observed may be satisfactorily explained if we admit, as he believes to be the case, that the temperature of a flame is increased in the same ratio as the increased pressure or density under which the gas is ignited.

The final verification of this physical law will need further elaborate and dangerous experiments, for the purpose of determining the temperature of combustion of various gases in oxygen, under various conditions of pressure higher than the atmospheric.

These conclusive experiments will soon be begun in France at the Ecole Normale, by order of the Emperor Napoleon III. The operators will be placed within a strong cylindrical iron chamber, where they will be surrounded by air, compressed to at least three times the weight of the atmosphere. Let us here remark that this pressure has been shown by the experiments of the bridge at Kehl to be harmless to the human organization.

The results of these experiments may eventually have a very important practical bearing on the use of gas and of liquid fuels in our furnaces and under our boilers, the heating surfaces of which they may tend to diminish. They may also furnish us with an easy means of working platinum and of producing an indefinite amount of heat, and will probably be the means of suggesting some useful hints for the increase of the illuminating power of our ordinary lighting materials.

EXPLOSIVE COMPOUNDS FOR ENGINEERING PURPOSES.

NO. II.

On page 167, we quoted from Mr. Nursey's paper on the above subject, read before the Society of Engineers, of London. The facts therein stated are so valuable for reference, and withal so interesting, that we continue our extracts. Mr. Nursey describes, by the aid of an engraving, a simple apparatus for determining the ignition point of explosives, by which their absolute and relative temperatures are ascertained at the instant of explosion. It is simply a contrivance similar to a portable retort stand. An upright fixed in a weighted base, to stand upon a bench or table, sustains two transverse adjustable sliding bars, secured at any point desired by set screws. From the upper one depends a thermometer graduated to 650° Fah. The lower arm holds a cup of oil into which the bulb of the thermometer dips. A miniature cup containing a small quantity of the explosive mixture, floats on the surface of the oil. Heat is applied by a gas jet under the oil bath, or by a spirit lamp. By this apparatus, Mr. Horsley has ascertained the ignition point of various explosives, and the following are among some of his results: Gunpowder ignites at a temperature of 600° Fah. A sample of Horsley's powder gave 430° as the ignition point. Gun cotton of a powerful character, prepared by Horsley, ignited at 325°, while some of Prentice's sporting gun cotton exploded at 410°. Trials of Schultze's sporting powder gave 385° as the ignition point. It is as well, at a time like the present, when new explosive compounds are constantly being brought under notice, that experimenters should know the character of the material they are dealing with, and which they will be enabled to ascertain by means of the above simple apparatus.

Another, and perhaps safer, application of chlorate of potash to the purpose in question was made some nine years since by M. Hochstädter, a German chemist. Unsized paper was thoroughly soaked in, and coated with a thin paste consisting of chlorate of potash, finely-divided charcoal, a small quantity of sulphide of antimony, and a little starch, gum, or some similar binding material, water being used as the solvent and mixing agent. The paper was rolled up very compactly and dried in that form. In this manner, very firm rolls of an explosive material are obtained, which burns with considerable violence in open air, and the propelling effect of which, in small arms, has occasionally been found greater than that of a corresponding charge of rifle powder. Moreover, the material, if submitted in small portions to violent percussion, exhibits but little tendency to detonation. But, as no reliance can be placed on a sufficient uniformity of action, in a firearm, of these explosive rolls, this alone sufficed to prevent their competing with gunpowder. The same description of explosive preparation, differing only from that of M. Hochstädter in a trifling modification of its composition, was again brought before the public in this country in the early part of 1866, having been patented by M. Reichen. The author has used this gun paper with very good results in rifle shooting, but nothing practical appears to have been done with the material.

The mixture previously referred to as German, or white gunpowder, consists of chlorate of potash, ferrocyanide of potassium, and sugar. Many years since it was proposed and tried without success as a substitute for gunpowder. Since then various preparations of similar character have been suggested for employment, either as blasting and mining agents, or for use in shells, or even for all the purposes to which gunpowder is applied. The most recent of these mixtures with which the author is acquainted, is a white gunpowder made by H. W. Reveley, of Reading. This mixture is a perfectly white impalpable powder resembling flour, powdered chalk, or magnesia in appearance. Reveley recently informed the author that he has constantly made and used it in preference to the ordinary gunpowder, both on account of its superior propelling power—which is at least one-third greater—and its perfect cleanliness. It produces neither smoke nor flash of flame at the muzzle on discharge, and can be used in a casemate with perfect comfort to the gunners. Mr. Reveley has used it for every purpose to which ordinary gunpowder is applicable, and invariably with the most perfect success. He has made many parcels of the white gunpowder during the last ten years, and has always found them uniform, both as regards strength and other properties, and he has never met with the slightest accident, although he has tested it very severely. The composition of white gunpowder is as follows:

Chlorate of potash	48
Yellow prussiate ditto	29
Finest loaf sugar	23
Parts by weight	100

In manufacturing this powder the yellow prussiate is dried in an iron ladle until it is as white as the chlorate. The ingredients are ground separately to very fine powder, and are then mixed by means of a conical sieve until they are thoroughly incorporated, but not by trituration. For small quantities, Reveley uses a common Wedgewood mortar and pestle, which must be perfectly dry and clean. The operation does not take many minutes, and with the above precautions, its manufacture is free from danger. In loading, it is treated in the same way as ordinary gunpowder, being pressed down by hand solid, but not hard. The charge is ignited in the usual way, with a common cap and nipple. In actual use, it does not appear to possess a bursting so much as a propulsive power, and Mr. Reveley has obtained some of the highest penetrative results in his rifle practice with it. The economy of this powder will at once be apparent, when it is stated that its wholesale cost is about 86s. per cwt., but as its strength is at least one-third greater than that of ordinary powder, its cost may be comparatively estimated at about 60s. per cwt. One important feature in the manufacture of white gunpowder is that it does not require to be—indeed, it cannot be—granulated, which process is the great source of danger in powder mills. The universal use of the cartridge entirely obviates any objection that may be made to white gunpowder on that score, or on the score of similarity in appearance to other substances, and, owing to its compact form, it only occupies half the usual space. Beside the foregoing, there have been several cruder applications of chlorate of potash in the production of explosive compounds, which it is unnecessary here to notice more particularly.

Among other materials, wood has been pressed into service to aid in superseding gunpowder as a practical explosive. Soon after Schönbein's discovery of gun cotton, a Prussian artillery officer, Captain Schultze, while investigating the subject, conceived that a finely divided wood could be converted into a controllable explosive agent more readily than cotton. He produced the substance known as gun sawdust, the explosive properties of which are mainly due to its impregnation with a large proportion of an oxidizing agent. In preparing the gun sawdust, the wood is purified from all resinous substances, and is digested in a mixture of sulphuric and nitric acids. This gives a very feeble explosive material, which is further strengthened for ultimate use by impregnation with nitrates, by which it is made to acquire great explosive power. Here, then, is a powder which may be preserved in a comparatively harmless condition until required for use, when it may be rendered powerfully explosive by impregnation with the nitrates. Although its properties are somewhat similar to those of gun cotton, many of the advantages of which it possesses, it is open to one very fatal objection. To be within the limits of safety, the completion of its manufacture must be delayed until the moment it is required for use; and, moreover, the final ingredients are the most dangerous, and require refined manipulation. It is needless to point out how incompatible the conducting this completing process is with the ordinary details of mining; the care and nicety required in such a chemical operation, must be referred to the skilled operator, and not trusted to the rough-and-ready hand of the miner. Practical safety can only be attained by an explosive agent into which the stray spark may fall without producing more than a gush of flame, a gradual burning, or without causing ignition at all, but which, nevertheless, when properly rammed home and tamped, may be fired with results at least equal, if not superior to ordinary gunpowder.

Utilization of High Falls of Water.

Glynn's "Power of Water," contains the following in regard to the utilization of high falls of water:

"Attempts have been made to employ a high fall of water by placing one wheel above another; this was tried many years ago at Aberdare, in South Wales, where two wheels, each forty feet in diameter, were so placed, like the figure of 8, and were connected by teeth on their respective rims—the lower wheel receiving the water after it left the upper one, and revolving in the opposite or reverse way. The result was not satisfactory; but in another case, a drawing of which lies before the writer, wherein Messrs. Charles Wood and Brothers, of Macclesfield, had two overshot water wheels, each of twenty-six feet in diameter, and six feet wide, placed over each other, they succeeded in a somewhat different arrangement of the toothed-wheel work. The two wheels were not connected immediately with each other, but by means of *pinions*, which worked into teeth upon the rims of the two water wheels, causing them both to revolve in the *same* direction, so that the water, on leaving the buckets of the upper wheel, was more easily and readily received by the buckets of the lower wheel.

"In either of these cases, however, the employment of the turbine, or the *pressure engine*, would have been much less costly and more effective. The like may be said of all the contrivances to substitute endless chains with buckets applied to high falls instead of water wheels.

"Where the quantity of water is large and variable, and the fall such as may be termed an intermediate hight, but varying also with the supply, it is found advantageous not to lay the water upon the top of the wheel, so that it may work overshot, but to make the diameter of the wheel greater than the mean hight of the fall, and to lay the water, as it were, '*on the shoulder*' of the wheel, or at forty-five degrees from the perpendicular; that is, half way between the horizontal line and the perpendicular, or, as millwrights say, 'at nine o'clock.' Very little mechanical effect is produced in the upper eighth of the circle as compared with the next quarter, on which the descent of the water is nearly perpendicular, and when the wheel is fitted with toothed segments at or near its circumference, acting on a pinion placed on a level with the axle, the weight of the water is brought to bear at once upon the pinion teeth, the stress is taken off the arms of the wheel, and the axle becomes, as it were, merely a pivot on which the wheel turns. By this arrangement, the late Messrs. Hughes and Wren, of Manchester, were enabled to make the arms of their wheels of simple tension rods of bar iron, by which the rim of the wheel was tied and braced to the center, a plan which, with some modifications and improvements, is still in use, and sometimes the segments have interior teeth, which render the wheel-work more compact.

"In the best constructed wheels, the water is laid on in a thin sheet of no greater depth than will give it a somewhat greater velocity than that of the wheel, the difference being just sufficient to pour into the succeeding buckets the proper supply of water. The buckets should be so capacious that they need not be full when the wheel carries its maximum load, in order that no water may be wasted, and that they may retain the water in them till the last moment that its weight on the wheel is effective, and yet empty themselves as soon as it ceases to be so. It is also expedient in practice to make the width of the sheet of water less than that of the wheels; if the wheel be broad on the face, the stream may be four inches shorter than the length of the buckets; the air escaping at the ends is thus prevented from blowing out the water; and all these precautions, though small in themselves, tend to produce smoothness, regularity, and increased effect in the working of the machinery.

"There is, however, one mode of using water power—acting by its gravity—in buckets upon a chain, much employed in South Wales, which is found very useful in raising ore from the pits. An endless chain is passed over a wheel of sixteen feet in diameter, placed between two shafts. The chain passing down each shaft, and through an opening at the bottom between the two, two large buckets, or rather shallow tubs of wrought iron, are fixed upon the chain, so that the suspension is by the center of the tubs, and they are so placed that when one tub is at the top of its shaft, the other is at the bottom of its shaft. Each tub or bucket is covered by a strong platform, which fills and closes the pit's mouth when hoisted up, and carries the small wagon or tram containing the ore upon it; and each is also fitted with a valve at the bottom to discharge the water. A branched pipe, communicating with an elevated reservoir, is laid to the mouths of the shafts, and fitted with stop-cocks or valves. The tub at the surface being filled with water, overbalances the empty tub at the bottom, and raises it, with its tram load of ore, to the top. When the full bucket has descended the shaft, the valve is opened and the water discharged; the other being filled in like manner, descends, and thus alternately each raises the other with its load of oar. The water finds its way out of the mine by a drift or adit into the valley; the long loop or bight of slack chain below the buckets, and hanging to the center of each, equalizes the weight of chain at all times; and a brake applied to the large wheel regulates the speed of the descending bucket. In some places the two buckets work in one shaft of an oblong form; the diameter of the wheel is reduced to seven feet; it is fitted with toothed segments, working into a pinion, fixed upon a second axle, on which the brake wheel is placed, in order to gain the requisite power to control the descending weight. Drawings of both these plans lie before the writer, but the principle and construction are so simple that a description will probably suffice. It may be proper to mention that the buckets generally work in guides, that the discharging valves are opened by striking upon a point or projecting spike at the bottom of the shaft, and that upon the platforms which cover the buckets, there is a portion of the rail or tramway laid to match with the lines of way at the top and bottom of the shaft, so that the tram or carriage may run from the platform to its destination."

Dr. Mallet's Opinion of the Heaton Process.

The following is Dr. Mallet's opinion of the reality and commercial value of Heaton's process:

"This process for converting crude pig iron into wrought iron and into steel, by the employment of nitrate of soda in Heaton's patent converter, has been repeated at Langley Mills many times in my presence. I have examined minutely into its details as applicable in practice on a large scale, and its results; and I have also considered the chemical researches made as to the materials used and products obtained, by Professor Miller, of King's College, and I have been present at experiments, conducted by Mr. David Kirkaldy, at his Testing Works, at Southwark, as to the physical qualities of the products which were obtained by this process, in my own presence, at Langley Mills. In view of all the facts that have come before me, I can affirm the following as truths established beyond question:

"1st. That Heaton's patent process of conversion by means of nitrate of soda, is at all points in perfect accord with metallurgic theory. That it can be conducted upon the great scale with perfect safety, uniformity, and facility, and that it yields products of very high commercial value.

"2d. That in point of manufacturing economy or cost it can compete with advantage against every other known process for the production of wrought iron and steel from pig iron.

"3d. Among its strong points, however, apart from and over and above any mere economy in the cost of production are these: It enables first-class wrought iron and excellent steel to be produced from coarse, low priced brands of crude pig iron, rich in phosphorus and sulphur, from which no other known process, not even Bessemer's, enables steel of commercial value to be produced at all, nor wrought iron, except such as is more or less either "cold short" or "red short." Thus, wrought iron and cast steel of very high qualities have been produced, in my presence, from Cleveland and Northamptonshire pig irons rich in phosphorus and sulphur, and every iron master, I presume, knows that first-class wrought iron has not previously been produced from pig iron of either of these districts, nor marketable steel from them at all.

"Heaton's process presents, therefore, an almost measureless future field in extending the manufacture of high class wrought iron and excellent steel into the great iron districts, as yet precluded from the production of such materials by the inferior nature of their raw products. It admits of the steel manufacture also being extended into districts and countries where fuel is so scarce and dear that it is otherwise impossible.

"I cannot, in this brief communication, point out the prospects which the employment of this system presents, of greatly diminishing the existing waste of material, fuel, time, and wages, in the puddling process, and of lessening difficulties in relation to labor questions which beset that process, injuriously to the British iron trade. Nor can I adequately point out the large reduction in the original outlay for plant which this system admits of as compared with any other for equal annual out-put of iron and steel.

"Dr. Miller has proved, incontrovertibly, that the Heaton process does eliminate from the crude pig iron almost the whole of the phosphorus and sulphur, the trace remaining being unobjectionable in the wrought iron and steel produced, even when they have been made from the pig irons known to be the richest in these injurious constituents of any make in Great Britain.

"The wrought iron made in my presence from Cleveland and Northampton pigs, and tested for tensile resistance, also before me, bore a rupturing strain of twenty-three tuns per square inch, and an elongation of nearly one-fourth of the original unit in length. It is therefore iron of great strength and toughness, and yet probably by no means the very best that this process is capable of producing hereafter. It possesses those qualities which best fit iron for artillery, armor plates, and iron ships or boilers.

"The tilted cast steel, also made in my presence, from the very same pig irons as the above, bore a tensile strain at rupture of above forty-two tuns per square inch with an elongation of one-twelfth of the unit of length. It is, therefore, a remarkably tough and fine quality of steel, well suited for rails, ship-building, and all other structural uses. In a word, steel suited for any purpose known to the arts can be produced by this system from inferior brands of pig iron."

The Electrical Machine at Trinity College.

It is not generally known, says the Hartford *Times*, that Trinity College in this city possesses what, if not the largest, is the most powerful electrical machine in this country. It was made in Vienna expressly for this college. We were present at an exhibition of the same, March 6th, and were as much pleased as we were astonished by the wonderful power of the machine.

It occupies a space on the floor of about 4½ by 5½ feet. The electricity is collected in large brass balls, supported by strong pillars of a peculiar glass, in which there is no metallic substance. The rubbers and the points upon which the axles of the plates work are also supported by the same kind of pillars. These balls are nine inches in diameter, having a smaller ball between them; and from a projecting point midway between the larger balls, the spark is drawn to a metallic surface mounted on glass. This is movable and connected with the rubber and the ground. The large balls are surmounted by two rings of light hollow wood, lined with metal which are thirty inches in diameter, and greatly increase the force of the spark. The whole apparatus, to the top of these rings is eight feet high. The plate is of heavy glass, very clear, 46½ inches in diameter and three-eights of an inch thick. The operator stands at a safe distance, and the handle of the machine is insulated by means of a rod of glass. The rubbers are covered with Bunsen's amalgam and the electricity when generated is taken from the plate by sharp points and conveyed to the above mentioned bath.

It is wonderful what an enormous amount of electricity can be obtained from this machine. A few revolutions of the wheel will cause a spark eight or ten inches long to fly off, and this length can be greatly increased by withdrawing the spark catcher, and pushing in the point from which the discaarge takes place. The peculiar odor which attends the generation of electricity is perceptible in all parts of the room, and persons are affected while standing several feet from the machine. On that evening—and the condition of the room, atmosphere, and other surroundings were not what they should have been for a perfect exhibition of the machine—a spark ten inches long was drawn twenty-one and a-half inches from the machine.

Among the different experiments shown by Professor Brocklesby, that evening, were, first, the charging and discharging of Leyden jars, around the interior of which bits of tin foil, diamond shaped were placed. The electricity would run from one to the other, filling the jar with rows of light. Another jar was lined with gold-leaf, and surrounded by brass filings. The electric fluid would run through this in lightning like streams. Tubes and globes similarly arranged were also shown. Then he showed the effect of electricity passing through vacuum. A hollow cylinder of glass, some five feet in length, was exhausted of air, and connected with the machine, the electricity passing through in streams of a light violet color, resembling the "Northern Lights." Then the effect of electricity on different gases was shown by means of tubes filled with gases. When passing through that filled with nitrogen gas, a yellow light was seen in vertical streams alternately light and dark. In going through carbonic gas, a green light was obtained, while a pale halo seemed to surround the tube. Through hydrogen there was a continuous flow of blue and yellow light, but the prettiest experiment was when the machine was connected with a cylinder filled with a combination of gases. Inside this cylinder was an arrangement of glass coils. As the electric fluid passed through these it gave the appearance of a slender vase of brilliant green, filled with pink, olive, violet, and yellow flowers. Large Leyden jars were then filled, and by means of a discharging rod, the electricity was carried off, passing on its way through a piece of card board on to a chain and wire connecting with the ground. A small hole was pierced through the card. This discharge would be sufficient to knock a man senseless, if not to kill him. Other experiments were tried, shocks administered to those who wished, a jar broken—our reporters hair made to stand on end "like quills upon a fretful porcupine," and an opportunity given to all to see the "long spark." The exhibition was an exceedingly interesting one, and we wish that Professor Brocklesby could be induced to repeat it in a larger hall, where our citizens might have an opportunity of witnessing the workings of the machine.

Solar Heat as a Motive Power.

A short time since we briefly referred to the experiments of M. Mouchot, made with a view to utilize solar heat as motive power. He, in a contribution to the *Comptes Rendus*, thus speaks of some of their results:

According to my experiments, it is easy to collect, at a cheap rate, more than three-fifths of the solar heat arriving at the surface of the globe. The intensity of this calorific source, so feeble in appearance, was revealed by Pouillet, more than thirty years ago. At Paris, a surface of one square meter, normally exposed to the sun's rays, receives, at least, whatever may be the season, during the greater part of a fine day, ten heat units (calories) per minute. [The unit of heat adopted by most physicists is the quantity necessary to raise one pound of water from 0° to 1° C. We suppose M. Mouchot adopts the same standard.] To appreciate such an amount of heat, it is sufficient to observe that it will boil, in ten minutes, one liter of water, taken at the temperature of melting ice, and it is almost equal to the theoretical power of a one-horse steam engine. Under the same conditions, a superficies of one "are" (119·603 square yards) would receive, during ten hours of insolation, as much heat as results from the combustion of 120 kilogrammes (321,507 lbs. troy) of ordinary oil. These numbers are eloquent: they should, if not dispel, at least weaken the serious fears entertained by some, in consequence of the rapid exhaustion of coal mines, and the necessity of going to increasingly greater depths, disputing with the subterranean water this precious combustible. The intensity of the calorific radiation of the sun is, moreover, much less at Paris than in intertropical regions, or upon the elevated plains. It is, therefore, probable, that the invention of "sun-receivers" will, some day, enable industry to establish works in the desert, where the sky remains very clear for a long time, just as the hydraulic engines have enabled them to be established by the side of water courses.

Although I have not been able to operate under very favorable circumstances, since my experiments have only been made with the sun of Alençon, Tours, and Paris, I proved, as far back as 1861, the possibility of maintaining a hot-air engine in motion, with the help of the sun's rays. More lately I have succeeded in boiling, tolerably quickly several liters of water submitted to insolation. In short, having satisfied myself that it was sufficient to have a silver reflector, with a surface of one square meter, to vaporize, in a hundred minutes, one liter of water (0·88 quart), taken at the ordinary temperature, or, in other words, to produce seventeen liters of vapor a minute, I tried to work a small steam engine by solar heat, and my efforts were crowned with success in June, 1866. In the meantime I have been able, by very simple apparatus, to obtain some remarkable effects from insolation, such as the distillation of alcohol, the fusion of sulphur, perfect cooking of meat, bread, etc. None of these experiments, particularly the application of the sun's heat to machinery, have been tried upon a sufficiently large scale. It would, therefore, be useful to repeat them in tropical countries, with "sun-receivers" of suitable dimensions. We would measure the volume and the tension of steam produced in an hour by a given insolated surface, the pressure developed by the sun in a considerable mass of confined air, and the temperature which might be obtained by vast reflectors, formed of a framework of wood covered with plates of silver, etc.

Tea Culture in this Country.

A correspondent of the New York *Times* writing from Knoxville, Tenn., gives some information, additional to that published on page 215, current volume, SCIENTIFIC AMERICAN, in relation to the culture of the tea plant in this country. Writing on this subject the correspondent says, in relation to Capt. Campbell's experiments, that his experience shows that tea can be successfully cultivated in East Tennessee, the climate of which is about the same as that in the tea-bearing regions of China and Japan. Frosts come late in the fall and leave early in the spring, and the winters are short and not severe. The writer says:

The plant can easily be protected, and the experience of Mr. Campbell shows that it can be cultivated here without doubt. His farm is some ten miles southeast of this city, on the rich bottoms of the French Broad River, and well situated for a fair test of culture. The plant is a deep evergreen shrub, and attains, at its full development, a hight of five feet. It is strong and compact, and needs but little protection from the frost. It bears well; it has a beautiful flower which develops about October. The next season produces a seed something resembling a hazel, which grows readily. Mr. Campbell has not attempted its culture to any extent. His idea was to prove fully its adaptedness to this climate rather than to embark in any enterprise in its cultivation. He has for some years raised all the tea he needed for his own family, and he feels quite well satisfied with its taste and the yield. It has been pronounced by several gentlemen fully equal to "Young Hyson." That he should have satisfied himself so long since of the adaptedness of this plant to this climate, and that such conclusions have not long since become known, and the enterprise been fairly tested on a larger scale, is a matter of surprise to me. It is a fact of great importance, as it seems to me, and it might be well for the Agricultural Bureau at Washington to encourage other and more extended experiments. If we can raise our own tea and our own beet-root sugar, we shall be relieved from a heavy expenditure which yearly inures to the benefit of the Chinese and Japanese.

Galvanizing Iron---Drawing off the Offensive Vapors.

The application of zinc with tin as a coating for iron, says *Van Nostrand's Engineering Magazine*, has become a most important manufacture in and about Birmingham. The application of iron for every purpose of construction is practically only limited by the difficulty of preserving the surface from rust. No method has yet been adopted which is at once so cheap, so effectual, and so enduring as galvanizing, and the works in which that process is carried on have very rapidly increased. To galvanize iron it is immersed for a certain period in an acid to cleanse the surface, after which it is dipped into a bath containing zinc and tin melted. In this salts of ammonia are thrown, which operate on the metal as a solvent, and enable it to be more evenly distributed over the surface. From this bath is given off a dense, pungent, white-colored vapor, which is heavy, and, especially in damp weather, spreads and becomes offensive. Complaints have been made of these vapors, and various plans have been adopted for the purpose of preventing them from passing into the atmosphere, but heretofore without success. The Wolverhampton Corrugated Iron Company have adopted a plan which is found very effectual. The top of the bath is surrounded by a flue which forms a projecting lip, and from this, run one or more iron pipes communicating with a powerful fan. From the fan a large flue extends to an annealing furnace. The fan, by creating a vacuum in the pipes, causes a strong current of air to pass over the surface of the bath, which drives the vapor into the furnace, where it is entirely consumed. Experiments are in progress to condense the vapors so as to utilize them, instead of consuming them in fires.

Casting Steel Under Pressure by use of Gunpowder.

Casting steel under high pressure by means of gunpowder, is thus described by the inventor: It is well known that cast-steel run into molds is subject to blister, and is otherwise porous, which defect reduces considerably its toughness. In order to give this metal its requisite tenacity it is subsequently reheated and then rolled or hammered. As many articles, such as cannon, cannot be treated in this manner, I have devised to submit them to a high pressure while in a liquid state, inclosed in their same molds, maintained in iron flasks. For this purpose, immediately after running a cannon, I cover hermetically the head by a metallic cap, by means of bolts or other devices attached to the flask. This cap is fitted in its center with a vertical pipe, and provided with a cock at its lower extremity, while its upper extremity is closed by a washer pressed by a bolt in such a manner as to act as a safety valve. Before attaching the cap, at, supposing, one inch from the surface of the liquid metal, I introduce in the vertical pipe, and between the cock and the washer, a charge of about one quarter of an ounce of a powder, prepared in the proportions of eighty parts of saltpeter and twenty parts of charcoal. On opening the cock this powder falls on the metal, ignites and engenders about one-third of a cubic foot of gas at 3,000° Fah. These gases exert on the liquid metal a pressure which is transmitted throughout the entire mass, thereby condensing the same and expelling the blisters. The effect thus produced is equivalent to the pressure of a head of liquid metal ninety feet high, admitting that the capacity between the cap and the surface of the metal contains thirty cubic inches. By making the flasks sufficiently strong, the charges of the powder may be varied, so as to produce by its ignition a uniform and general pressure, which is preferable to the partial, irregular, and momentary action of a hammer.—*Engineering Magazine.*

Louisiana Sugar and Sirup.

An esteemed correspondent of Plaquemine, La., Mr. Evan Skelly, has sent us a barrel of sirup of fine quality, and some samples of sugar, made with his sulphur apparatus, for which he will please accept our thanks. He writes us that "the sirup was made direct from cane juice in common open iron kettles from six degree juice, plant and stubble cane mixed, with the use of three and a-half pounds of sulphur to the hogshead, limed 64 cubic inches to the grand, four grands to the hogshead of 1,000 pounds, made about the 25th November, 1868, (rather late in the season) on the Pecan plantation, in the Parish of Iberville, worked by Mr. David N. Barron, with one of my sulphur apparatus. I send also samples of sugar made with the apparatus on various places, that you may judge for yourself of the practical working thereof. It is well established in New Orleans, that a greater quantity of inferior sugar has been made in Louisiana this year than in any previous year in proportion to the crop, caused from the fact that most of the cane ground was plant, and generally planted in fresh land."

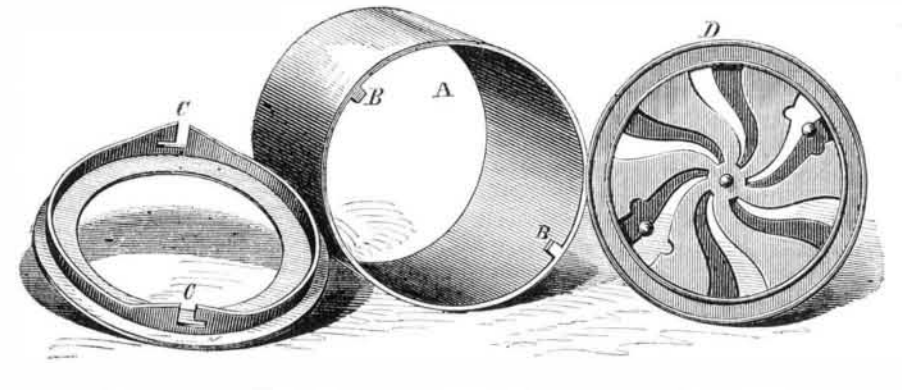
The quality of the samples sent is such as substantiate the efficiency of the apparatus. In the manufacture of neither the sugar nor sirup, he adds, no chemicals were used except sulphurous acid and lime.

THE sprouts of the potato contain an alkaloid termed by chemists *solanine*, which is very poisonous if taken into the system. This does not exist in the tubers, unless they are exposed to the light and air, which sometimes occurs from the accidental removal of the earth in cultivation.

Improvement in Thimbles and Ventilators for Funnel Flues.

Unsightly tin plates or guards to cover funnel holes of unnecessary size in the chimney are not very pleasant adjuncts to the arrangements of the kitchen, dining, or sitting room. A perfect fit of the stove funnel to the thimble or sleeve makes a neat appearance, whether the thimble is of tile clay, or of sheet or cast iron.

The engraving represents a method of making a neat fit to any size of pipe. A is the thimble or sleeve to be seated in masonry of the chimney. It has snugs, B, which engage with recesses, C, on the flange that is one of a set intended to fit each size of pipe or funnel down to four inches. The register, D, is to take the place of the flange or collar in summer, when the stove and pipe are removed. It is secured in the same way as the collar, by means of a projecting circular flange fitting the interior of the sleeve, A, and the snugs and recesses as seen. This device can be attached or detached instantly, and it makes a neat, safe, and handy contrivance.



LITTLE'S STOVE FUNNEL CAP AND VENTILATOR.

Patented, Nov. 3, 1868, by J. L. Little, who may be addressed for rights or for additional information at Atkinson, N. H.

PROGRESS OF THE VELOCIPEDE.

The interest in the velocipede continues unabated. A "Long Island rider" writes us a description of an improvement which strikes us as being novel at least. It is a device to enable velocipedestrians to use the ordinary horse-car tracks as a way for their machines. The attachment is a bar of iron or rather a rod about ⅝ of an inch in diameter with a small wheel at the end, remote from the velocipede proper, and having the other end attached to the "back-bone" of the machine. The small wheel bears on the opposite rail from the one in which the velocipede wheels run, and thus acts as a brace, and prevents running off the track. He says it has been tried with complete success; the machine being propelled with very little effort, and running up a grade with ease and rapidity. These attachments will soon be offered for sale.

The *Journal of the Telegraph* proposes that telegraph messengers be supplied with velocipedes for the more rapid delivery of messages. It says: "The messengers of a company perform a most important part of the telegraphic service. Their service demands a high degree of fidelity, sagacity, determination, beside the mere swiftness of foot necessary to perform their duty acceptably. But there is more practical skill and more persistant watchfulness needed to reduce the time which is even now expended between the reception of a message by the wire and its delivery into the hands of the party addressed, than in all the other parts of its progress. Anything which will reduce the time thus consumed, which will prevent the consumption of an hour or more to deliver a dispatch two miles from a central office which came a thousand miles over the wires in two minutes, must be hailed as an acquisition, and, if possible, made available.

"Well, 'we shall see what we shall see' by-and-by. We would like to see the experiment tried. Ponies were once tried in St. Louis, with what success we do not know. We want to see a good boy straddled across a velocipede and put on his honor and metal. We think there would be some quick time made."

An exhibition of a ladies' velocipede took place at Hanlon's Hall on Tenth St. on the evening of the 24th of March. It differs from the ordinary machine in having the perch lower, and in the arrangement of the spring, making it more convenient to mount and dismount. Instead of a saddle, there is a seat of wicker work neatly woven. The fore wheels are about thirty-two inches in diameter. Two of these machines were exhibited, ridden by two graceful young ladies, who drove the cranks with both feet, in the same manner as men. They were dressed in a very becoming costume of dark woolen stuff, their skirts being divided at the bottom, and buttoning around the ankles, not unlike the trowsers of a Zouave, and exposing the neatest foot and *Chaussure* that can be imagined. Their gloves were of the same hue as their dress; one wore ribbons and facings of blue and the other of pink.

They rode with much skill and elegance as well as strength, and, with the assistance of Mr. Pickering and Mr. Brady, went through with a number of intricate and pleasing figures, in the presence of a large number of ladies and gentlemen, who loudly testified their applause. We have no doubt that this velocipede will come into extensive use among the ladies, who will find it an attractive means of healthful exercise, in halls set apart for the purpose.

A Utica correspondent writes us as follows: "Your velocipedic readers may like to have a ready means of determining their speed. The following method is nearly accurate, not varying from the fact more than two feet two inches in a mile. Divide 336, by the diameter in inches of the driving wheel; the quotient will be the number of revolutions per minute, which will produce a speed of one mile an hour. 336·135245, will give the result more exactly, but 336 is near enough for all practical purposes.

"Thus with a 4-foot wheel, 7 revolutions a minute give a speed of a mile an hour, 70, of ten miles an hour."

A correspondent of Toronto who subscribes himself "Unfortunate" makes some good suggestions He says:

"I have been watching the velocipede notes in your valuable Journal for some time past in the hope of learning that one of these marvelous machines had been invented especially adapted for the infirm and crippled portion of the community, but up to the present time of writing I have discovered nothing suitable. The late war has caused the loss of many a leg and in this age of machinery, the number of maimed persons is increasing. To lighten the lot of this unfortunate class is surely worthy of some thought; many of your ingenious contributors will I am sure, be glad to turn their attention to it, from motives of humanity and not profit. The loss of a leg, replaced by never so shapely an artificial one, incapacitates a man from almost every employment by reason of the difficulty he experiences in moving about. I am aware that there is at present a machine with a crank in the axle used by persons whose pedal extremities have become paralyzed but the effort required for propulsion is very great. I would suggest the construction of a velocipede that could be worked jointly by one foot and one hand or by the hands alone, or the motion might be taken from the shoulder perpendicularly with advantage, the one foot being used for steering. I am not a mechanician and merely throw this out as a hint to any good Samaritan who will take the matter up.

We give herewith an engraving of a two-seated bicycle which will interest our readers. This machine, designed by H. P. Butler, of Cambridge, Mass., seems entirely practicable. The engraving shows the parts so clearly that a detailed description is unnecessary. We may add, however, that the back

seat is intended to be used either as a side saddle for ladies, as shown in the engraving, or an ordinary saddle for gentlemen, both riders assisting in the propulsion. The inventor also has in view the placing of two side saddles over the rear wheel, to accommodate two ladies, who could then assist in propelling the machine.

Several leading firms in Newark, N. J., heretofore engaged exclusively in the manufacture of elegant carriages, have begun the manufacture of velocipedes for New York firms, while other establishments are rapidly turning off the wheels and iron works to supply the trade in other cities.

An inventor in New Albany, Ind., is making a new locomotive apparatus. It consists of a pair of skates on the bicycle order, the wheels being five inches in diameter and three-fourths of an inch wide, fastened to wood, which are to be strapped to the feet. The wheels are made large and broad, in order that the wearer may have no difficulty in passing over rough pavements at a rapid rate.

We understand that the prices are gradually coming down at the halls of instruction, the result of the competition that has arisen. As a counter influence, however, upon the rates demanded, the increasing number of those desiring instruction still enables the proprietors of these places to make large profits

Remarkable Millstone Explosion.

A correspondent from Leesburg, Mississippi, writes us an account of a remarkable explosion which occurred, March 2d, in an adjoining county under somewhat mysterious circumstances.

The millstone was a patent French burr of about 30 inches diameter, considerably worn, having been run for years. The burrs were encased in cast-iron beds and were driven by steam power. The mill had not been in operation more than ten minutes before the fatal accident occurred. The miller was regulating the mill, and finding that it was running too slow, he ordered the engineer to give it more speed; but before the order was complied with, the explosion took place with terrible effect, scattering the fragments of stone in every direction, killing the miller instantly, and wounding five other hands employed about the mill. The report of the explosion was heard at a distance of four miles.

We are requested to give our opinion of the cause of this explosion, which can be accounted for in no other way than either the accidental or malicious introduction of some explosive compound into the grain, which was exploded by the friction of the stones. The loud explosion points clearly to this conclusion, and as it is by no means probable that anything of the kind could have been the result of accident, an effort ought to be made to discover whether or not it was the work of some malicious fiend, in human shape, instigated by motives of revenge, or otherwise.

OBITUARY—LUTHER ATWOOD.

Among the scientific men of this country, and in connection with some of our most important discoveries in the department of natural wealth, the name which heads this article deserves to be perpetuated. The history of the manufacture of coal oils could hardly be written without frequent reference to the labors and inventions of Luther Atwood; and, indeed, in the manipulation of the hydro-carbons, there is no one who has performed such signal service, both to science and the arts, as he

Luther Atwood was born at Bristol, N. H., November 7, 1826, and remained in his native town until 1849. He received only such education as could be gained at the town school and a neighboring academy; but, having evident predilections for the acquirement of knowledge, commenced the study of medicine with Dr. Sawyer, of Bristol, when quite a lad. He, however, soon found that the bent of his desires and capacity was in another direction, and accordingly abandoned medicine for chemistry, to which science he devoted his entire life. He was a natural chemist; and component parts, under his manipulation, seemed to assume their proper correlation, almost by magic. His studies were now prosecuted under great difficulties, and in the face of many obstacles, and in 1849 he removed to Boston to avail himself of the advantages of a wider sphere.

There Mr. Atwood entered upon the manufacture of medicinal chemicals for Messrs. Philbrick & Trafton. The following year he commenced the series of original labors to which his life was to be devoted, by instituting some investigations into the nature of the products of coal tar, as well as the manufacture of benzole and naphtha therefrom. In 1853 Mr. Atwood obtained his first patent, being for a "process of preparing para-naphthaline oil from the distillate of coal tar, collecting the products at certain fixed temperatures;" the product being designated as "coup oil." At about the same time he obtained a patent for the use of manganate of potash for purifying alcohol, the alcohol purified by this process, being known in trade as "Atwood alcohol."

During the following year Mr. Atwood, associated with his brother, William Atwood, now superintendent of the Portland Kerosene Oil Company, and president of the Atwood Lead Company, of the same city, commenced experiments in the manufacture of oil from coal and bituminous products, and these investigations he pursued until his failing health incapacitated him from all mental labor. During the ten years between 1853 and 1864, Mr. Atwood took out no less than thirteen patents, nearly all of which related to distillation, and the manipulation of hydro-carbons. One of his most important discoveries was the process known as "cracking," by which a heavy oil is changed to a lighter grade. Another was the process of distilling coal in a tower, known as the "meerschaum" or "pipe" process. Indeed, the high standard of purity which has been reached by the oils, known under the trade mark of "kerosene," is owing in a very large degree to the original, scientific far-sightedness, and laborious efforts of Luther Atwood. Mr. Atwood was at one time superintendent of the New York Kerosene Oil Company's works at Hunter's Point, and within a few years of his death occupied a similar position in the works at Maysville, Ky. He died of consumption, at Cape Elizabeth, Me., November 5, 1868, after a lingering illness.

A Successful Inventor.—Nothing in the line of our professional duties gives us more pleasure than to hear of the success of inventors, and under this head publish the following from John W Case, of Worthington, Ohio:

From the patent you took out for me one year ago this March, I have realized about $10,000, and all of this I owe to the Scientific American. I have always been of an inventive turn of mind, and have originated a great many things, but have always neglected to patent them, owing to the cost and the necessary neglect of my other business, but on subscribing for your paper, I was induced by reading it to apply for a patent. Therefore I am truly indebted to the Scientific American for my success during the past year.

A Prolific Inventor from Texas.—Mr. F. C. Richers, of Gilmer, Upsher county, Texas, arrived at the office of this paper a few days ago, with no less than sixty-two new inventions, on which he is making applications for letters patent. His subjects are quite varied, comprising improvements in nearly every department of mechanical and chemical science, from a steam engine and coffee mill to a process for roofing material, and mode of extracting saccharine juices from cane. All of the inventions exhibit a large degree of ingenuity, and many of them possess very much merit. Mr. Richers will remain in this city several weeks, and parties desirous of engaging in the manufacture or sale of good patented articles, can address him at Box 773 P. O., N. Y.