of the most skillful players in the country test it. The room itself was hard, angular, and devoid of grace; but just about the instrument, as the player touched the keys, there was an atmosphere full of tranquility and of peace. It was easy to understand why the spirit of devotion in a church is aided by music, or the education of children rendered more pleasant where the melodeon or piano is introduced. The slow and solemn notes of praise rose in rich harmony from the brazen reeds as they trembled soft and low with the air current flowing through them. Sonorous, full-bodied, flute-like tones, that emulated the wind among the pines in June, or the laugh of a trout brook rippling over its graveled course.

Ancient mythology speaks of the statue of Memnon, which, as the first rays of the morning sun fell upon it, gave forth sweet music, so that the people in that age believed it to be inspired, and forever wondered at the cause of the sounds. There may have been a reed inserted in the mouth of this statute by some cunning craftsman of the period, having a valve which opened by expansion or the heat of the sun's rays; this once accomplished, the morning air breathing through pipes would cause the reed or reeds to give forth airs. Be this as it may (mere speculation on our part) the reeds that Messrs. Carhart, Needham & Co. make, discourse music enough, if the skill of the performer is equal to the quality of the instrument. And in both hearing and seeing the wonders of this factory we consider that our afternoon was well spent.

Correspondence

Mariotte Law---Expansion.

Messrs. Editors:—The well-known law of pneumatics is simply this:—If you take a vessel holding one cubic foot of air, and with sufficient pressure you diminish the volume of air to one-half a cubic foot, you have two quantities of air in one space; or, as it is usually expressed, you have a pressure of two atmospheres. If you take the mercury column in a barometer as the measure of pressure, the atmosphere supports a column 30 inches high, and two atmospheres occupying one space will support a column of mercury 60 inches high—and so on for three, four, or more quantities. Hence the axiom, "double the pressure is half the volume;" but should the air be quickly compressed there would be an increase of temperature from the compression of the heat (or molecular action) contained in one volume of air, and, consequently, there would be a little more than one-half the volume for double the pressure until the temperature was the same as the original volume that was compressed. Now take this quantity of compressed air and suddenly remove the pressure, and it would not quite be double the volume, but after the temperature had been acquired of the original quantity, it would be exactly double the volume.

The foregoing statement is the complete definition of the much-talked of "Mariotte law." The only plausible way that this law can be applied to steam is as follows:—One cubic inch of water will make one cubic foot of steam at the pressure of one atmosphere, or it will make one-half a cubic foot of steam at the pressure of two atmospheres—and so on; by doubling the pressure it will make half the volume nearly.

The actual proportions of volume and pressure, according to the tables published by Pambour, Lardner, Brande, and others are one cubic inch of water at—

1	atmosphere	pressure	makes	1,669	cubic	inches	steam
2	"	"	"	881	"	"	"
4	"	"	"	467	"	"	"
8	"	"	"	249	"	"	"

whereas, if the Mariotte law perfectly applied to steam, the volumes would be for 1 cubic inch of water at—

1	atmosphere	1,669	cubic	inches	steam
2	"	834·5	"	"	"
4	"	417·25	"	"	"
8	"	208·125	"	"	"

So that 417 cubic inches steam at four atmospheres' pressure does not have water enough to make 1,669 cubic inches of steam at 1 atmosphere by 12½ per cent. nor 208 cubic inches steam at 8 atmospheres by nearly 25 per cent.

That 467 cubic inches steam, at 4 atmospheres' pressure would, on gradually removing the pressure to one atmosphere, enlarge itself to 1,669 cubic inches, had not, as far as it was possible to learn, been determined experimentally up to the year 1860. During that year it was tried in an apparatus suggested by myself, the tables of which I may furnish in a future paper.

The application of the Mariotte law to the use of steam expansively is stated in the "Treatise on the Steam Engine by the Artisan Club," edited by John Bourne, London, 1849, as follows:—"If the steam valve be closed when the piston has descended through one-fourth of its stroke, the steam within the cylinder will exert one-fourth of the initial pressure at the end of the stroke, ... and, as a summary of the ascertained effects of expansion will induce a more careful examination of the principle at a future stage of our progress, we may here set down some of the most notorious. Let the steam be stopped at ½ the stroke its performance is multiplied—

	1·7 times
at 1-3 stroke	2·1 "
" 1-4 "	2·4 "
" 1-5 "	2·6 "
" 1-6 "	2·8 "
" 1-7 "	3·0 "

To reduce the statement of Bourne to a correct comparison with Pambour, it stands thus:—1 cubic inch of water makes 281 inches steam at the pressure of 7 atmospheres; now this expanded 7 times ought to make 281×7=1,967 cubic inches steam at one atmosphere; whereas one cubic inch of water at 1 atmosphere pressure makes only 1,669 cubic inches steam—a deficiency of near 20 per cent. I remark here, that it is not known that Bourne ever tried one single experiment, or knew of one that verified these "notorious facts;" they are mere theoretical hypotheses.

Let us now look at Regnault's statements of the motive power of elastic vapors. He knew all about the Mariotte law, but he says (London and Edinburgh *Philosophical Magazine*, October, 1854): "According to the views which I have adopted regarding the mode of generation of the power in machines moved by elastic fluids, the motive power produced by the expansion of any elastic fluid is always in proportion to the loss of heat undergone by this fluid in the part of the machine where the power is produced. During the last few years several distinguished geometricians have endeavored to deduce this principle from abstract considerations founded upon hypotheses of greater or less probability. For my own part I have long labored to bring together the experimental data by means of which the theoretical motive power, produced by a given elastic fluid, which undergoes a certain change of volume, as well as the quantity of heat which becomes latent in consequence of this change, might be calculated *à priori*. Unfortunately these data are very numerous, and most of them can only be determined by extremely delicate and difficult experiments."

Herein is the difference between air and steam, if a cubic foot of air at two atmospheres' pressure be contained in a tight vessel for a thousand years, it will give out its elastic force on removing the pressure, while a cubic foot of steam must give out its force in a few seconds, or else its force is entirely lost. Also the relative volumes of air at different pressures, of which the Mariotte law is the exponent, depend on the same temperature; whereas the different pressures of steam depend wholly on different temperatures; for instance steam at the pressure of—

1	atmosphere	is	212° Fah.
2	"	"	250° "
3	"	"	274° "

Now the slightest increase of pressure at these temperatures, or slightest decrease of temperature at these pressures, will turn the whole of the steam to water; while an increase of pressure on the air will only diminish its volume to the amount due to that pressure.

The modern received opinion promulgated by Joule, that heat is converted into force in the steam engine, is in accordance with the statement made by Regnault, that the amount of power developed by the expansion of any elastic fluid is always in proportion to the loss of heat undergone by this fluid in the part of the machine where the power is produced. The quantity of heat, or, as it is expressed, the "total heat," as ascertained by M. Regnault from actual experiment, in a cubic inch of water in steam at—

1	atmosphere	pressure	is	1,178° Fah
2	"	"		1,190° "
4	"	"		1,203° "
8	"	"		1,218° "

If the force is all a heat-force, and it is properly applied in moving the piston of a steam engine, and as it is not possible to increase this heat by expanding the steam, it would seem as if some of the modern theorists are endeavoring to make out that the steam can work three or four times over, or, as some of the most enthusiastic say, "expand a thousand times." The experiments of Regnault, to determine the theoretical motive power of expansion, being "extremely delicate and difficult" are not applicable to so rude a machine as a steam engine, they of course furnish no rule to calculate the motive power produced by expansion in a steam engine.

We are finally left to recent experiments on the steam engine itself, and these, so far as they have been fairly tried, show that the "notorious" multiplying of its performance by expansion is founded upon "hypotheses" of no great probability.

W. Rowell.

New York, June 22, 1864.

THE LAST MEETING OF THE POLYTECHNIC.

The Polytechnic Association of the American Institute held its last meeting for this season, on Thursday evening, June 16, the President, D. S. Tillman, Esq., in the chair.

THE FLOW OF WATER THROUGH PIPES.

Mr. Root described an experiment which he had tried to ascertain the effect produced on the flow of water through pipes by dividing the pipes with perforated diaphragms. In a three-inch tin pipe he inserted ten diaphragms at equal distances with a hole three-fourths of an inch in diameter through the center of each diaphragm. The pipe was perforated on the upper side by a minute hole in each space between the diaphragms, and water was admitted under a head. The jet from the minute opening nearest the end of the pipe where the water was admitted rose to the hight of ten inches, the next jet to the hight of nine inches, the next to the hight of eight, the next to seven, the next to six, and so on to the last, where the water rose one inch, and it flowed out of the three-quarter opening at the end of the pipe without any projectile force, falling perpendicularly.

Mr. Dixon explained that the obstruction in the flow of the water was caused by eddies formed between the diaphragms. He described an experiment tried in Jersey City of making enlargements in a pipe, and it was found that four or five enlargements diminished the flow of the water sixty per cent.

PAPER FROM CORN HUSKS.

The regular subject for the evening, "The Utilization of Waste Products," being called—

Mr. Watson presented some samples of paper and cloth made of corn husks by the process of Moritz Diamant, as improved by Dr. J. C. Schaeffer, and Dr. Auer von Weisbach, all of Austria. As this process will be fully described in the Scientific American, we occupy no further space with it here. In the discussion which followed—

THE WAY ITALIAN PEASANTS EAT,

was described by Professor Joy. He said that in riding by the fields in the morning you would see a large kettle of Indian meal and water boiling over a fire in the field. When the mush is cooked it is poured out upon a large flat stone, when the men, women and children gather about, and take it up in their hands and eat it. At noon you will see the same process, and at night the same. They eat little else than mush. At first there was a prejudice against the American corn, as they call it, but now it is almost the only article of food among them.

The time having arrived for the usual summer vacation, the Association adjourned to the second Thursday in September.

Miniature Engine.

The Philadelphia *Ledger* thus describes a small steam engine exhibited at the Sanitary Fair, in that city:—"The old "Curiosity Shop" has had an addition to its wares in the shape of a miniature steam

engine. It stands upon a space less than an inch in diameter. It is a high-pressure engine constructed principally of gold and silver, and is composed of over one hundred and fifty pieces. The diameter of the cylinder is one-sixteenth of an inch, length of stroke three-sixteenths of an inch, diameter of fly-wheel five-eighths of an inch. The cylinder, cross-head and beam are made of gold, the boiler of silver, and in five separate sheets. The screws which hold the several parts together are so small that the threads on them can scarcely be seen with the naked eye. The engine, boiler, stack, and plate on which the whole rests, weighs less than one-half ounce. It is believed to be the smallest working steam engine in the world, and will run about three thousand revolutions per minute.

RECENT AMERICAN PATENTS.

The following are some of the most important improvements for which Letters Patent were issued from the United States Patent Office last week; the claims may be found in the official list:—

Stamping Mill.—This invention relates, first, to a certain means employed for taking the powder or dust from the mortar chamber and conveying it to the deposit chamber; said means consisting of a blast generated by a fan or an equivalent device arranged in connection with a blast spout in such a manner that the dust will be taken from the mortar chamber and conveyed to the deposit chamber, and the same blast made to act continuously so as to avoid the admission of fresh external air and the consequent mixing of dirt and other light impurities held in suspension in the external air with the quartz powder or dust, The invention relates, second, to the employment of a valve arranged in connection with the mortar chamber and blast spout in such a manner that, by regulating or adjusting the valve, the quartz may be reduced to a greater or less degree of fineness. The invention relates, third, to an improved mode of securing the dies in the bed of the mortar, whereby said dies are firmly held in position and very readily adjusted in the mortar bed and detached therefrom. The invention relates, fourth, to an improvement in the construction of the frame of the mortar, whereby the frame is rendered extremely durable and well calculated to resist the jars and concussions caused by the stampers in the prosecution of their work. Zenas Wheeler, of San Francisco, Cal., is the inventor of this improvement.

Machine for cutting Lead-pencils.—The final operation in the manufacture of lead-pencils is that of cutting off the ends of the same after they are otherwise completely finished. This operation, simple as it appears to be, requires great care, because it must be done after the pencils are already varnished, and without proper precaution the varnish is liable to become tarnished, and, furthermore, in cutting the ends the edges of the wood and the ends of the lead are liable to splinter, and thereby the market value of the pencils is considerably deteriorated. For these reasons this operation requires particular care, and heretofore it has been accomplished entirely by hand labor at great expense and loss of time. The object of this invention is a machine by which the operation of cutting off the ends of lead-pencils is accomplished automatically, requiring no hand labor except that of feeding the pencils to the machine, which can be performed by a child, and leaving both the ends of the wood and those of the lead perfectly smooth. Albin Warth, of Stapleton, N. Y., is the inventor of this machine, and he has assigned his whole right to Aerhard Faber, of 133 William street, New York.

Harvester.—This invention relates, first, to a novel and improved cutting device, the same consisting of two reciprocating cutters placed one above the other and working in opposite directions and through slotted fingers, each provided with a tongue which are between the two cutters, and all arranged in such a manner as to admit of a short stroke and rapid movement of the cutters with a very moderate application of expenditure of power, thereby insuring the work being done in a perfect manner and without the liability of the cutting device becoming choked or clogged. The invention relates, second, to an improved means employed for operating or driving the two cutters, which means consist of a rack at the inner end of each cutter and a vibrating toothed segment placed between the two racks of the cutters and gearing into the former; the segment being operated by means of an arm connected by a ball-and-socket joint with a pitman connected with the driving shaft; all being arranged in such a manner as to cause the necessary motion to be transmitted from the driving shaft to the cutters in a very direct manner and with but little friction. The invention relates, third, to an improved arrangement and application of a supporting wheel for the cutter-bar, said wheel being attached to an arm which projects at right angles from the front side of a socket to which the inner end of the cutter-bar is attached, whereby the cutters are made to conform to the inequalities of the ground over which they may pass and be supported or retained at all times in a proper working position. The invention relates, fourth, to a novel and improved means for connecting and disconnecting the traction wheels of the machine with the sickle-driving mechanism, whereby the connection and dieconnection may be made with the greatest facility and without subjecting any of the gears and working parts of the machine to the wear and tear hitherto consequent on such manipulation. The invention consists, fifth, in an improved mode of hanging the axle of the traction wheels of the machine as well as the driving shaft thereof, whereby all warping or springing of the frame of the machine is compensated for, and the working parts allowed to operate equally as well if the frame should warp or spring (a contingency of not unfrequent occurrence) as if it retained its proper shape. The invention consists, sixth, in an improved mode of bracing the cutter-bar so as to diminish side draught, and at the same time retain the cutter-bar in proper position. J. W. Prentiss and E. M. Birdsall, of Penn Yan, N. Y., are the inventors of this harvester.

Tanning Apparatus.—This invention consists in a platform revolving on the top of a tank or vat containing the tanning liquor, and provided with an open box or framework extending from its lower surface down into said tank or vat, in combination with frames on which the hides or skins are stretched, in such a manner that by placing said frame with the hides or skins in the open box and imparting to the platform a rotary motion, the tanning liquor is brought in intimate contact with all parts of the hides or skins, and the operation of tanning is considerably facilitated. It consists, also, in the employment of movable baskets in combination with the frames containing the hides or skins and with the revolving platform, open box and tank or vat, in such a manner that the introduction and removal of the frames containing the hides or skins into and from the tanning vat, can be effected with comparatively little labor and loss of time; it consists, finally, in the application of adjustable frames provided with movable bars and arranged in such a manner that each frame is capable of holding two sides of hides or two skins properly stretched, and at such a distance, one from the other, that the tanning liquor has free access to all their parts, and when the tanning is completed, the leather requires no further labor to be straightened or brought in the proper form. Henry Liebermann, of Paducah, Ky., is the inventor of this improvement.

Blast Furnace.—This invention consists, first, in a blast furnace, the hearth of which, when bisected by a horizontal plane, presents a narrow, long rectangle, the two short sides of which are to be used as working sides, and its two long sides for two or more rows of tuyeres, and whose long and short sides increase gradually from the hearth up to a point near the throat, in such a manner that a perfectly steady and gradual descent of the charges from the throat to the hearth is effected, and the ore, fuel and fluxes (as charged in horizontal layers), preserve the same relative position toward each other while descending from the throat to the hearth of the furnace; and, furthermore, the reduction of the ore can be effected in less time and with less fuel than it can in a furnace of the ordinary construction; it consists, further, in the employment, in combination with a long rectangular hearth, of a double row of tuyeres, each tuyere being placed so as to be between two of the opposite sides, in such a manner that a smelting and oxidizing zone of uniform temperature and little vertical depth is obtained throughout the entire length of the furnace, and the process of reducing the ore is effected with less fuel and in less time than in furnaces having the tuyeres arranged in the ordinary manner. It consists, further, in the arrangement of one or more fire-places and fire-flues under the bottom and through the walls of the furnace, in such a manner that a uniform and quick heating of the external walls of the furnace during the erection of the same, and particularly previous to lighting the charge in its interior, can be effected, and thereby the successful working of the furnace is rendered practicable, and its durability considerably increased. It consists, finally, in the employment of slotted air-chambers in place of or in combination with the tuyeres, in such a manner that the cost of mechanism used for introducing the blast into the furnace is considerably reduced without diminishing or impairing the effect. Woldemar Raschette, of St. Petersburg, Russia, is the inventor of this furnace, and he has assigned it in full to Alex. Trippel, of No. 18 Exchange Place, New York, who is to be addressed for further information.

HEAT PRODUCED BY DIFFERENT KINDS OF FUEL.

Several men of science have undertaken series of experiments to ascertan the exact quantity of heat developed in burning a given quantity of various substances. The most satisfactory of these experiments are those of Andrews, and those of Favre Silberman. Andrews inclosed the substance to be burned, together with just the quantity of oxygen required to burn it, in a close copper vessel with thin walls, and immersed this vessel in water—the water being carefuly weighed. The substance was then set on fire by an electric current, and the temperature of the water was measured before and after the burning by a thermometer so delicate that it indicated 1-500th of a degree. The apparatus of Favre & Silberman was essentially the same, though they adopted some extra precautions to guard against the influence of the external atmosphere. The table below gives the results obtained by these two experimenters. It will be observed that the rise in the temperature of the water is given in degrees of the centigrade thermometer, which may be reduced to Fahrenheit degrees by multiplying the amount by 9 and dividing by 5:—

Substances burned	Heat Units.—Lbs. of water raised 1° C., by 1 lb. of each compound	Lbs. of water raised 1° C., by combination of 1 lb. of oxygen	Compound form'd	Observer.
Hydrogen	34462	4307	HO	Favre & Silbermann.
Hydrogen	33808	4226	HO	Andrews.
Carbon	8080	3030	CO_2	Favre & Silbermann.
Carbon	7900	2962	CO_2	Andrews.
Sulphur	2220	2220	SO_2	Favre & Silbermann.
Sulphur	2307	2307	SO_2	Andrews.
Phosphorus	5747	4509	PO_5	Andrews.
Zinc	1301	5285	ZnO	Andrews.
Iron	1576	4134	Fe_3O_4	Andrews.
Tin	1144	4230	SnO_2	Andrews.
Copper	602	2394	CuO	Andrews.
Carbonic oxide.	2431	4258	CO_2	Andrews.
Carbonic oxide.	2403	4205	CO_2	Favre & Silbermann.
Protoxide of tin	521	4349	SnO_2	Andrews.
Suboxide of copper	256	2288	CuO	Andrews.
Marsh gas	13063	3266		Favre & Silbermann.
Marsh gas	13108	3277		Andrews.
Olefiant gas	11942	3483		Andrews.
Olefiant gas	11858	3458		Favre & Silbermann.
Alcohol	6850	3282		Andrews.
Alcohol	7183	3442		Favre & Silbermann.
Ether	9027	3480		Favre & Silbermann.
Oil of turpentine	10852	3294		Favre & Silbermann.
Bisulphide of carbon	3401	2692		Favre & Silbermann.

SPECIAL NOTICES.

TIMOTHY ROSE, of Cortlandville, N. Y., has petitioned for the extension of a patent granted to him on Sept. 24, 1850, for an improvement in water wheels.

It is ordered that the said petition be heard at the Patent Office, Washington, on Monday, Sept. 5, 1864.

GEORGE K. SNOW, of Watertown, Mass., has petitioned for the extension of a patent granted to him on Oct. 15, 1850, for an improvement in machines for folding paper.

It is ordered that the said petition be heard at the Patent Office, Washington, on Monday, Sept. 26, 1864.

All persons interested are required to appear and show cause why said petitions should not be granted. Persons opposing the extensions are required to file their testimony in writing, at least twenty days before the final hearing.