Next is the novel arrangement of the deep-box motion that is creating considerable interest among manufacturers. This motion commands any shuttle or color out of four, a point that has been long sought for, but has not heretofore been accomplished with success. The shuttle boxes, G, are operated by an inclined-plane-shaped cam, sliding at H, on which the shuttle-box lever, I, rests. The cam, H, is connected to a cross-arm, at J, which is vibrated by hooked arms, connected at K L M, which are attached at different distances from the center or pivot, and are operated by a vibrating lever—not shown—and governed by the pattern chain, N. If the bracket arm connected at K, be operated, it will move single boxes; but if the hooked arm, connected at L, be operated, it will skip from the first box to the third; and if the hooked arm, connected at M, be operated, it will skip from the first to the fourth box, or what is called fall deep or four boxes. The boxes are carried in the same way by similarly hooked arms attached at the lower end of the cross-arm. The shuttle boxes on the opposite end of the loom are operated by a shaft passing through the loom and connected to the cross-arm.

This motion is secured by Letters Patent, dated January 9, 1866. The rest of the movements of the loom are similar to those on an ordinary loom, but are of improved patterns. These looms are built for broad or narrow goods. For further information address Duckworth & Sons, Mount Carmel, Conn.

TWENTY-FIVE YEARS---A RETROSPECT.

In looking back through the dim vista of the past, and noting the world's advancement, we can detect no era so fruitful in results as that embraced within the period of the last twenty-five years. The great discoveries in science and the arts, the numerous useful inventions, the wonderful expansion of commerce, the finding of inexhaustible mines of precious metals, and the rapid growth in wealth and population, all tend to make the last quarter of a century unparalleled in the world's history. The whole civilized world has felt the impetus of growth and expansion, and we are happy to believe that our own favored land, untrammeled by the traditions and dead forms of the Old World, has not only distanced all other nations in the race of progress, but has, by its example of energy and enterprise, infused new life into effete and decaying nationalities.

Less than twenty-five years ago the first successful experiment with electro-telegraphy was made, though it had been the subject of investigation for some years previous. A wire was stretched from Washington to Baltimore in 1844, and soon after extended to New York, and very rapidly throughout the country and the world, till, at length, the earth is girdled, and time and space are literally annihilated. The author of this wonderful discovery still lives, in the enjoyment of a green old age, rich in honors and the substantial rewards of his genius.

Twenty-five years ago ocean steam navigation was a new thing, and its practicability had just been demonstrated. True, years before a little steamer, known as the *Savannah*, had crossed the Atlantic, but her daring feat had long been forgotten, never, perhaps, to be recalled, had not the Western World been waked up one morning by the astonishing news that the *Sirius*, a small English-built steamer, had arrived from London. The *Sirius* was soon followed by the *Great Western*—and thenceforth, ocean steam navigation became a fixed fact. Before, there had been no steamships, only steamboats—useful craft on lakes and rivers, and other inland waters—but the idea that steam could be made available for navigating the ocean had long been scouted in high places. Twenty-five years ago there were no steamships of war, but, ocean steam navigation having been demonstrated as practicable, the nations ceased to build sailing vessels for war purposes, and rapidly substituted steamers.

Twenty-five years ago most of the inventions of agricultural machinery, which now so lighten the labors of the farmer, while they increase his gains, were unknown. Who ever heard of the reaping machine till it made a sensation at the London Exposition in 1850? It must have had a brief existence before that, for it was sent, a perfected engine, from Chicago to London; but how few had ever heard of it; and now, who would think of working even a twenty-acre farm without its aid?

Twenty-five years ago there were railroads with locomotive engines, but they date only a few years anterior. The writer of this well remembers reading the account of Mr. Stephenson's first sucess in England, and he has not forgotten when the first short line was put in operation in this country. Twenty-five years ago railroad connection between the Hudson River and Lake Erie was scarcely completed, the Erie and the Hudson River lines were hardly thought of, and in the Great West, where the railroad may be said to have achieved its greatest triumphs, it had no existence at all. If the last twenty-five years did not witness the origin of the railroad, it has seen its wonderful expansion, until this country and Western Europe have been converted into gigantic gridirons by the crossing and interlacing of iron bands, and all other modes of land travel have become nearly obsolete, and a five-mile journey in an old-fashioned stage coach is more to be dreaded than a hundred miles in a rail car.

Twenty-five years ago California was unexplored and uninhabited, save by Indians and a few Mexican adventurers and outlaws, and its wealth of precious ores was a well-kept secret; and the other gold-producing States and Territories—Nevada, Colorado, Arizona, Montana, and Idaho—now so familiar to every ear, had no existence, save as they formed parts of the great unexplored Far West of the Rocky Mountain region.

Twenty-five years ago a hundred thousand dollars was regarded as a magnificent fortune, to which, though many aspired, few attained; and the number in the metropolis of the Western World whose estates reached this figure could be counted on one's fingers. There are more men in New York to-day whose annual incomes reach one hundred thousand dollars, than there were twenty five years ago of those whose entire possessions amounted to as much. Twenty-five years ago there were, possibly, half-a-dozen millionaires in the whole country. To-day they may be counted by hundreds.

Twenty-five years ago the population of the city of New York was little over three hundred thousand. To-day it is a round million, and the overflow into the adjacent country may be reckoned at half a million more.

Twenty-five years ago the population of the Empire State was less than two and a-half millions. To-day it cannot be much less than five millions.

Twenty-five years ago the population of the entire country was only seventeen millions. To-day it is nearly forty millions.

Twenty-five years ago there were twenty-eight States in the Union. To-day there are thirty-six, with half-a-dozen more to be added within a few years.

The world moves; but such wonderful strides as it has made within the last twenty-five years former generations never saw. Every department of life has felt and seen its accelerated motion; and it is almost enough to make one feel giddy to look back over the last quarter of a century and witness the rapid succession of discoveries in art and science, and the wonderful increase in wealth and population.

And what is the secret? It is the wonderfully-developed spirit of invention which has infused energy and enterprise into the world, and encouraged men to undertake the accomplishment of things which, without the inventor's aid, would have been wild and chimerical.

In 1840, the United States Patent Office issued lees than five hundred patents; in 1865 it issued six thousand. This is the key to the whole secret. Of the fifty thousand patents issued during the last twenty-five years in this country, some doubtless were worthless; others were of little account; while a very large number were of value beyond the power of man to compute. Their importance to commerce, to manufactures, to mining, and to agriculture, cannot be estimated. Who will undertake to compute the value of the sewing machine, to cite a single example; or how long would the gold fields of California have continued to give a profit to the miner, if the inventor had not come to his aid?

To the inventor and the mechanic, then, rather than to the statesman and the politician, is the world indebted for the wonderful growth of the last twenty-five years. They are the pioneers in the great army of progress, the *avant couriers* of every great social and moral revolution. ANTIQUARY.

Williams's Theory of the Diffusion of Steam.

[For the Scientific American.]

Charles Wye Williams, whose death was noticed recently, was for nearly forty years superintending agent of the Dublin and Liverpool Steam Packet Company. His practical experience in all the details incident to steam navigation, combined with a good share of scientific knowledge, render his opinions worthy of more than ordinary weight. The subjects to which his attention were more particularly directed, were the combustion of coal, heat, and steam.

Upon the former subject he published a work many years ago, which has become a text-book wherever it has been introduced. His views and opinions—the result of his own experience—received the sanction of such men as Dr. Ure, Prof. Brande, Robert Kane, and others of scarcely less note in the scientific world. A vast saving in fuel was the immediate result of adopting his system; and most of the patented devices of the present time, for mingling a suitable quantity of oxygen with the products of combustion, are but modifications of his discoveries and experiments. He was essentially a practical man, and where possible, he never failed of illustrating his ideas by diagrams and presenting them in visible form to the eye. At a much later day he published a work upon heat and steam, but his views upon these subjects, although the result of his own experience and observation, after a long and patient investigation, seem to have received but little attention, for the reason, probably, that they were opposed to the received opinions of the day. They, at least, brought him in collision with those whose previous writings had been considered as law upon the subject. The distinctive feature of the work is his doctrine of the diffusion of steam through the mass of the water. He contends that when a steam boiler is under pressure there is just as much steam contained in a cubic inch of the water space as there is in a cubic inch of the steam space. The water is, in fact, so far as the steam is concerned, empty space, or a vacuum into which the vapor enters. In this view he was supported by the previously-written opinion of Dr. Dalton, Sir John Herschel, and others, in their remarks on the diffusion of gases and vapors through liquids. He carried out to its legitimate result the now generally received "atomic theory," illustrating his position by diagrams of his experiments, and seeming, at least, to settle the point in his own favor.

In relation to the explosion of steam boilers, he repudiates the idea that heat can be "stored up" in the water, or that the water can flash into steam when relieved of pressure, according to Colborn and Clark, Dr. Alban, and many others. But he contends that the globules of steam in the water, being confined in a medium over eight hundred times as dense as the steam alone, fly into the steam space instantly when the pressure is removed, and there expand in volume in proportion to the density of the two mediums, or over eight hundred times. If the boiler was already strained to near its bursting point, a disastrous result might well be anticipated. If his theory of the diffusion of steam through the water is correct, we may pretty safely assume that his theory of steam boiler explosions will account for some, at least, of those disasters.

There are other phenomena in connection with this subject of heat and steam which can scarcely be accounted for upon any other hypothesis than that of Mr. Williams. For instance. Why will the temperature of water, in a steam boiler, when heated to say 300 deg., fall to 212 deg., or the boiling point, as soon as the pressure is removed, no matter how suddenly? Water, compared with vapor, is a solid body, and any other solid body, as metal, for instance, would retain its high temperature for a long time. But the mercury, though plunged to the center of the mass of water, will, just as soon as the pressure is removed, drop to the boiling point.

H. N. T.

GOLD quartz is profitably mined in Australia when it yields only two dollars per tun.

Moire Antique.

This term is familiar to dealers in silks and those who wear them, but comparatively few know why it is applied to the class of goods bearing the name, or what is the process by which their peculiar character is given to them. As with most other articles in common use, the mass of persons are content to wear them without knowing any thing about how they are produced. The name is of French origin, as well as the goods, the word *moire* meaning simply watered, and is applied to the silks which have a wavy appearance imparted to them by being stamped when damp, and are consequently also called watered. The *antique* is added because of the resemblance which these goods bear to the heavy fabrics worn by our ancestrial grandams. Their peculiar appearance is owing to a slight inequality in the surface of the silk, and is produced either by an arrangement of the woof in the weaving, or by operating upon the surface after it is completed. A slight twisting of the threads composing the woof will give an undulating appearance to the silk by changing from place to place the angle of reflection of the light, but this effect is more commonly produced after the process of weaving has been completed. The discovery of this peculiar effect is said to have been accidental. A piece of silk rolled tight, when a little damp, was found to have this wavy appearance imparted to it, which suggested the idea of applying pressure, by which it is now effected. Machinery enables the manufacturer to give it any style of watering that he may choose. Two cylinders are prepared, one or both of which have slight prominences or depressions corresponding to the lines which he wishes the fabric to bear, and it is then passed between the cylinders under a heavy pressure, giving it a permanent stamp or figure. As the whole effect is produced by the reflection of the light, and as the unequal reflection depends upon the angle which different parts of the surface make with the rays, what is called the watered appearance is thus produced. The process is greatly facilitated by having the silk dampened before it receives the pressure, and still more by heating the cylinders, just as in the laundry the sprinkling of linen and the use of hot iron make the smoothing process more easy and the effect more complete and permanent. There is a great variety in the styles of watering. Some are simple and others more elaborate, the smaller patterns being more frequently known as watered and the larger more technically *moire antique*, but the process is the same, and the effect is owing to the same cause.

The preparation of this style of silks was formerly confined for the most part to France, where the art was kept secret for a long time, but it is now largely carried on in other countries, and to some extent in our own. It is a branch of the dyer's art to give to plain silks this watered appearance, and it is carried to such an extent that any style or pattern may be matched. Other fabrics beside silks are treated in the same way. What is known as morcen, a worsted material, has the same general appearance imparted to it by a similar process, but the effect is not as great, owing to the superior luster of silk, which gives it greater power of reflecting light, and thus makes the variety of the surface much greater. —*New York Journal of Commerce.*

The North Pole.

Two French gentlemen recently explored the Island of Spitzbergen in a manner never before done. They have measured the mountains, mapped the whole coast, examined the vegetable products, the geological composition, etc., of the island. They have found that the long day extended over several months, during which the sun never sets, becoming intensely hot after a month or two by the unceasing heat from the sun. In this period vegetation springs up in great luxuriance and abundance. The North Pole is only a matter of 600 miles from the island, and it is thought by the two explorers, as by many others, that the pole itself, and the sea which is supposed to surround it, could be reached from Spitzbergen without many great difficulties being encountered. A singular fact noticed by the explorers, in connection with this island, is the enormous quantities of floating timber which literally cover the waters of the bays and creeks. A careful examination of the character, condition, and kind of these floating logs would, no doubt, lead to a conclusion as to whence and how they came, and probably suggest new theories for the solution of geographical problems connected with the arctic seas.

Improvements Going on South.

The South is going into manufacturing. All over the country new cotton mills are being built and put in operation. Georgia has heretofore nearly monopolized this branch of industry at the South; but now Mississippi and Alabama as well as the Carolinas are waking up to the advantage of the manufacture of cotton goods. At Camden, Alabama, a wealthy company have taken the initiatory steps to erect a large building, and fill it with the most approved machinery. At Carrollton, Mississippi, a factory is now in operation, which, in a short time, will employ one hundred and eighty spindles. In Marengo county, Alabama, they are making arrangements to manufacture on a large scale. At Cuba station, Sumter county, a factory is shortly to be in operation. These are a few of the indications that the South will soon become filled with factories. The results of the war in throwing capital into an entirely new channel, the facilities of easy intercommunication, abundance of material to be used in manufacturing, contiguity to the said material, equability of temperature, and a thousand other facts, point out this region as the future home of the factory.

Sawing Lumber.

We give the points of a long communication from Mr. J. W. Churchill, for the whole of which we have not room. He corrects some errors, in this communication, which appeared in No. 20 of Vol. XIV. viz: that for "contracts" it should read "counteracts the range of the saw," and for "running out at the log" it should be "running out of the log."

The instructions in that article comprehended the sawing of all sorts of lumber, hard and soft. Our correspondent insists that, notwithstanding the objections urged against his rules, they are correct and useful; that end play of the mandrel will make good work, and is preferable to changing the range of the saw many times a day. He has run a saw according to his rules many years, sawing millions of feet of lumber, and always did good work without changing the range of the saw, but allowing it to adjust itself to the different kinds of lumber. He thinks Emerson's rule of nine hundred feet per minute for the edge of a circular saw, is too slow, and that 16,000 feet of lumber sawed in an hour is a large amount, especially when applied to oak or maple. He objects to swedging alone, and prefers setting the teeth, as he has not swedged his saw for three years. He has sawed 2,200 feet of half-inch boards in one hour and eight minutes, and 18,000 feet in one day, always allowing end play.

The Change of Leaves.

The cause of the beautiful tint which our foliage assumes during the autumnal months, has long been a subject of investigation, and many are the hypotheses that have been put forth in explanation.

M. Fremy, who has devoted considerable attention to this subject, stated, as the result of a series of experiments, that he had succeeded in resolving the green coloring matter of the leaf (*chlorophyll*) into two components, one, a yellowish substance, he called *phylloxanthine*, the other a blue matter for which he proposed the name *phyllocyanine*. By considering the blue as more evanescent, the different shades of yellow leaves might be produced.

These views were very generally accepted till recently Fremy has again appeared, essentially retracting his original views. He now gives, as the result of subsequent experiments, the new supposition that *chlorophyll* is a simple green coloring matter very unfixed, being influenced by vegetation, thus passing through varied modifications.

M. Carey Lea, of Philadelphia, has lately advanced a theory in which he considers light as the primary cause, producing photographic changes of color.

During the healthy state of the leaf, vitality counteracts this influence, but as the fall approaches the frost begins its work; the petioles dry up, the leaf gradually loses its firm hold upon the branch, then the action of light, no longer held in check by the vital principle, predominates, the leaf falls away, but in fading acquires those brilliant hues that will soon variegate our forests.

MISCELLANEOUS SUMMARY.

It is stated that the salt mines of Nevada throw in the shade all others known in the United States. One bed is reported to cover 52,930 acres, yielding 2,000,000 bushels annually of salt, ninety-five per cent fine. No bottom to this salt bed has ever been discovered. As deep as any work has gone, the bed is solid rock salt, and from a depth of thirty-five feet the salt water comes so rapidly as to prevent work without efficient working arrangements. The salt water wells up to the surface and overflows the large floor from which the fine white salt is continually gathered. This floor, several acres in area, has been so well leveled that the water flows evenly over it, and this, by exposure to the atmosphere, is rapidly evaporated, leaving a stratum of fine salt. This yield and production go on continually, and the more rapidly it is removed the better the quality of this salt.

M. G. Planté has communicated to the Academy of Science at Paris, a description of his new apparatus for the production of ozone, by using electrodes of lead, in place of platinum, when ozone is sought by the electrolysis of water. He asserts that he can secure a much larger proportion than is obtained in the usual way.

Artificial Diamonds.—A correspondent of the *Mechanics' Magazine* details a process he has employed for crystallizing carbonic acid by means of a continuous electric current. At the end of three weeks he obtained a number of milky-white crystalline bodies, which, from their resisting not only the strongest acids, but also the oxygen flame, he more than intimates are artificial diamonds.

The Isthmus of Suez Canal appears decidedly destined to become a "great fact." Messrs. Bazin & Co., of Marseilles and Alexandria, advertise that as regular transit service by the canals of the Isthmus of Suez is about to be established, they will be shortly prepared to receive and forward goods.

Official information has been received from Madrid of the confirmation of the Royal Order, granting to Major General W. F. Smith, President of the International Ocean Telegraph Company, the right to establish lines of submarine telegraph between the United States and the West India Islands by way of Cuba.

The needle-gun has again been tried at Chalons, and found wanting. About one hundred and fifty of these weapons were put into the hands of the guards, and the commission has reported that these rifles are not suitable to French troops.

Arched floors of concrete, or beton, a mixture of broken stone, sand, and hydraulic cement, are being put down in Paris without any support of vaults, girders, or the like. The material is simply packed in or molded on timber centerings, which are withdrawn when the concrete has "set."

The largest masses of gold ever found were—first, that found at Ballarat, Australia, in 1859, which weighed 224 lbs.; second, that found in Calaveras county, Cal., in 1854, which weighed 195 lbs.

California is becoming a wool-manufacturing, as well as wool-growing country. A company for manufacturing woolen cloths has lately been incorporated at Marysville, and another at Stockton.

It is said that wood can be rendered uninflammable by coating it with a preparation composed of a solution of potash thickened with clay.