Scientific American.

MUNN & COMPANY, Editors and Proprietors.

PUBLISHED WEEKLY

At No. 37 Park-row (Park Building), New York.

O. D. MUNN, S. H. WALES, A. E. BEACH.

TERMS—Two Dollars per annum.—One Dollar in advance, and the remainder in six months.

Single copies of the paper are on sale at the office of publication, and at all the periodical stores in the United States and Canada.

Sampson Low, Son & Co., the American Booksellers, No. 47 Ludgate Hill, London, England, are the British Agents to receive subscriptions for the SCIENTIFIC AMERICAN.

☞ See Prospectus on last page. No Traveling Agents employed.

VOL. II., No. 12.....[NEW SERIES.]....*Fifteenth Year.*

NEW YORK, SATURDAY, MARCH 17, 1860.

AGRICULTURAL SCIENCE AND MACHINES.

OUR people seem to be devoting attention to agricultural science with a fervor which augurs well for its future growth and progress. Every State, we believe, has now its agricultural society; and there are county and town farmers' clubs almost innumerable. In addition to these, there is a United States Central Association, numerous agricultural periodicals and farm schools; and perhaps a higher influence, in some respects, than all of these, are the chairs of agricultural chemistry which have lately been established in some of the old colleges. These great and manifold agencies for increasing and spreading information on agricultural subjects ought to yield good fruits and bring forth abundant harvests. One of the best evidences of the desire now felt for the acquisition of agricultural science is the series of popular lectures which were recently given at Yale College by eminent practical and scientific agriculturists and horticulturists, who had been invited for the purpose from every section of the country. These lecturers detailed the results of their experience, and the methods which they practiced; and they expressed their opinions as to the best modes of cultivation and the most suitable fruits and grains for different soils and climates. This was teaching science in the very highest sense.

The questions naturally arise: why is there such an ado made about improved agriculture now-a-days? Do we not feed ourselves, and also supply other countries with large quantities of provisions, and are these not evidences of the prosperous condition of agriculture among us, and the high state to which the science and art have been carried by our farmers? To these, we answer: this subject is of vast importance to our people, because two-thirds of our population are engaged in, or connected in some manner with, agriculture; it is the greatest interest of our country, and ought always to engage the most attention. Another reason why this should excite them in more than an ordinary manner at present, is the fact that in most of the older cultivated districts the crops have decreased, both in quality and quantity. This has caused alarm, and it accounts for the activity among our people to retrieve evils which had been inflicted upon the soil by former unwise and unscientific farming. There are many extensive tracts of country, where wheat was once cultivated with great success and profit, where not an acre of it is now grown; and this is the case with some fruits, also, such as the peach and plum, which are now aliens to the same lands on which they once flourished. It has been proved that, in proportion to the extent of soil cultivated, there has been a decadence of the agricultural products of our country, and this has been caused by improper cultivation and exhaustion of the soil. The fact was formerly not duly appreciated, that the grain, fruits, hay, butter, beef and pork raised on farms, and sold to consumers, represented so much of the fertile soil itself, and that every bushel of wheat or other crop taken from it required to be returned again in some form as constituents, under the penalty of future barrenness. This fact is now universally recognized, and it forms the very foundation stone of agricultural science. Old farms, under proper cultivation, can be made to yield larger crops than new farms; but the best methods of enabling them to do so can only be acquired by experience. The whole science and art of agriculture may be summed up in a few words; it consists in the practice of the most successful farmers; this is the only sure guide for others to follow. Many persons seem to consider "agricultural science" in the light of an abstraction; something exceedingly subtile and vague, which can only be learned in colleges. But we assure them it is something exceedingly practical; it means nothing more than farming conducted in the best and most systematic manner.

At this season of the year, we call the attention of our farmers to these, the leading ideas which should govern in agriculture. In the mechanical department of farming, it is a gratifying fact that our country is unrivaled; thanks to our inventors, and the encouragement given to them by the protection of patents. No farmer can really be successful unless he employs the most improved labor-saving implements and machines; and to us it is a most certain sign of success and progress to witness the alacrity of our farmers in adopting the most recently patented and improved machinery. Among the most valuable patents issued are those for agricultural implements; they meet with ready sales, and are justly remunerative. Every farmer should commence the season's operations with the best implements he can obtain; they will yield profitable returns for their cost before the year is closed.

TRADE STRIKES.

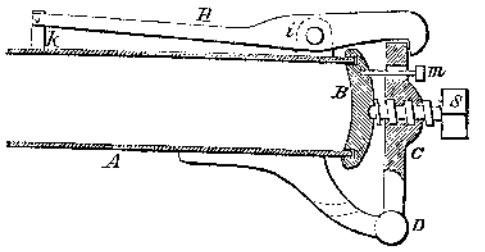
It is a blot upon modern civilization that the war of trades and classes is still waged as fiercely as of yore. Mutual good will should exist, and a fair understanding should always reign among employers and their workmen. The question of industry should be viewed in a broad light, unbroken by selfish individual interests; because, in reality, the interests of employers and employed are one. How very seldom—almost never—do we find these parties feeling and acting right towards one another. They seem to act as if their welfare and prosperity consisted in looking out for their individual interests, even to the injury of one another. They act upon purely selfish motives; and this being the case, frequent outbursts like that which took place in London among the builders, last year, and the strike now going on among the shoemakers of Marblehead and Lynn, Mass., may be expected—it cannot be otherwise. The last-mentioned strike is for a rise of wages among the shoe operatives of all classes—male and female. From published statements, it is evident that their wages have been very low, and we would be glad to see them greatly elevated. If it is possible to do this, it would be better for both operatives and manufacturers; but here comes the practical question upon which it is very difficult to pass judgment. It is said that the wages of the shoemakers have been reduced by manufacturers endeavoring to undersell one another, and that they have gradually reduced the prices of labor in order to sell low in the market. If this is so, we must say that the manufacturers did wrong, both for their own interests and those of their workmen. On the other hand, if, as some others have stated, the manufacturers have large stocks of goods on hand and cannot get paying prices for them, they cannot give prices that will cause loss on stock and capital. The question of "labor and demand" is one which operates by natural laws, and cannot be over-ruled by manufacturers or their workmen.

Trade strikes are usually impolitic, and end in the defeat of the operatives. They depend for their daily bread upon their wages, and when they cease laboring penury follows. But no matter which party is successful, the dregs of a strike are sour and bitter to both; because a spirit of mutual ill-will is usually engendered, and this is seldom, if ever, entirely removed. This being the case we deprecate all trade strikes, and would rejoice to see "courts of conciliation" established in the manufacturing districts to settle all "industrial disputes."

A SINGULAR ACCIDENT.

On Saturday, March 3d, a most singular casuality occurred at Elizabethport, N. J., which resulted in the very wonderful escape of Mr. George Gee, and in the death of Mr. Wm. Allen, brother of Mr. Horatio Allen, of the Novelty Works. It was the premature discharge of an apparatus for separating the fiber of wood for making paper and other fabrics, which was patented by A. S. Lyman, of this city, Aug. 3, 1858, and which is now attracting a great deal of attention.

It is well known that wood is composed of an immense number of minute tubes, arranged in a position parallel with the grain. Mr. Lyman's plan consists in filling in these tubes with steam or water under a high pressure a close vessel, and then suddenly ejecting the wood into the open air, when the pressure of the steam, being no longer counterbalanced by the pressure external to the wood, bursts the fibers asunder. A tight and strong



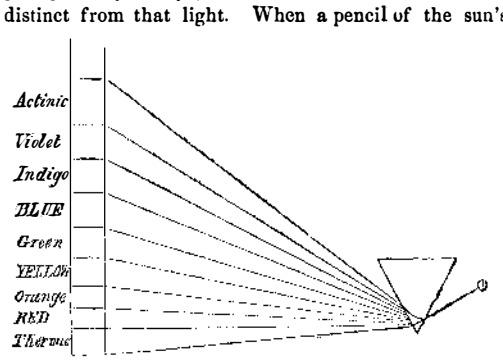
iron cylinder, A, in the annexed cut, 7 inches in diameter and 20 to 25 feet long, is prepared with one end permanently closed and the other covered with a movable valve, B, held in place by a latch, H. The wood is placed in this cylinder (or gun) and subjected to a pressure of steam of 180 lbs. to the inch for a sufficient length of time to heat the wood through to a temperature corresponding with this pressure, when the valve, being released from the hold of the latch, is blown off, and the wood is shot out into the open air. The steam in the tubes, being no longer confined by external pressure, expands and tears the fibers asunder. The lever, C, is provided with the screw, S, for adjusting the pressure of the valve to the end of the cylinder.

On the day mentioned, Mr. Gee had loaded the gun, and on shutting down the cap, perceived that the steam escaped. As he was endeavoring to ascertain where the breakage was, Mr. Allen came up behind him and wished him good morning. Mr. Gee turned around, and just as Mr. Allen stepped in front of the gun, it exploded prematurely, the steam and fibrous wood striking him with such violence that his body was thrown several yards. He was, of course, instantly killed. Mr. Gee escaped without the least wound or injury. The body of Mr. Allen was brought to this city by a steamtug on Sunday morning, and was landed at the Novelty Works, whence it was conveyed to the late residence of the deceased.

THE PHILOSOPHY OF THE PHOTOGRAPH.

We have made a practice of mentioning the great discoveries which have, from time to time, been made in the art of sun painting; and finding so many photographers among our subscribers, as well as such wide spread interest in the subject, we design to hereafter make a fuller record of the numerous small improvements which are constantly being made in this most delicate and beautiful art. In order to render this department of our paper interesting to as large a portion as possible of our readers, we wish to make the accounts of these improvements intelligible to *all*; we therefore introduce them with a brief explanation of the principles of photography, which, it will be understood, is not intended for those who have thoroughly investigated the subject, but for those who have not.

The lights and shades in daguerreotype and photographic pictures are the result of chemical changes wrought in various substances by the action, not strickly speaking of *light*, but of an element in the sun's rays which is not perceptible by the eye, and which is therefore an element distinct from that light. When a pencil of the sun's



rays is admitted through a small hole in the shutter of a darkened room and allowed to pass through a triangular prism of glass, the ray is bent from its straight path and produces an image upon the wall, of varied and most exquisitely delicate colors. Sir Isaac Newton, who first made this experiment, pronounced these colors to be seven in number, the ray which is the least bent being

the red, and the others in order the orange, yellow, green, blue, indigo, and violet. But later observers have studied the spectrum with far more care and minuteness than Newton, in the midst of his multifarious labors, was able to bestow upon; it and their researches have been rewarded by some remarkable discoveries. The most noteworthy of these is the discovery that the sun's ray is not simple, being composed of at least three distinct elements, light, heat, and the actinic rays, as those are called which produce most of the chemical changes. In one experiment by Sir William Herschell, he found that a thermometer suspended in the blue ray rose in three minutes 1°, in the green ray 4°, in the yellow ray 6°, in the red ray 16°, and below the red ray, where there was no visible light, 18°. Other observers have confirmed these results, and it is now fully established that the maximum heat is below the visible spectrum, where there is no light.

Again, if we place a sensitive plate or paper in the spectrum, where the yellow ray falls upon it, it will not be changed in the least, any more than it will in absolute darkness, the green affects it very slightly, the blue more, and the violet most; while the greatest effect is produced beyond the violet, where no light can be seen. By other experiments the elements of light and actinism in the sunbeam are completely separated, and there is no doubt of their being separate and distinct principles or forces.

How the actinic ray effects chemical changes we do not know; that is one of the mysteries which surrounds us in every department of knowledge. But that it does produce them we have abundant evidence. The changes operated by actinism are of three kinds: 1, chemical decompositions, 2, chemical combinations, and 3, alterations of color, in which we have no evidence of any modification in chemical composition. From the long list of these changes we select a few as samples of the three kinds.

The oxyd of silver will remain in combination for an indefinite period in the dark, but exposed to blue light, or to the dark actinic ray beyond the violet, it is decomposed into its elements, silver and oxygen. The same is true of the oxyd of gold, and of the oxyd of mercury.

Nitric acid is soon decomposed, if exposed to the light, into nitrous acid and oxygen. It is ascertained that this change is not produced by yellow light but by blue and the rays beyond the blue in the spectrum.

Among the *combinations* produced by light are the following:—

1. If chlorine and hydrogen gases are mixed together they may be kept in the dark for any length of time, but on exposure to the light they immediately unite in chemical combination, forming hydrochloric acid.

2. Carbonic oxyd gas and chlorine gas may also be mixed and kept in the dark, but when blue light, or the full sunbeam which contains it penetrates the mixture, the two substances enter into chemical combination.

3. Mere change of color is effected by light in several substances, among which is chloride of silver, which is changed from snowy whiteness to perfect black.

Now, the whole art of sun painting—including the daguerreotype, ambrotype, &c., as well as all the various processes of photography—consists in combinations of the several substances which are acted upon chemically by the actinic rays of the sunbeam, in their proper exposure to the action of the light, and proper treatment after receiving the picture to prevent it from fading away. Some of the processes are exceedingly simple, especially that of the daguerreotype, but we shall postpone a description of it till our next issue.

In accounts of new discoveries in photography, and in all discussions of the subject, such constant reference is made to the *spectrum*, that we present an illustration of it, to enable those of our readers who have forgotten the order in which the colors are refracted, to refresh their recollections without the trouble of consulting a book. Close observation has detected two additional colors not noticed by Newton—a faint but deep crimson below the red, and a pale lavender beyond the violet. As these are not generally mentioned we omit them in our cut. It has also been found that the seven (or nine) colors are all produced by three primitive rays—red, yellow, and blue; the orange resulting from a lapping over each other of the red and yellow, the green from a mingling of the yellow and blue, and the indigo and violet being a mixture of the red and blue.

THE PEMBERTON MILL TO BE RE-BUILT.

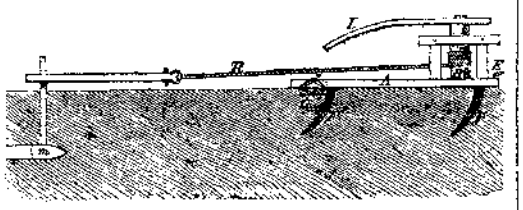
One of the owners of the Pemberton Mill has purchased the interest of his partner, and has announced that the mill will be re-built without delay. It is said to be his intention to put up a more substantial building than was ever yet erected for manufacturing purposes anywhere in the world.

There is now no doubt that the fall of the building was owing to the most gross negligence and want of fidelity in casting the columns. The cores were so negligently set, and so insecurely fastened, that they were floated by the melted metal to the upper part of the mold, making the upper side much thinner than the under side. In a great number of cases, the thickness of metal does not exceed 3-16ths of an inch, and is often less than $\frac{1}{8}$ of an inch, on one side.

A column so extremely eccentric, left to cool naturally, would, of necessity, be so crooked by reason of unequal shrinkage as to be rejected, of course, as a dangerous casting. But they could be, and, of necessity, must have been, straightened by weighting them while yet very hot. This process would at once weaken them, and lull to false security by giving them a deceptive appearance of uniform thickness. One overseer testifies that he was looking directly at a spinning frame, and saw it go down through the floor; while a man who was in the room below says he saw the shafting coming down in this same place. This was the commencement of this awful disaster. In confirmation of this direct testimony, the pillars among the ruins are found to be exceedingly thin; many of them on one side. It is even said that they may be broken with a stamp from the heel of a boot. In the architect's order, allowance was made for strength to support tenfold the weight that was placed upon the pillars; but they were not cast in accordance with the order.

MOLE PLOWS.

MESSRS. EDITORS:—Your correspondent, F. A. W., on page 101 of the present volume of the SCIENTIFIC AMERICAN, writes that he labors under some disadvantages in taking up and putting in the stakes of his mole-ditcher; that he needs an extra team to move the capstan over the ground, and wishes to know if any machine has been got up that will save some of the labor he alludes to. I do not know what kind of a machine he has got; but annexed hereto I have tried to give him an idea of a mole-ditcher that I have seen in use in Morgan county, Ill., which did very good work, which requires no staking and in the use of which the team is all the time em-



ployed. A represents a plank lying upon the ground upon which plank is erected the capstan, B, in a strong wooden frame, said capstan being turned by the lever, L, to which are attached three to four yoke of oxen, according to the depth of the mole, M, say from three to four feet in the ground. F F are curved iron feet or stakes, curved backward or in an opposite direction to that in which the mole moves. G is a strong plank, say three by six inches thick and about eight feet long, which is tied upon the under side of A, and behind the iron foot, F, to prevent the rear of the machine sinking into the earth. All that is necessary is to put the mole in proper position in the earth, and the frame, A, with capstan, upon the top of the ground. Upon drawing the mole, the feet, F, enter the earth until the machine is firm. After the mole has been drawn up to the machine or capstan, all that is required to move it is to make the team fast to a stout chain or ring, E, and draw the capstan along in the direction of the work, to the extent of rope, replace the oxen to the lever, and go-ahead again. If the above is of any use to F. A. W., he is welcome to it. J. G. H.

Philadelphia, Pa., March 1, 1860.

INDUSTRY—MANUFACTURES—COMMERCE.

Boston Shoe Trade.—The Boston *Traveler* says that there is no place in the world where so many boots and shoes are sold, in an equal area, as in Pearl-street, in that city. The shoe trade has become gigantic in its proportions, and Boston is the center of it. Thirty years ago the total value of the shoe trade in that city amounted to about $1,500,000 annually; now it amounts to $20,000,000, and the prospect is that it will reach $100,000,000 during the present century. The number of pairs sold in 1859 was 37,500,000. Most of these were for the southern and western States, and 250,000 for Australia and Canada. The number of shoe-dealers in Boston is 340.

California Silver.—The newly discovered Washoe silver mines, situated on the eastern slope of the Sierra Nevada, are the richest by far in the world, if all the stories are true which have come to us from California. A tun of ore smelted in San Francisco yields $3,600, and it also contains a considerable amount of gold. Some of the ore is of a black color, resembling brown coal.

Michigan Iron.—The Wyandotte Rolling Mills Company, near Detroit, have commenced the erection of another large mill at Wyandotte (adjoining the Merchant Mill, and about the same size) for rolling boiler plates of Lake Superior iron, nail rods, railroad spikes, and forging heavy shafts. The mill is to be provided with new and improved machinery, and to be erected with all possible dispatch.

Stuart's Thread.—This thread (as we have been informed by those engaged in the sewing-machine business) has superseded all other brands for machine sewing, on account of its great strength and smoothness. It is manufactured in Scotland by Messrs. David Stuart & Co., near Glasgow, from which city almost all the cotton thread employed in our country is imported. There has been a most marvelous improvement effected within five years in the dressing of cotton thread by friction surfaces, whereby it is glazed and made more beautiful and smooth. Paisley, in Scotland, is the most celebrated place in the world for thread manufacturing. The rise of this business dates back to the days of witchcraft, when Christiana Shaw, a famous bewitched girl, became celebrated for spinning fine linen thread, since which time this art has progressed in that town until it has surpassed all others.

Mineral Discovery.—A correspondent of the Brockville *Recorder* intimates that a very rich mine has lately been discovered in the front of Yonge, C. W. The vein first opened consisted of very pure nickel. The mine is located on the farm belonging to Mr. Benjamin Bayle, and was discovered by a mineralogist. The work has been pursued to some extent last summer, but will be properly opened this Spring.

Southern Manufactures.—A cotton factory, capable of running 2,500 spindles, has just been put in operation at Jefferson City, La., by Mr. L. N. Lane, of New Orleans. For the present it will make only cotton yarns. There are two factories in Iredell county, N. C., at which yarn and cotton osnaburgs are made in large quantities. One is located at Turnersburg, and owned by Mr. Turner; the other at the Eagle Mills, and owned by Messrs. Colvert & Co. There are small cotton factories in Yadkin, Surry, Catawba, Cumberland, and other counties of the same State. In the course of the last four months three of the manufactories in Richmond, Va., have shipped to New Orleans 64 steam engines and sawmills.

A Great Show.—The Massachusetts Charitable Mechanics' Association have fixed upon Wednesday, Sept. 12th, for the commencement of their "Ninth Exhibition of American Manufactures."

Piscatorial Productions.—The herring fishery in Nemaskit river, according to the Middleborough *Gazette*, yields 300,000 herrings a year, and below Middleborough, on the Taunton river, are thirteen fishing privileges, yielding annually about 26,000 shad and 2,000,000 herrings.

Speculations in Screws.—We see it stated that the Eagle Screw Company and the New England Screw Company (both in Providence, R. I.) have united in one establishment under the name of the American Screw Company. Great speculations are made in the transfer of the stocks.

Statistics of Salt.—Three-fourths of the foreign salt consumed in the United States is brought from England, though a large portion of it is not produced there. The value of the salt received last year from England was $982,638; that from British West India, $163,212; all other countries, $149,684: total, $1,295,534.

Coffee Mills.—It has been stated that the first board coffee mills were made by Job King, of Taunton, Mass., and cost $18 per dozen, and retailed in 1820 at $2 and $2.25 each. Previously the box coffee mill was used.