends of the pegs both at the heel and toe of a boot or shoe. It is secured in either position by means of a spring catch or locking device.

IMPROVED PUMP VALVE.

Garret D. Hopper and William H. Laufkotter, Sacramento, Cal.—The invention consists in the valve stem, made rectangular in its lower part and round in its upper part. Across the lower part of the valve box passes a crossbar, through which is formed a rectangular hole which receives the valve stem. Across the upper part of the box is formed another crossbar, so placed that the shoulder of the stem may strike it, and the upward movement of the valve be thus limited. Upon the stem is formed a second shoulder, against which the valve is clamped by a nut. By means of a bail the valve can be lowered into, and raised from, its place by a hooked rod.

IMPROVED NUT LOCK.

Frederick Swingly, Bucyrus, O.—An ingenious device for preventing the bolts from working loose in railroad joints, and in other places where they will be subjected to an intermittent or continuous jarring. It consists in the combination of two or more nuts with each other, in such a way that the backward movement of either will tend to move the other forward, causing them to mutually lock each other. This is one of the simplest inventions for the purpose that have come under our notice.

IMPROVED CAR COUPLING.

Hermann Wittmann, Manitowoc, Wis.—Accidents to brakemen while coupling cars are among the most common on railroads. The present invention aims to prevent these in great measure by improving the common draw-heads so that the link may be readily and conveniently guided to the opposite draw-head by the brakeman without danger of injury to the hand. The invention consists of a draw-head with a swing bar, pivoted to screw pins at both sides, near the lower part of the same. The swing bar is bent of one piece of rod iron, with side extensions. The pendent position of the swing bar, when the cars are coupled, prevents any damage to the same, as it is entirely out of the way.

IMPROVED MACHINE FOR FORMING SHEET METAL TUBES.

Abner C. Goodell, Salem, Mass, assignor to Mortimer M. Camp and John E. Searles, Jr., New Haven, Conn.—This consists of an endless belt of suitable strength, that is revolved by a driving roller mounted in a sliding carriage, and applied to a detachable tube-forming mandrel by top and bottom stretching rolls. The sheet metal blank is fed to the mandrel by being introduced between it and the belt, and formed by lapping around the same. The tubes are thus formed of any required length and thickness, as rapidly as the blanks may be fed and the tubes removed.

IMPROVED PRESS FOR TOBACCO AND OTHER ARTICLES.

William H. Malone, Farmington, Ky.—This is a strong yet simple and inexpensive press, constructed subtantially as follows: A lever is pivoted in one of the upright ends of the frame, and moves in a slot in the opposite end of the frame. The said slot has ratchet racks, which are engaged by pawls attached to the end of the lever. There is also a lever which is fulcrumed in the said frame, and carries a ratchet bar that engages with, and moves, the first mentioned lever; and there is a device for raising the main lever after the bale has been pressed.

IMPROVED BOILER.

Robert Excell, Chicago, Ill.—This is a tubular saddle boiler for heating greenhouses and for other purposes. It consists of a semicircular boiler with longitudinal flues arranged therein, in connection with a lateral fire-back at the bottom, and a lateral circulator at the top part of the boiler, between which the fire passes from the fireplace back to the flues. The boiler communicates by top-flow tubes above the circulator and return tubes at diagonal ends with the heating tubes. The heat of the fire is first exerted on the front section of the boiler, next on the circulator and generator, then on the rear part of the boiler, and finally by the passage through the flues, utilizing thereby quite fully the heating capacity of the fire.

IMPROVED SEWING MACHINE.

Lyman Robinson, Matteawan, N. Y.—The object here is to adapt a sewing machine for sewing on the binding of the brims of stiff hats, which, up to this time, have been sewed by hand. The needle and the presser-foot project outward from the head in which the bar works, to allow room for turning the crown of the hat over toward the head. In this way the needle and presser-foot can work on the upper side of the brim along the sides, which are curved up toward the crown.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED VEHICLE SPRING.

William W. Sayers, Harrodsburgh, Ky.—The object of this invention is to provide for buggies, top carriages, or other light vehicles, a spring which shall be superior in point of elasticity, lightness, strength, and durability, and also adapted to prevent rocking motion of the body of the vehicle. The invention relates chiefly to the use of end cross-springs, which are connected with the brackets or scroll springs that support the side springs of the body.

IMPROVED COMBINED POLE AND SHAFT.

William H. Hiteshew, Peru, Ind.—This is a contrivance of the shafts and their connecting devices whereby they may be readily shifted into suitable position for forming a pole for two horses. The shafts are pivoted to braces, so that they may be swung around to the center for use as a pole, or to the side. The shafts are connected at the outer ends, when used as a pole, by a metal point which has a kind of double clamp socket that slips on the ends, and fastens by an eccentric ring, or other device. The shafts are also connected together in this position by a plate.

IMPROVED METHOD OF VENTILATING BUILDINGS.

John F. Cameron, South Brooklyn, assignor to Elizabeth W. M. Cameron, Brooklyn, N. Y.—The impure air that rises to the top of the room passes through plates and spouts into a space between true and false ceilings, and thence into the cavities of the cornices and out through the pipes, the spouts preventing its return into the room. A number of new devices are embodied which may be recommended to the notice of architects and sanitary engineers.

IMPROVED VENTILATOR.

John Sandall, Jr., St. John, N. B.—This is a simple ventilator for railway cars which works efficiently without regard to the direction in which the car may be moving. It consists, essentially, of a case projecting laterally from the side of the car, with an opening on two sides, into a passage which curves from the side to the outer end. The two passages unite with each other a short distance from the outlet, where there is also the outlet of an exit passage from the car. In this passage draft is established by the air rushing through one of the side passages, and making a vacuum in the middle passage from the car. At the junction of the passage is a valve, which is opened automatically to the advancing side, and closed to the other side, by the wind.

IMPROVED PROCESS FOR MAKING WOODEN SCOOPS.

Robert Richardi, Belleville, Ill.—An ingenious mode of turning scoops out of a single piece of wood. The block is first turned in the form of a goblet and then hollowed out at the scoop part. The inclined handle is cut and turned from the smaller rear portion, and finally the edges of the scoop are finished off.

NEW HOUSEHOLD INVENTIONS.

IMPROVED EASY CHAIR.

Henry Parker, Osawatomie, Kan., assignor to himself, Ammi A. Brown, and Frank A. Lauter, of same place.—This improvement consists in pivoting the back of the chair to a supporting frame, and pivoting the back, bottom, and foot pieces together, so that the back and foot pieces may be placed at any angle between a horizontal and vertical position. The parts are attached in such a manner that the back and foot piece are always parallel to the same line. The chair will doubtless prove useful for dentists and barbers, and also as an easy or invalid chair.

IMPROVED LAMP EXTINGUISHER.

Leonard H. Pilger, Philadelphia, Pa.—This consists of a fulcrumed lever and slide rod at the under side of the burner. The lever extends below the collar of the bowl, to form contact with the same on detaching the burner, and to raise thereby the slide rod and a weighted extinguisher tube sliding on wick tube. A guard piece opposite the lever assists the working and re-inserting of the lever into the bowl. An automatically operating attachment is thus provided, which extinguishes the light even in case the person filling the lamp neglects to extinguish the flame before unscrewing the burner. It thus forms a good preventive against accident.

IMPROVED WEATHER STRIP.

David O. Hink, Maryville, Mo.—This is a new weather strip for outside doors that adjusts itself in automatic manner on the sill, so as to give protection against the entrance of moisture in stormy weather. A drop with a raised round knuckle is attached to a bed piece, and applied at suitable distance from the bottom edge of the door. The bed piece has a concave groove and is so constructed as to form a projecting lip, in which the knuckles of the drop swing, being held in position by means of hinges embedded in the knuckle-joint, thus forming a continuous knuckle hinge.

IMPROVED GAS LIGHTER.

Eddy T. Thomas, Boston, Mass.—This is an exceedingly ingenious device which automatically turns on, ignites, and extinguishes the gas at any desired hours. It consists of a clockwork train arranged in connection with a dial, the latter spaced off for 24 hours. By this dial the mechanism may be adjusted in accordance with the hours when it is desired to light and extinguish the gas. The apparatus when set in motion, at the regulated time turns on the gas, and removing a match from a receptacle, lights it, and ignites the gas. Subsequently, at the hour desired, it turns the gas off. The device may be moved and set once a week to the required time.

IMPROVED WASHING MACHINE.

Joseph O. Beauperland, Fall River, Mass.—The novel feature in this device is a metallic cylinder, having longitudinal corrugations, in the internal concavities of which octagonal rollers are sustained, being journaled in the cylinder heads. Clothes and a quantity of hot or cold water are introduced through the doors in the covering and in the cylinder, and secured therein by closing and fastening the doors. The cylinder is then rotated, and the by constantly falling toward the lower portion of the cylinder over clothes, the roller, soon become cleansed.

IMPROVED WEATHER STRIP.

Jesse Chandler, Warsaw, Ill.—A timely invention intended as a means for excluding cold and rain from windows and doors. It consists of a strip of metal or wood, which is movably attached to the door by the staples, and is of such length as to fit loosely between the jambs of the door. It is placed in a rabbet at the lower edge of the door, and is of sufficient width to drop into the rabbet in the threshold when the door is closed. On opening the door the strip strikes the block, which throws it upward until it engages the catch, by which it is retained until the door closes, when it is allowed to fall into the rabbet in the door sill.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CHURN DASHER.

Chapman J. Syme, Petersburgh, Va.—The invention relates to certain improvements in churn dashers, designed to churn the butter more rapidly by producing a larger degree of agitation in the cream. It consists in the particular construction and arrangement of a conical or funnel-shaped dasher, having a socket to receive the handle and provided with a perforated plate near its apex upon the outside, and a second perforated plate attached to a rod upon the inside.

IMPROVED CORN SHELLER.

Zadok T. Blackwell, Carrington, Mo.—A useful invention for farmers, by which the corn is rapidly separated from the cob and the cob expelled. It consists of a toothed revolving cylinder of slightly tapering shape, to which the ears of corn are fed from a hopper by a reciprocating slide with step-shaped surface. The ears drop on spring acted pressing pieces, that carry the same along the clearing teeth, and, finally, by means of a roller of the spring piece, through an exit aperture of the sheller frame, to the outside. A small outside hopper, with opening near the lower end, conducts any corn that may pass out with the cob back into the sheller. The especial feature of the invention is that the cylinder enlarges as the cob in its progress becomes stripped of its corn.

IMPROVED PLOW.

Samuel Huber, Danville, Pa.—In order to fasten the share or point of the plow without bolts, this inventor attaches the share to the plow by means of a projecting finger or dowel that fits into a corresponding aperture in the mold board, and locks the share by means of a dovetail in the beam and land side. The advantages of this method are that, as no bolts are required, the surface of the share may be smooth and entire. The usual danger of breaking the share by tightening the bolts is thus obviated, and it is not liable to become accidentally loosened.

IMPROVED CULTIVATOR.

Philip Studer, Mechanicsville, Iowa.—This is an improved machine for cultivating corn and other crops planted in hills and drills. It is so constructed that the plows may be readily adjusted toward or from the plants, and raised from the ground for passing from place to place. The new features relate mainly to improved construction of frame and braces.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Notes & Queries

J. M. will find on p. 17, vol. 30, an article on the examination of engineers.—J. M. P.'s theory of the chord of an arc, to decide the area of a circle, is correct. Can he find the angle or number of degrees in the arc?—M. N. will find directions for fastening sheet rubber to metal on p. 101, vol. 34. He should use marine glue if he wants a waterproof cement. See p. 43, vol. 32.—T. will find directions for polishing wood in the lathe on p. 139, vol. 35.—G. B. will find directions for preserving natural flowers on p. 204, vol. 28.—T. W. will find directions for putting a polish on starched goods on p. 213, vol. 34.—P. L. L. will find on p. 91, vol. 36, an answer to his question as to marine glue.—W. H. P. will find directions for nickel-plating iron on p. 235, vol. 33. For galvanizing iron, see p. 346, vol. 31.—D. H. will find a description of a pantagraph on p. 179, vol. 28.—O. J. S. will find a recipe for a black walnut stain on p. 90, vol. 32. For polishing boxwood, see p. 315, vol. 30.—S. L.M. will find on p. 330, vol. 26, directions for making an æolian harp.—E. will find on p. 344, vol. 34, a description of the fastest trains on railways.—J. J. will find on p. 106, vol. 32, a good recipe for vinegar.—McC. Bros. queries as to injectors were answered on p. 91, vol. 36.—A. B. will find directions for removing inkstains from paper on p. 154, vol. 30.—G. L. W. will find an excellent recipe for dried yeast on p. 204, vol. 33.—J. T. B. will find on p. 203, vol. 30, a recipe for cement for fastening leather to rubber.—P. T. will find something on making superphosphate of lime from bones on p. 90, vol. 36.—F. B M. will find an article on lubricants for drilling iron, brass etc., on p. 43, vol. 35.—W. A. H. will find directions for making rubber hand stamps on p. 206, vol. 35.—L. M. C. should repair his rubber boots with rubber cement made according to the recipe on p. 203, vol. 30.—W. R. R. should apply to the Massachusetts Institute of Technology, Boylston street, Boston.—S. L. M. should abstain from using hair dyes; but a comparatively harmless one is described on p. 138, vol. 27.—A. F. G. is informed that we know nothing of the toughened glass of which he speaks.—T. W. W. will find directions for making cheap telescopes on p. 186, vol. 30.—S. R. S. can blue watch springs or other steel goods by following the instructions on p. 123, vol. 31.—R. D. R. should thin his shoe polish by adding more ink.—J. M. & Co. should read our article on p. 241, vol. 35, and they will find that no decision as to the respective merits of exhibits was made by the Centennial judges.—A. B. W. will find directions for soldering all metals on p. 251, vol. 28. We cannot answer his question as to brick, as we do not know the nature of the clays.—H. A. L. will find directions for galvanizing iron castings on p. 346, vol. 31.—S. will find a recipe for waterproofing paper on p. 17, vol. 33.—J. L. T. will find on p. 324, vol. 32, directions for making salicylic acid.—E. E. K. can make his lightning rod of either iron or copper. See p. 277, vol. 35. Copper is a better conductor than iron.—O. A. H. will find directions for vulcanizing rubber on p. 378, vol. 28.—D. H. C. cannot calculate horse power of an engine unless he knows the mean steam pressure in the cylinder and the piston speed, as well as the dimensions of the cylinder. See p. 33, vol. 33.—J. H. B. will find a recipe for a silver-plating fluid, for use without a battery, on p. 408, vol. 32. To bleach beeswax, see p. 299, vol. 31. For a varnish for polished brass, see p. 310, vol. 35.—P. P. H. will find directions for straightening wire on p. 299, vol. 34.—V. A. S. will find directions for making a cheap battery on p. 43, vol. 35.—T. P. H. will find an answer to his question as to molding rubber on p. 203, vol. 35.—W. W. should study the lessons on mechanical drawing published in the SCIENTIFIC AMERICAN SUPPLEMENT.—E. J. B. will find directions for painting transparencies for magic lanterns on p. 330, vol. 35.—A. H. B., C. F. P., T. W., C. E. R., C. H. S., C. M. W., F. B., A. L., R. L., S. M. H. N., F. H., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) W. E. L. asks: 1. Which is the most economical to heat a dry house with, hot air or steam? Our boiler has capacity to supply steam for a fifteen horse engine, but our engine is but two horse power. A. If you have the appliances, steam will be best for you to use. Enclose a low coil of pipe in the drying room, and admit cold air below it; have registers in the floor for the air to escape, and conduct it to a flue built against or around your chimney; this will insure a circulation. 2. How large a dry house can we heat with steam from this boiler, without robbing the engine? A. This you had better prove by experiment, as so much depends upon conditions.

(2) C. M. F. asks: What shall I use in filling the grooves in a ceiling so as to make it smooth enough for wall paper? A. The usual course is to paste narrow strips of thin cloth over the joints.

(3) S. K. S. asks: How can I easily ascertain which of several sugars contains most saccharine matter? A. The amount of saccharine matter in a given quantity of raw sugar is determined now, almost exclusively, by means of an instrument called a saccharimeter. If a beam of polarized light be caused to traverse a solution of the sugar, and is examined by a thin plate of the mineral selenite, the solution will be found to have caused a rotation of the beam towards the right. A sugar solution of 6·1 cubic inches (3·4 fluid ozs.), containing 231·5 grains of sugar, turns the ray of polarized light, of 7·88 inches length, 20° to the right; with twice the amount of sugar, 40°, etc. The scale is generally graduated to read percentages directly. One of the best chemical tests is the following: Dissolve 617·32 grains of sulphate of copper in 2,469 grains of distilled water and add 5·14 ounces of neutral tartrate of potash in a little water, and 1¼ pints of caustic soda ley of specific gravity 4·12. The solution should then be diluted (with distilled water) to 2·438 pints at 60° Fah.; and 3·1555 ozs. of this solution corresponds to 77·17 grains of dextrose or 73·31 dry sugar. The sugar solution (of known strength) is added to a sufficient quantity of the reagent and boiled for a few minutes in a glass flask. The sugar reduces the copper to protoxide, which is removed from the solution by filtration, and weighed.

(4) H. N. R. says: I have set up a loom for rag carpet weaving, and have on hand a quantity of unbleached cotton warping which I wish to dye red or green. Will you oblige by giving some rough, ready, and cheap way of dyeing with the above colors? A. The aniline colors are the brightest and least troublesome to handle. With these, for the most part, wool requires no mordant. Cotton goods require to be mordanted with tannic acid in alcohol or by animalizing the fibers with albumen. You can purchase these dyes, together with the proper mordants already prepared, with instructions for use from any druggist.

(5) E. J. F. asks: 1. What is the best preparation for promoting the vigor of human hair, and what will prevent its turning gray prematurely? A. See p. 50, vol. 36. 2. What is the best method of restoring the color to faded switches of human hair without resorting to the use of hair dyes which contain poisonous ingredients? A. The natural color cannot be restored in such hair except by the use of dyes. Wash the hair thoroughly with soap and water, and dye with the aniline colors, which may be purchased already prepared, and accompanied with instructions, from any druggist. Do not use these dyes except on loose hair. In general we cannot recommend the use of hair dyes under any conditions.

(6) J. N. A. asks: Is there any instrument or contrivance to register the changes of temperature? A. In the United States signal service observatories, advantage is taken of the expansion and contraction of very long wires of brass, zinc, and iron; and of the unequal expansion of thin bands of brass and steel, which causes a compound bar of these metals to curve by a slight change of temperature. Some of these latter are in the form of large springs. Besides these, the old photometric method is still in use at some stations. In this, the light is caused to pass into a dark box, over the top of the column of mercury in an ordinary thermometer, where it leaves a record on a moving slip of photographic paper. None of these instruments are in the market.

Is steam used as a motor at as low temperature as 212° Fah.? A. No.

(7) A. W. asks: Is it possible that an ice boat can travel faster than the wind? A. Yes. On smooth ice, the wind blowing with a velocity of fifteen miles an hour, a firstclass ice boat may be sailed sixty miles an hour, or three times faster than the wind.

(8) J. L. asks: I am in charge of two boilers, 16 feet x 50 feet, with 56 tubes of 3½ inches diameter. The boilers are suspended at each end by a column. They have been two years in use, using one at a time. The boilers leak on top of the fire; we had a boiler maker caulk them, but in a short time they were leaking. A friend proposes to have belts turned to fit and take the place of the rivets (some of the leaks take in 15 rivets). I say the nuts coming in contact with the same will burn, and be dangerous. Which is the better plan? A. The bolts and nuts would answer and would not burn; but to ream out the rivet holes and put in new rivets would probably be the best plan.

(9) M. P. asks: Where can I have failed in my efforts to produce the firstclass waterproof blacking, directions for making which are given in your number of September 9, 1876? I have followed the instructions as carefully as possible—both by the aid of heat and without it—I have also varied the proportions of the ingredients given, and all without success; and as I am most anxious to attain my object, I shall be thankful for any help you will kindly afford me. A. The following are the materials and method employed in the manufacture of an excellent blacking, and one which we can vouch. Dissolve 18 ozs. caoutchouc in 9 lbs. hot rapeseed oil by constant stirring. Add to this 60 lbs. finest ivory black and 40 lbs. molasses, with 1 lb. finely ground gum arabic previously dissolved in 20 gallons vinegar, No. 24; the whole to be triturated in a paint mill until smooth. Then add, in small successive quantities, 12 lbs. commercial oil of vitriol with constant stirring for half an hour. Repeat this half hour daily stirring for 2 weeks, add 3 lbs. gum arabic in very fine powder, and continue the daily stirring, as before, for 2 weeks longer. It is then ready for use. Care should be taken to avoid loss of the solvent by evaporation. For blacking in paste, use only 12 gallons vinegar. A good blacking is also made by mixing 3 ozs. ivory black, 2 ozs. molasses, a tablespoonful sweet oil, 1 oz. oil of vitriol, 1 oz. gum arabic dissolved in water, and 1 pint vinegar.

Will you give me directions for preparing a firstclass oil for watches? It should be free from gummy matter, and should neither freeze nor act upon metals, and yet have lubricating power. A. For delicate machinery pure olive oil is in general use. For this purpose glycerin has also lately been employed, and mixtures of glycerin with sperm and olive oils. One of the best watch oils now in use is prepared from finest sperm oil. We are not, however, in possession of sufficient information concerning the precise method pursued in its production to warrant us in formulating a recipe for its preparation.

(10) M. J. says: We have built a tank house about 40 feet high and 15 feet square at the base, and 12 feet square under the eaves. The tank is in the top story of a building; it is 10 x 10 x 8 feet, and it leaks. We made the tank out of 1¼ inch matched flooring 6 inches wide; the joints were well tarred, but it was no good. So we laid another layer of common flooring inside of the 1¼ inch layer or outside body of the tank, and used white lead on the joints throughout, and had the floor coated with tar; but it still leaks, and a new difficulty has presented itself in that the water which comes from the tank tastes very strongly of tar. How can I stop the leaking of this square tank without using any poisonous substance, as all the water used for culinary purposes and drinking comes through this tank? A. You would have done better to have made a circular tank secured with iron hoops, the tank increasing in size towards the bottom. Your surest remedy now is to line your present tank with sheet lead, properly put in by a plumber.

(11) G. M. G. says: I wish to make a circular saw arrangement to run by treadle or foot power. If I put a fly wheel on large enough, can it not be made to run all right? The saw is 8 inches in diameter; what must be the size of the fly wheel? A. Use a 3 inch pulley and a 3 foot driving wheel with a heavy rim. If you intend using the saw for sawing short stuff or for cross cutting, a balance wheel on the saw mandrel will assist, as the power stored up in the balance wheel will carry the saw through a short cut.—J. E. E., of Pa.

(12) J. J. G. says: 1. If I pump 130 lbs. of air into a boiler 30 inches in diameter and 20 feet long, in the evening, will I have the same pressure in the morning? A. If the temperature of the air is unchanged, the pressure will remain constant, in this case. If the air becomes heated, the pressure will increase; if cooled, the pressure will fall. 2. Is 130 lbs. of air equal to 130 lbs. of steam, and is expansion of air less than that of steam? A. There is not much difference between the expansion of air and steam, for constant temperature; but where there is no gain or loss of heat, the difference is considerable. 3. Has any one invented an air locomotive? A. There have been quite a number of compressed air engines invented. If your device is an improvement over others, it may be worth your while to bring it to the notice of the public.

(13) H. L. H. says: I have 6 oscillating engines 10 inches stroke by 3 inches diameter. I wish to run them 500 revolutions per minute, with 25 lbs. pressure. How large a tubular boiler will I need? How much water will be evaporated per hour at that speed and pressure? A. It would be best to make some experiments with one of the engines before building the boiler. But if this cannot consistently be done, it may be well to design a boiler capable of evaporating 24 cubic feet of water per hour. You may allow from 30 to 35 square feet of heating for each cubic foot of water to be evaporated per hour.

(14) S. W. asks: Can you give me a method of rendering soap fat, so as to get the grease free from water? A. The fat is heated, not boiled, in a vat (see article on p. 22, vol. 36) with dilute oil of vitriol for some hours, which treatment separates the fat completely from the scrap, and it, being lighter than the pickle, rises to the surface, where it is allowed to stand for a short time, molten, until the water is eliminated by its superior gravity. By this method the water may be completely separated without difficulty.

(15) J. E. W. says: I have a piece of land of 100 acres, and I cannot get water by digging wells. I have a spring of very best water at the base of a hill which affords 12 or more gallons a minute. I want to force the water 100 feet high into a large tank 1,000 feet from spring, and let half the water into this tank and the other half 50 feet higher to the top of hill, to another tank 500 feet from first tank, making in all 1,500 feet from spring. Which would be the best, windmills or steam power, to pump the water? A. We judge from your remarks that a windmill would answer your purpose very well; and we advise you to adopt it in preference to the steam pump.

(16) R. B. G. says: In the SCIENTIFIC AMERICAN of September 30, 1876, I notice a problem given by C. D. S. to find the radius of a circle, the chord and versed sine being given. The formula given is erroneous. When using the square of 1 and dividing by 1, you do not materially change the result. But take any other number than 1 for the versed sine, and you will readily perceive the catch in your formula. If C. D. S. will use the following old formula he will be always right. Thus: Chord = 6 inches, versed sine ·2″. Then:

$$2\text{ rad.} = \frac{\left(\frac{C}{2}\right)^2}{\text{V. S.}} + \text{versed sine};$$

this gives the radius 22·6″. Your formula gives:

$$\frac{\left(\frac{C}{2}\right)^2 + \text{V. S.}^2}{2 \times \text{V. S.}} = \text{rad. } 23{\cdot}7.$$

Now the proof is as you stated. Rad. — $\sqrt{\text{rad.}^2 - \text{semi-chord}^2}$ = V. S., which shows your formula erroneous, giving the versed sine 0·193 instead of 0·2. A. The two expressions are alike, and will give the same value for the radius, if the proper substitutions are made. By a slight reduction, either formula can be changed into the other.

(17) G. C. R. says, in relation to the subject of testing milk: A solution of subsulphate of iron does the work admirably. I took two wide mouthed bottles of the capacity of nearly 2 ozs. each. In No. 1, I put 1 oz. milk, added 5 drops of the iron solution, and mixed them by shaking, merely closing the mouth of the bottle with my hand. The milk was at once divided into water, containing the excess of the solution of iron, and coagulum. On bottle No. 2, I fixed a small piece of wire gauze in a box, so as to have a border around the sieve. On pouring the contents of bottle No. 1 on the sieve, the water ran through, leaving nothing but the wet coagulum.

(18) B. asks: In preparing books for sewing, will a set of saws 8 inches in diameter, each saw having 8 teeth, cut the paper to ⅛ inch depth as well as a set of the same size having more teeth? A. The more numerous the teeth the better, unless they are so small that the paper clogs them.

(19) H. & F. say: During the recent frosty weather, an upright tubular boiler was caught well filled with water, which froze so hard that the boiler sprung the bolt heads and seams; so that when fire was again started and steam up, it leaked, and let steam escape from many places. After caulking up these places, however, the leaks seemed to be stopped, and she now carries her usual head of steam; but the boiler is very plainly sprung outward, and our anxiety is to know whether she has received any permanent injury from this strain, or been weakened in any manner? A. We have known of several cases resembling yours. It would be impossible for us to say certainly, without a personal examination, whether or not your boiler has been permanently injured; but, as far as we can judge from your account, it seems probable that no serious damage has been done.

(20) T. & H. ask: We wish to put up a steam saw and planing mill run by a 40 horse power engine with governor. At a distance of 150 or 200 feet therefrom is a large building for ginning cotton, requiring, say 10 or 12 horse power, to drive successfully. Which would be the best way to run said cotton gins, by a line of shafting from saw mill to gin house (the land being level), or to put a 12 horse power engine in the gin house, to take her steam from the boilers 150 or 200 feet distant through 1½ inch steam pipe laid on a level with the ground? A. Use the steam pipe, but jacket it thoroughly to prevent radiation.

(21) W. S. H., Jr., says, in reply to a correspondent who asked for a soldering fluid that will not corrode tools: For the past three years, I have used a fluid the fumes of which do not rust tools (I cannot say what actual contact might do, as I do not spatter my fluid about. It consists of muriate or iodide of zinc in crystals 1 oz., best alcohol 2¼ to 3 fluid ozs. It keeps best in a glass-stoppered phial. I have found the above to work full as well as the old kind, and much prefer it to anything I have ever used for the purpose.

(22) W. T. asks: 1. Why will not common charcoal do for the carbons for a bichromate battery? It does work for a short time. A. It will do, but its porous nature and brittleness are great objections to its use. 2. Is it as easy to magnetize a rod of soft iron, 12 inches long, as it is to magnetize one 2 inches long, provided the same number of layers are used? A. Yes, but greater current is required to produce the same degree of magnetization. 3. Will No. 30 wire magnetize satisfactorily

a core ⅜ inch in diameter and 8 inches long? I have put 4 layers on to a core of that size, intending to put on about 20, but the result, so far, does not encourage me to proceed. My object was to run a good sized core, with a very small quantity battery. A. Two to four layers of No. 16 or 18 copper-covered wire will answer your purpose better. No. 30 is used only when the resistance of the circuit, exclusive of the magnet coils, is comparatively great. 4. Why is platinum used for vibrating tongues? I have some of brass and copper that work very well. A. Because it is less oxidizable than most other metals. 5. How is sheet brass toughened? A. By rolling or hammering. 6. How is iron softened for electro-magnets? A. By heating it red hot and then allowing it to cool very slowly.

(23) J. M. M. asks: What metal will expand and contract the most by heated air? How much would a bar of metal 10" feet long and ½ inch square expand for each degree of heat? A. Lead, zinc, and tin are among the most expansible solids, their coefficients of linear expansion per Fah. degree being about as follows: Lead 0·000016, zinc 0·000017, tin 0·000015.

(24) E. S. says: In answer to your correspondent P. J. S., who having read "that the seed of sunflower is the most healthy feed that can be given to horses in winter and spring, half a pint a day keeps them in health and spirits, with sleek coats, and more animated than any other feed. It prevents heaves and some other disease," and he inquires if there is any truth in it. I have a large number of horses under my care, and had the above feed recommended to me. I gave it a trial, and found it to do good, it bringing horses into a good condition in a short time. The seed contains an oil which the horse seems to relish, when the seed is mixed with other food; and given in half pint doses, it aids digestion and acts as a mild laxative, and as such may prevent some cutaneous diseases and other disorders arising through constipation. I have never used it as a preventive of heaves, but know it to give relief to horses afflicted with them. I have also used it with good results on a horse whose lungs had been left impaired by a severe attack of pneumonia, and whose respiration was difficult and laborious, and it afforded considerable relief. The following is also a very good food for horses, and may be used for the same purposes as the above: It is composed of 2 quarts oats, 1 bran, and ½ pint flaxseed. The oats are first placed in the stable bucket, over which is placed the flaxseed. Add boiling water, then the bran (do not mix), covering the mixture with an old rug, and allowing it to thus rest for 5 hours, when it is mixed and ready for use. The bran absorbs while retaining the vapor, and the flaxseed binds the oats and bran together. A greater quantity of flaxseed would make the preparation too oily and less relished. One feed per day is sufficient; it is easily digestible and is especially adapted for young animals. It also tends to fatten.

(25) H. F. B. asks: Can I return the condensed water of a coil of pipe into the boiler without the use of a pump? A. With properly designed heaters, you may possibly be able to return the water; but it will be better to use a trap specially constructed for the purpose.

(26) O. O. M. says: I have a model sidewheel boat 45 feet long by 12 feet beam; it draws 14 inches of water. I want to put two direct connecting engines in it. What size will I need? What size single engine will I need? What size wheel should I use? A. Diameter of wheels, 8 to 10 feet. For engines, 7 to 8 inches diameter, 1 to 18 inches stroke, or a single engine with same cross section of cylinder.

(27) D. B. T. says: In the open air, water boils at 212°. In a boiler having an air pressure of six atmospheres, it will not boil at less than 320°. What would occur in a steam boiler having a pressure of six atmospheres of steam, if we turn air of seven atmospheres pressure into it, without allowing the temperature to rise? Would all the steam be condensed or would the air be diffused through the steam according to Dalton's law of the diffusion of gases? If so, why? A. If the temperature of the air was not raised, none of the steam would be condensed, and the mixture would follow Dalton and Gay Lussac's laws. This follows from the definition of a perfect gas. You will find a good discussion of this subject in Rankine's "Treatise on the Steam Engine."

(28) T. S. S. says: I wish to build a governor, the arms of which, from the centers of motion, shall measure 6 inches, the balls to be 2 lbs. weight each. How many revolutions per minute will be required to raise the arms to a horizontal position? A. You cannot raise the arms to a horizontal position, at any rate of speed, but you may approximate the position quite closely. A full explanation is given on p. 389, vol. 31.

(29) H. H. H. asks: I have a horizontal bar suspended from two wire ropes and guyed to the floor with four more; it however turns with the hands. How should the suspension rope and guys be fixed to the bar so that it will not turn, and will be perfectly stationary? A. The manner in which the bar is set up by professional gymnasts is probably as good as any. The bar is secured to two uprights, so that it cannot turn. These uprights rest on the floor, and the guys are attached to them.

(30) J. B. asks: Why is it that the low pressure cylinder of a compound engine is made larger in diameter than the high pressure? Would not the effect be the same if the terminal pressure in the high pressure cylinder acted upon a piston of the same size, instead of a reduced pressure (due to larger space occupied) acting upon a larger piston? A. One of the objects of the compound engine is to obtain a high grade of expansion; another is to employ a comparatively low temperature in the cylinder which is exposed to the cooling action of the condenser; and it is also desirable, generally, to have the equivalent mean pressure the same in each cylinder. We think these are the principal reasons for making one cylinder larger than the other, when only two cylinders are used.

(31) C. J. A. says: 1. I have two low pressure boilers, 18 feet long and 40 inches in diameter, with two flues each. They have a two foot brick wall between them and are not connected together. I heat 125 large rooms with them, so that do not have regular heaters in and only have a large quantity of piping hung on the walls in a zigzag form. The steam passes directly through about 280 or 300 feet of piping before reaching my return pipe in every room. Those that are close to the boilers get the most steam and return steam or foam into my boilers; while those at a distance retain the water so that the lower part of the pipes have water in them all the time. I have no pump, and have to depend on my condensed steam for supply of water. Is it safe to set boilers without having a pump, injector, or other reliable way of supplying them, or can I safely depend on condensation for supply? A. Without knowing the size of rooms and character of building, we could not form a very definite opinion as to the economy. We think it would be well for you to attach a trap of the kind that is made for returning the condensed water from heating coils. 2. In starting steam in the morning, there is a continual cracking and thumping noise until I have a complete circulation. I have about 35 drip cocks to assist in letting the air out, besides two main air cocks. A. To get rid of the cracking and thumping noise, it will be necessary to re-arrange your heating apparatus, so as to secure better circulation.

(32) J. J. says: 1. A reservoir ½ mile square in surface, 20 feet deep, 2 miles from town, and 200 feet above the level of town, has 2 pipes, of the same size and length. One is inserted at foot of reservoir, the other is inserted 19 feet above the first, or as near the surface as practicable without admitting air. Both pipes are brought to the same level in town. Would there be any difference in the pressure or amount of water discharged? If so, why? A. As long as the proper level was maintained in the reservoir, there would not necessarily be any difference in the action of the two pipes beyond what would be due to their difference in length and shape. 2. What would be the effect if the last mentioned pipe was fed from a box three feet square, the water being kept at the same height as the reservoir? A. The box, under the conditions named, would answer just as well as the reservoir for the connection.

(33) H. S. P. says: 1. I have a small copper boiler 12 inches high and 8 inches in diameter; it has a funnel inside, 8 inches in diameter at the bottom and 1½ inches at the top. The copper is $\frac{1}{16}$ of an inch thick. How much pressure will it stand? A. You can carry a pressure of 20 lbs. per square inch. 2. How large an engine will it run? A. Make one 1 x 1½ inches.

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

H. A. S.—Your precipitate consists principally of organic matter and sulphur, together with a small quantity of silicic acid.—J. D. R.—It is galena, sulphide of lead, and contains, in 100 parts, lead 87, sulphur 13 parts (by weight).—M. T. D.—No. 1 is a silicate of alumina and lime, together with carbonate and sulphate of lime, blende, and sulphide of lead. No. 2 is jamesonite (3 Pb $S+2 Pb S_3$), and contains in 100 parts, lead 43·6, sulphur, 56·4 parts.—G. S. M.—Nos. 1, 2, 3, 7 and 8 are impure clays (silicate of alumina) containing considerable quantities of lime and sesquioxide of iron. They might be employed as material for the manufacture of bricks. No. 4 might be called a low grade of potter's clay. No. 5 is clay slate, of no particular value. No. 6 is clay, containing a large quantity of carbonaceous matter, etc. No. 9 is red hematite (sesquioxide of iron). If in large quantities, it is valuable as an ore of iron.—W. H. J.—The substance consists of carbonate of lime, a little magnesia and iron, some fine sand, and a considerable quantity of alumina and silicate of alumina, or clay. The greater part of the alumina, clay, and sand may be removed from the water by slow filtration through gravel, and the iron and bicarbonate of lime by the addition of the proper quantity of clear lime water. The quantity of lime water requisite may be determined by experiment with known volumes of the water and reagent.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Transporting Ships Overland. By E. R.
On Brushing the Teeth, etc. By S. M. A.
On Nature and Life. By E. S. N.
On the Coast of France. By P. G.
On a Cave in Pennsylvania. By P. M.
On the Geographical Distribution of Animals, etc. By G. D.
On the Flight of Birds. By F. B.
On the Diagonal and the Side of a Square. By T. F.

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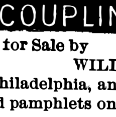

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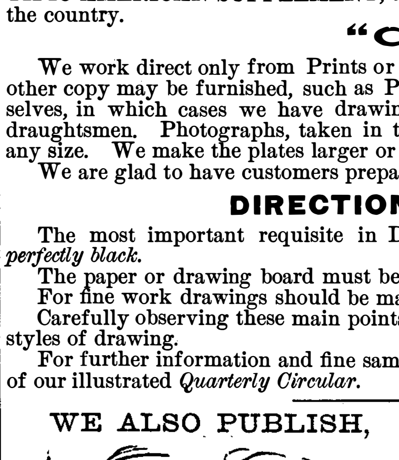

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