even if it includes the production of labor-saving devices, opens and clears the way for the pioneer, the laborer, the *avant guard* of civilization. Has the sewing machine been a benefit to the women who before lived by sewing? Let the demands for female seamstresses daily published in our journals answer. Has the introduction of railway trains driven by steam diminished the production or the price of horses? Let the plain facts of to-day reply. Has the adaptation of steam to river and ocean navigation diminished the amount of freight and the number of passengers conveyed, or even the number of men heretofore employed? The condition of this business as compared with itself fifty years ago is a sufficient demonstration of the value of labor-saving machinery in this department.

The proudest days of the Roman empire saw a state the wealthiest members of which knew less of the luxuries of life than the ordinary American mechanic of to-day, and the workers were simply slaves whose liberties and lives were held in fee simple by their masters. While their masters shivered in the cold of their unheated marble palaces and gorged themselves on food, barbarously cooked, their slaves courted any sunshiny corner for warmth and greedily devoured the leavings we now think fit only for dogs. Then, the only relief from this state of vassalage was the army. Here, even, the soldier was not always sure of his regular food, but like the savage dogs in Eastern cities in our own time, or the wild beasts of the wilderness, he must fight for, or thieve for, or murder for it, before he could get it. Even the commonalty (*Cives Romani*) were only hired hinds, the tools of warlike generals, the victims of licentious civilians, or the protegés of a wolfish government, that raised her cubs to imitate the fabulous dam of the empire's founder. There were laborers enough then, but their labor was enforced and their pay stripes, imprisonment, or death. They had brains as we, but they did not invent; they had necessities but they could not supply them. Would they have been worse, would the empire have been poorer, if a patent office had existed and an invention could have been protected? The remedy, then, for too great a population was that of Malthus propounded in later times, and his admirers in our day.

Now, it is hardly necessary that we should allude to times nearer our own, but it may be well to direct our readers—those at least who delve into the musty soil of history—to the condition of our mechanics less than one hundred years ago. These readers will see the wonderful difference between the condition pecuniarily and the position socially of the mechanics of that time and those of the present.

In 1769 a carpet on the floor was unknown, except in the houses of the magnates of the church or state, and at that time they were one. In the Plymouth Colony, in that year, one of the deacons (then like our present ministers, ordained to baptize and conduct religious services) was brought before a committee of his church in a town in Eastern Massachusetts and roundly reprimanded by his pastor for "presenting before ye congregation of ye w^ch he was an honoured officer ylch an yxample of luxury as best befitts yee times of ye ungodly of England" and was suspended for his daring, although the carpet, which was the head and front of his offending, was the handiwork of his dame and daughter.

Have we progressed since that? And is the progression, if made, to be attributed more to religious tolerance than to mechanical invention? Here is a nut for our Malthusian philosophers to crack. The world of eighteen hundred years ago contained all the means for man's comforts it does now—possibly more. We have found out not only what the earth contains, but we have found out the means of getting at it and using it. We with our Briarean arms of labor-saving utilities can afford to sneer at the Roman patrician of eighteen hundred years ago, and offer to his despairing slave not only freedom from his bonds of iron and steel that bound his limbs or prevented his freedom, but an equal right with his patron, or master, in the present possibilities, and in the magnificent future, for himself and his. And why? Because science and mechanical skill has made the impossible possible; because labor-saving machinery has not only opened new fields for the exercise of his faculties, but has provided with its iron fingers what he never could hope to provide for himself.

KEROSENE OIL.--REPORT OF PROF. CHANDLER TO THE METROPOLITAN BOARD OF HEALTH.

We reproduce the salient points of a report lately made by Prof. C. F. Chandler to the Metropolitan Board of Health, of New York, not particularly because it presents any new facts or suggestions, but because it deals with a subject to which we have repeatedly called attention in these columns, and recognizes the importance of a matter to which we have devoted much thought and given much space in our paper, as we deemed it of great and general importance. Prof. Chandler says:

The burning fluid sold so extensively throughout the United States under the name of kerosene oil, is refined petroleum from the oil wells of Pennsylvania, Ohio, Virginia, Kentucky, and Canada. As it comes from the wells petroleum is generally of a dark yellowish or greenish brown color, and possesses an odor more or less offensive. To render it salable it is subjected to a process of refining by which it is rendered almost colorless and freed as much as possible from its disagreeable odor. One of the most important objects of the purification is, however, the separation of the more volatile constituents, the benzine, keroseline gasoline, or naphtha, as they are variously called. These liquids, being very volatile, and, at the same time, very combustible, are the substances which give rise to the explosions which render the use of kerosene so dangerous. Benzine being the cheaper article, the cupidity of the refiner leads him to leave as much benzine in the kerosene as possible, regardless of the frightful consequences. Native petroleum is a mixture of a great number of hydrocarbons, compounds of hydrogen and carbon. These differ from each other in volatility. Some are so volatile as to evaporate rapidly at ordinary temperatures, making it dangerous to approach an open tank of petroleum with a flame. Others are much less volatile, some requiring a temperature of 700 to 800 degrees Fah. to vaporize them. The volatility of these component hydrocarbons is intimately related to their specific gravity or weight, the lightest oils being the most volatile, while the heavier oils possess the high boiling points. The inflammability of the oils is also intimately connected with their volatility and specific gravity. The light volatile oils ignite on the approach of a burning match, no matter how cold they may be; while the heavy, less volatile oils can only be ignited when they are heated above the ordinary temperature of the air.

The crude petroleum as it comes from the wells is subjected to distillation, when the most volatile constituents pass off first in the form of vapor, and are condensed by passing through a coil of iron pipe surrounded by cold water, and collected as benzine; subsequently the burning oil or kerosene makes its appearance; this is followed by a heavier oil which may be used for lubricating machinery: and there is finally a small residue of tar or coke left in the still. That portion of the product which is designed for illuminating oil is then subjected to the action of sulphuric acid to remove the odor and color, and destroy a little tar which it still contains. It is then subjected by the more careful refiners to a somewhat elevated temperature to expel a small percentage of benzine which it still contains. Thus purified it constitutes the kerosene oil as it is sold in the market.

The conscientious refiner runs all the dangerous oil into the benzine tank, and only when the oil is sufficiently heavy to be safe does he allow it to pass into the kerosene receiver. But as the benzine must be sold at a lower price than burning oil, the refiners are many of them led to collect as little benzine and as much kerosene as possible. It must not be supposed, however, that the specific gravity of the oil can be considered a safe index to its quality. On the contrary, the specific gravity gives very little idea of the quality; for while benzine and naphtha render the kerosene lighter, the gravity of good kerosene is preserved by the presence of heavier oils. So a poor, dangerous oil may be much heavier than a safe oil.

As the products of petroleum are dangerous in proportion to their inflammability, a fire test has long been in use, by which the temperature is determined at which the oil evolves an inflammable vapor—the "vaporizing point"—and the temperature at which the oil itself may be handled with a burning match—the "burning point." The vaporizing point of good kerosene oil should not be much below 100 degs. Fah., and the burning point should not be below 110 deg. Fah. Unfortunately the results of this investigation show but little of the oil sold in New York comes up to this standard.

Processes have been patented, and venders have sold rights throughout the country for patented and secret processes for rendering benzine, gasoline, and naphtha non-explosive. Thus treated, it is sold under such names as "liquid gas," "aurora oil," etc. These patents and secret processes are not only ridiculous, but their sale to ignorant persons is a crime only equaled by murder.

The fire test gives the only sure indication. Apply a lighted match to a little of the oil contained in a cup or saucer, and if it can be made to take fire, it should at once be considered unsafe, even though the experiment be made in one of the hottest days of summer.

Seventy-eight samples of kerosene oil have been procured from the same number of kerosene dealers in different parts of the city, and these have been carefully subjected to the fire test to determine the vaporizing and burning points. Several of the samples have also been subjected to fractional distillation to determine the proportions of benzine and naphtha which they contain. The result was that not one of the seventy-eight samples, selected at random throughout the city, which are all that were tested, is of a good quality, which may be called safe. The only single specimen of safe oil in the entire list is manufactured in Boston.

It is a little singular that Prof. Chandler should have been so unfortunate in the samples of kerosene he obtained. If he is correct, the surprise is not that occasional explosions, and consequent injuries, occur, but that such are not reported almost daily. Several months ago we made repeated trials and tests of kerosene obtained from our family grocer in Brooklyn, and in no case did we find the kerosene below the legal and practically safe test. We could mention the names of refiners of petroleum who would scorn to attempt such a murderous imposition on the public, or such a fatal stroke at their business name as to send out an improperly distilled or refined product. The test is so easily made and the law is so explicit that either manufacturer or dealer should find his attempt to impose on the public a spurious, dangerous, or inferior article a sad and serious failure.

No one possessed of common sense, a thermometer, a saucer, and a match, need ask anybody's opinion as to the explosive or dangerous quality of the kerosene he uses. The facts in regard to the character and tests of the fluid have been repeatedly published in the SCIENTIFIC AMERICAN, and it adds nothing to the importance of the subject that professional chemists should write, and daily papers print, a rehash of facts long ago sufficiently plainly stated.

Foreign Contracts for American Guns.

The gun-making ingenuity of Americans seems to be appreciated in Europe almost as much as that of the Prussian or French, if foreign orders for American fire-arms are any indication. The *Sun* says the Remington Company has recently delivered to the Danish government, 40,000 of their guns, and to the Swedish government 30,000, and the Greek government has contracted for 15,000 which have not yet been delivered. The Remington pattern is a single cartridge breech-loader of superior make and efficiency, of which from 200 to 300 are turned out daily by the Company. The Cuban government has bought upwards of 20 000 of Remington and Peabody rifles, the latter an arm manufactured in Providence. The Cuban revolutionists also have been buying up a large quantity of small arms, but of a poorer class, chiefly muzzle-loaders, being unable to pay for better ones. They hope to achieve their independence with the odds of breech-loaders against them. The Russian government has a contract with the Colt Fire-arms Company at Hartford, for 30,000 rifles, an improvement on the Prussian needle gun.

Besides the above contracts, shipment of guns to other governments have been made by American firms. The standard arm of the United States Government, is the Springfield musket, converted into a breech-loader, upon what is known as the Robert plan. It is a beautiful and very effective piece, and is admired by the ordnance departments of foreign governments. The regular army is now supplied with them. The great quantity of muskets which our Government had on hand at the close of the war is being disposed of at auction and private sale.

The only repeating rifles now made in this country are the Winchester at Bridgeport and the Spencer at Boston. The former is an improvement on the celebrated Henry rifle, carrying eighteen shots, and can be fired with great rapidity. The latter is a seven-shooter, and in Sherman's campaign through Georgia six men on a picket post armed with the Spencer carbine kept at bay for some time a whole battalion of the enemy by the rapidity of their firing. These repeating rifles are used for hunting on the Plains, and meet with much favor in foreign countries. American gun makers regard the famous Prussian needle gun as inferior in every respect to our best patterns.

PRIMEVAL CHEMISTRY---LECTURE BY PROFESSOR J. STERRY HUNT.

Reported for the Scientific American.

Professor Hunt, of Montreal, delivered the eighth lecture of the scientific course before the American Institute, on the evening of the 14th instant. Subject, Primeval Chemistry. Whatever may have been the opinions of his hearers in regard to the peculiar views of Professor Hunt, all will concede the singular ability with which he maintains them. The lecture, although from its subject, a dry and abstruse discussion might have been anticipated, proved, on the contrary, one of great popular interest, both on account of the order in which the points were arranged and the happy method of illustration employed by the speaker. We have only room for an abstract of the lecture, but we shall, as far as we can, give its leading features.

Upon his introduction to the audience by Judge Daly, Professor Hunt said:

MR. PRESIDENT, AND LADIES AND GENTLEMEN: You have already been informed that the subject of this evening's lecture is Primeval Chemistry—the chemistry of the earlier condition of the world's history---chemistry before there were chemists, before there was any eye, except the eye of the great All-seeing One, to investigate or to study His marvelous phenomena. As this has reference more especially to the history of this earth, it may be well spoken of as chemical geology, a term which has been very frequently applied. We speak of geology as if it were a science, but in reality under that name we include a whole group of sciences. In the first place, to the astronomer this world is one of a system revolving around our sun—the so-called solar system—and that so-called solar system is but one of many more such great systems, thus occupying a very insignificant position in the great cosmos. Thus our world appears to the astronomer. To the physicist, again, who studies it in relation to the laws of gravitation, with regard to the laws of light, it appears altogether in another light. Then comes the chemist, who examines the relations of its rocks, its waters, and its atmosphere. He has also his history of the globe. Then comes one who studies the changes in its crust, the movements which give rise to mountains, which cause all the geographical diversities of the earth's surface. This has been discussed before you by my distinguished predecessor, Professor Hall. Later, comes a period in the history of the planet, in which life appears upon the surface, animal and vegetable. Already Dr. Dawson has explained to you the laws which govern the evolution of vegetable life, how during successive periods, successive creatures, flora after flora, each more beautiful and more perfect than its predecessor, appeared upon the surface of the planet. Then again comes the zoologist, who investigates the various forms of animal life. All these studies, beautiful and important as they are, are mere branches of that great complex study which we call geology. Professor Hunt said he would merely discuss the chemical relations of our globe, but he must to a certain extent go outside of our globe, because he must look at it from the astronomer's point of view. The chemist had to look to the rocks, the waters, and the air; but behind all these came in another question, whence was the origin of rocks, of water, and of air? There must have been a time when these were not, and the first question of the student was as to the origin of these things. It was the rare privilege of the scientific eye to look backward, to solve this problem, and to learn, as it were, the history of these pre-historic times. From the astronomer, who recognizes the fact that our globe is but one of many worlds, there comes in a strange and unexpected light to aid us, and physical science here contributes most curious stores of knowledge Speculating upon the origin of our earth, and seeing the curious harmony which existed between its motions and those of its satellites, and of the other planets that moved around the sun, the great Kant was induced to ascribe a unity of origin to all. Later, the idea was developed by La Place, who supposed that from a great nebulous cloud existing in space there was formed, in accordance with certain physical laws, successive planets, successive satellites, the sun finally remaining in the center; the result of the condensation of one immense cloud of vapor, for whose origin, still further back, we must only look to the great Author of existence, who created it, and imposed upon it the laws which, in after ages, regulated its development. This great nebulous cloud rested in this condition until Sir William Herschel, in studying the skies, examined certain masses of light which had before been known as certain cloudy, milky masses of white light. He viewed them with his great telescope, and was unable to resolve them. Here he said, "I have the origin of this cosmic matter; here I really see the stuff of

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which worlds are made," and he described them as so many nebulæ. Later astronomers looked at the masses with more powerful glasses and were able to resolve many of them into groups of stars. For instance the great milky-way which we observe so plainly in a clear, cold winter's night was found on close examination to be made almost entirely of little stars which came out under our brightest telescopes. Still there were certain masses of light which Herschel could not resolve, but which other observers discovered to be made up of suns or of stars, and hence the nebulous hypothesis fell into doubt. It was said as some of the supposed nebulæ have already been shown to be composed of stars, still more powerful instruments will enable us to show that these nebulous masses are made up of stars. Just at this point came in a very unexpected aid in the spectroscope. With this instrument, in the examination of light in the first place from terrestrial sources, it has been found that you can discriminate between the light that comes from a solid body and the light which comes from a vaporous, or gaseous body—that you can pierce distance and resolve problems, for the investigation of which the most powerful telescope was impotent. We have now discovered that in the sun and in the fixed stars we have present the very same elements as those of our earth, and we may hence conclude that the same chemical laws which hold good in our planet hold good in the bodies of the solar system. We might, therefore, conclude not only the unity of our system, but the unity of all systems, and all worlds, and we are enabled by comparison between these and our own planet to show that all these nebulæ, suns, and planets, are worlds in so many successive stages of development, of which our own is perhaps one of the latest and most complete. Having determined this great luminous or nebulous mass, the natural inquiry is what are the laws which regulated its condensation; how should it ever become reduced to the condition of a solid globe? By the simple process of cooling. The sun, the great center of our system, was and is a cooling body. It is a body constantly giving off light and heat, and therefore slowly but surely undergoing a cooling process. When we investigate the laws of cooling bodies, and still more when we investigate the chemical changes in bodies at a greatly increased temperature, we learn another curious lesson, which is, that at intense temperatures (such heat as must exist in the sun and in the nebulæ), almost all bodies are in a state of chemical indifference. To make himself plainly understood, he would refer to the composition of water. This was known to be produced by the combination of oxygen and hydrogen gases. These combine with an evolution of heat to produce water, but if you exposed water to a very much higher heat than that by which it is formed, it will break up again into oxygen and hydrogen. So we find that almost all compound bodies known in nature, when intensely heated, are decomposed. It seems as though the chemical affinities, which brought them together and tended to make them a unit in combination, are completely suspended at these higher temperatures, so that one may well suppose that on the sun, and still more in these nebulous bodies, all the elements are in a state of chemical indifference. The spectroscope told us that, because we recognized the spectra of the simple elements, and not of the compound bodies. The process of condensation going on in the sun, and which surrounds that body with an envelope of luminous mist, is going on in all the planets. Our earth was once a luminous mass of vapor, passing through a stage in which it was self-illuminating like the sun, until it finally became cool to such a point that it liquefied and became at last solid. Many suppose that this great liquid earth was surrounded first by a solid crust; but there is no evidence to prove that the cooling began at the center, and proceeded outward to the outer surface. This question is interesting to us from more than one point of view; it has an important bearing upon many facts connected with the changes of the earth's crust; the question as to whether this solid surface upon which we walk rests upon a liquid molten rock, or whether we have a solid mass through to the center. This subject has been extensively investigated by physicists, and has given rise to many differences of opinion. We must either regard the earth as solid to the center, or, if not solid, the crust must be many hundred miles in thickness, as the laws spoken of have operated from the beginning; and the vast masses of solid matter would arrange themselves at the center of the globe, while the surface would be covered by a thin layer of liquid matter, and this acted on by the internal heat would naturally assume the uneven character of the surface of our primeval globe. So far as the chemistry of our planet is concerned, we have only to deal with the outer crust. In this we find granite, quartz, limestone, gypsum, coal, and the various metals, and the waters of the ocean, and all these surrounded by the still lighter atmosphere. We must understand that these elements must have been formed from the materials which were near the surface and in the air. There, of course, could have been at one time no water. The high temperature of the mass rendered its existence impossible. Then there was no ocean. We must, therefore, restrict the primitive crust to the solid rocks, and the atmosphere with its gaseous contents. Thus we may form a just idea of what that early crust consisted, if we suppose the atmosphere and the ocean to be brought together at the intensely high temperature which then existed.

Suppose the earth to be now melted with fervent heat. Every chemist can readily see that by bringing together the limestone and the waters of the ocean under such conditions, sulphur also being present, the sulphur, the chlorine, and the carbon would be transformed into gases; the alkalies, lime, alumina, and magnesia, would unite with the acid gases to form sulphates, carbonates, and chlorides, while the metals, with silica and alumina, would combine in the crust to form a substance similar in composition to what are now known as slags, and over and above this an atmosphere, charged with acid vapors—sulphur and carbon in the form of gases, and water in the form of steam, mixed with the elements of the atmosphere, nitrogen and oxygen, and carbonic acid, or the elements of carbonic acid in the free state. Under these conditions the atmospheric pressure would be immense, and the barometer would stand three or four times as high as it now does. Under the pressure of such an atmosphere, water and the less volatile materials would be precipitated upon the rocks. This water would, of course, be strongly charged with acids—hydrochloric and sulphuric—and being fluid, would fill the cavities and spaces in the solid earth. The result would be, at this high temperature, to give rise to the immediate decomposition of the silicates and carbonates, and set free the whole of the silica, while the acids would combine with the lime, magnesia, soda, and many of the metals; chlorides and sulphates would be formed, while the silica, separating, would form quartz. The salts of lime, magnesia, and soda would dissolve in the water, and form sea water. The activity of the combinations would gradually become less violent, as the affinities would be rapidly satisfied. The acids would combine with the rocks until they got their full equivalent, and then would commence a new process. A process of slow decomposition by air and water would now set in. Carbonic acid and water would attack the silicates, and take the lime from them; clay, bicarbonates of soda, etc., would be formed, which, dissolving, would find their way to the sea, where chloride of sodium or common salt would also be formed. This action is still going on upon the felspatic rocks, decomposing the strongest quartz and making clay, though much less rapidly then formerly on account of the diminished quantity of carbonic acid in the atmosphere. Every lump of clay then upon the earth's surface represents granite decomposed, limestone formed, and salt added to the sea.

Until the acids were in a great measure removed from the atmosphere, animal and vegetable life was impossible. Professor Dawson has told you that vegetation was one of the most powerful agents in removing carbonic acid from the atmosphere; but I believe that a very large quantity of it must have been first removed before vegetation could have taken place.

Another curious question solved, if these views are correct, is the fact that in the polar regions, where there is now little or no vegetation whatever, there existed in former ages plants now confined to the tropics. Many hypotheses have been framed to account for this change of climate; but the true solution is undoubtedly to be found in the composition of the atmosphere at this period—the mixed gases heretofore described. These gases imprisoned, so to speak, the sun's heat, so that the earth might be compared to an immense greenhouse. The high temperature at the poles was then the consequence of impeded radiation.

Beside the chemical forces already named, there succeeded of course mechanical forces, described in a previous lecture by Professor Hall, until finally the whole surface of the earth became nearly covered with sedimentary deposits. I deny that at this period the interior of the earth was in a fused condition; but I admit that its temperature was very high—as hot as it could be and remain solid.

The surface of the earth receives but little heat from the interior at present, not enough to change its temperature more than one degree, but as we descend into mines we find an increase of temperature. The loss of heat from the earth's interior diminishes daily, and the increase which would have been felt in descending was formerly ten times as great as now. The result of this high temperature was crystallization and new combinations. Hence the origin of the metamorphic rocks, which are sediments changed in character by crystallization. If I had time, I think I could show you that the White Mountains of New Hampshire were originally of the same age and composition as the Catskills of New York. The mountains of New England have had their rock masses changed by the action of heat.

Granite has been supposed to be the primitive rock. This is a fine theory, but we really know as little of the primary nucleus of the earth, as we do of the other planets. Granite is a rock, derived from quartz. Quartz cannot be formed by heat, it is only formed by water. Quartz when heated ceases to be quartz, so it will be seen that what were supposed to be primitive granites, are not primitive, but derivative rocks.

This can be determined by the microscope, which not only shows the origin of the rock, but the very temperature at which it was formed. The crystals are found to contain cells inclosing water, when this water is heated to a temperature at which it exactly fills these cells, that temperature must be the precise temperature at which these rocks were formed. This temperature has been determined to be below that of melting lead.

The question now arises, how these rocks were softened. To answer the inquiry it will be necessary to consider the relations of pressure to the melting point of bodies. It has been found by Tyndall and others, that ice melts more easily under pressure, than otherwise. But ice is in this particular, as in some others, an exception to solid bodies in general. Most bodies expand in liquefaction, so that pressure raises the melting point of bodies. Thus pressure tends to solidify the center of the globe. Solution resembles in many points, the fusion of solid bodies, but every solution is denser than its ingredients. Hence pressure favors solution, while, with the exception of ice, it retards fusion. It will be seen then how water penetrating deeply into the crevices of the earth's crust, and there acting under enormous pressure would soften obdurate sediments, and—a point made for the first time here to-night—aided by the contraction by cooling of the deply buried sediments, which, tending to open crevices of great depth, gives rise to the yielding bed upon which the earth's crust now rests, and so also the oscillations and other phenomena of volcanic action. Did time permit, I would like to show how the precious metals remained suspended until finally they were deposited in veins and gangues, as now found, but I forbear. I think I have said enough to show that the proper commencement of geological science is chemistry.

Why Boilers Sometimes Explode.

The last number of the *Locomotive*, published by the Hartford Steam Boiler Inspection Company, gives the following somewhat startling summary of inspections made by its inspectors during the month of December: One hundred and eighty-two visits of inspection were made, three hundred and forty-one boilers examined externally, seventy internally, thirty-four tested by hydraulic pressure. In these boilers one hundred and sixty-eight defects were discovered, thirty-two being sources of special danger. Among them we enumerate the following: Six furnaces out of shape, thirteen fractures—three dangerous, six burned plates, twenty-four blistered, seven dangerous, thirty-one cases noticeable incrustation, twenty seven boilers corroded externally, five dangerous, seven boliers grooved internally, five safety valves overloaded—three dangerous, five blow-out apparatus out of order—three dangerous, thirteen water gages out of order, twenty-two pressure gages out of order—three dangerous, two boilers without gages, six cases of deficiency of water, three boilers had stop-cocks between safety valve and boiler—a dangerous apparatus, one boiler had no safety-valve, one had no feed pipe, three were cracked entirely around the shell. One was blistered so that the Inspector pushed his finger through the shell, after cutting off the blister. One was corroded through from accumulation of ashes, combined with small leak. One gage-pipe was completely stopped up. One boiler was so badly burnt, blistered, cracked, etc., as to give out entirely under pressure. These boilers were all in actual use.

Voice From the South.

Perhaps in the whole range of exchanges that come to our table, there is none more welcome—while there is certainly none more useful—than the SCIENTIFIC AMERICAN. Devoted to explanation and discussion of all the most novel improvements in science, mechanics, and arts, which are rendered plain and easily understood by admirable cuts, this paper has a high mission which it fulfills with exceptional ability. It has that novel quality, too, of minding the business for which it set out, and eschews politics most carefully. It is perhaps this fact, as much as its very great ability, that has for years given this paper the high standing it has among the business, manufacturing, and scientific men of the country.

Munn & Co. who own the paper, are everywhere known as thoroughly experienced and successful Patent Agents. They are prompt and reliable; and we can state of our own personal knowledge, that any such business entrusted to them will be perfectly certain to give entire satisfaction.—*Mobile Daily Register.*

The Value of Small Inventions.

The great value of some of the smallest inventions is strikingly illustrated in the success of the Bag Fastener, recently patented by Charles M. Nye, of Elizabethport, N. J. It is only three months since the issue of the patent, and he has already received cash orders for over 800,000 of the Fasteners, and several offers of $10,000 for the patent, which he declines. He has established a factory capable of turning out 15,000 of the article per diem. The Fastener consists merely of a couple of small leather straps, united by a central buckle. One customer in Philadelphia orders them by the ten thousand, and says that they save him $50 a day in cash. A man can securely fasten a dozen bags of grain in the time that it ordinarily takes to tie a single bag. The millers like the improvement, and it is coming into extensive use. Patented through the SCIENTIFIC AMERICAN office.

The New Breech-Loader.

The work of preparing tools for the fabrication of the new breech-loader, which is to be made at the Springfield (Mass.) armory, is being rapidly forwarded, the machinists, at the request of the commandant, working ten hours a day for that purpose. When everything is ready the making of the new model will begin at once, and a larger force than the present one will necessarily be employed, in order to furnish the army with the improved breech-loaders as rapidly as they are called for. In anticipation of this demand for labor many of the former workmen at the armory are returning and entering their names and addresses on a book kept for that purpose, so that the authorities can send for them when they are wanted.

Experiments by Professor Tyndall.

At a recent meeting of the Photographic Section of the American Institute, Professor Joy read the following extract from a private letter which he had received from Professor John Tyndall:

My daylight hours have been recently occupied with the question of the chemical action of light upon vapors, and also with the blue color and polarization of the sky. These questions, which have been so long the great enigmas of meteorology, have, I hope, at length been brought within the grasp of experiment, and have been, to a great extent, satisfactorily solved. The condensed summary of my results is at the present moment in the hands of Sir John Herschell, who has manifested great interest in the inquiry. As soon as he sends it back to me I shall hasten its publication, and it will give me great pleasure to send you a copy of it. J. TYNDALL.

ARCHITECTURE AND BUILDING.—We intend to devote considerable attention during the year to the subjects of architecture and building, and shall endeavor to furnish inform a tion that will be useful and interesting to all our readers.

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Bridging the Connecticut River.

The subject of bridging rivers for railways purposes is still agitated. It is proposed to bridge the Connecticut River at Lyme and at Middletown, and the Connecticut Legislature has authorized the construction of the bridges. The matter has been carried before Congress for confirmation. It is claimed that by bridging the river at Middletown the distance by rail from New York to Boston will be shorter twenty-six miles.

Connecticut interests oppose the interference of Congress and the building of the bridges, for the reason, among others, that they will obstruct the navigation of the river. There is apparently a big "lobby" on both sides. We predict that in the end the bridges will be built.

Editorial Summary.

MR. GEORGE W. BLUNT has issued a notice cautioning masters of vessels passing Hell Gate of the danger of collision with the vessel at work removing the obstructions at that point. He says: "It is a settled fact that masters and owners of vessels colliding with the contractor's tug and machinery at work over Frying Pan must make full indemnity for the damage done. It is also important, for public reasons of humanity, that collisions should be avoided, as large quantities of nitro-glycerin must be kept constantly on the spot, and liable to be exploded by the shock of percussion, which would be highly destructive to human life in case of collision." Mr. Shelbourne, the contractor, particularly requests the pilots of the Sound steamers to slow their engines in passing the point of his operations. Regular work on Frying Pan commenced on Monday, January 11.

SOCIAL SCIENCE ASSOCIATION.—The annual meeting of the American Social Science Association will be held in Albany in February, under the direction of the District Committee, among whom are General John Meredith Read, Jr., Chairman; Thos. W. Olcott, Treasurer; Charles E. Smith, Secretary; John V. L. Pruyn, William Cassidy, Jas. Hall, Erastus Corning, Hon. Ira Harris, S. B. Woodworth, John H. Reynolds, the Hon. Amasa J. Parker, J. H. Armsby, Benjamin Nott, Dr. S. O. Vanderpoel, William A. Rice, Dr. James McNaughton, R. L. Banks, Orlando Meads, John H. Van Antwerp, Geo. Dawson, Hamilton Harris, John F. Rathbone, and William H. De Witt. Papers will be read by General Garfield, John Stanton Gould, Professor Goldwin Smith, President Samuel Eliot, and other distinguished gentlemen.

THE New York "Journal of Medicine" says that Dr. N. Hickman, Demonstrator of Anatomy in the University of Pennsylvania, has met with a case of complete transposition of the internal organs in the dissecting room of the university. The apex of the heart is on the right side; in fact every organ occupies exactly the opposite side from what is natural. This may be cited as a good case of total (physical) depravity.

MELTING SNOW WITH SALT.—Persons are in the habit of sprinkling salt upon snow before their doors. They could not do a more silly or injudicious thing. The result is to change dry snow or ice at the temperature of 30° to brine at 0. The injurious effect of damp upon the feet at this excessive degree of cold is likely to be extreme. The practice is prohibited in this city.

ORANGES were frozen solid on the trees, at Augustine, Fla. on Christmas day. The weather was the coldest known in that locality since 1865. The thermometer at daylight stood at 20° above zero. It afterward touched 17°. In a climate where even white frosts are unusual, this was very severe. Last year, at the same time, the Florida ladies were dressed in lawns.

IT is said that the Sutro Tunnel has been considered by the Committee on Mines and Mining since the opening of the session, and a favorable report is expected. The plan has been somewhat modified. It now contemplates the guarantee of bonds by the Government to the amount $5,000,000, and the raising upon this basis $12,000,000 in Europe.

POLISHED PLATE GLASS.—A correspondent writes to know why polished plate glass is not manufactured in the United States.

Ans. Want of good material, cheap skilled labor, and capitalists to invest in a business involving a good deal of risk.

THE recent thaws have broken up the ice, and produced a disastrous freshet at Albany. Large quantities of grain have been lost, and the piers along the river front so undermined, that the buildings resting on them are insecure. Some have already fallen.

A CONVENTION has been held at Peoria, Ill., to consider the improvement on the Illinois river. It is proposed to seek aid from the State in addition to the appropriations made by the general Government to carry on the work.

A BOSTON paper asserts that a Portland mechanic has made a fine cambric needle which can be unscrewed, and contains in a hollow within another smaller one. This is a delicate piece of work, but by no means without precedent.

SIEMENS' FURNACE.—We are having inquiries about the above furnace which we are unable to answer. Parties interested will do well to advertise in our paper.

THE new suspension bridge at Niagara has been opened to public traffic. It is said to have the longest span of any bridge on the Continent.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

GAGE FOR SEWING MACHINES.—Mrs. Anna P. Rogers, Quincy, Ill.—This invention consists of an adjustable gage plate having a recess in its front edge, in which a presser pad, having inclined serrated grooves on its lower face, is arranged and connected to the said gage plate by an adjustable spring which governs the pressure of the pad upon the cloth.

RAILROAD CAR OIL BOX.—John C. Creed, Omaha, Neb.—This invention consists of an improved form in which the box and its cover are cast, whereby when the one is hinged to the other by a single pivot, a close-fitting joint is obtained without the expense of other finishing.

WATER ELEVATOR FOR STOCK.—D. J. Keller, Kane, Ill.—The nature of this invention relates to the elevation of water for the purpose of supplying stock. The general features of the invention consist of a hinged platform upon which the animal steps to approach the trough, and the weight of the former causes the platform, through the interposition of proper mechanism, to compress a water bellows which forces the water into the said trough.

EXTENSION TABLE.—G. S. Manning, Danville, Ill.—This invention relates to a new and useful improvement in extension tables, whereby the table is rendered much more convenient and useful than extension tables of ordinary construction. The invention further consists in so forming the table that the parts may be separated and a number of separate tables formed thereby.

OVEN.—Charles H. Finn, Syracuse, N. Y.—The object of this invention is to provide means for determining at all times the temperature of baking ovens, cooking stoves, and ovens in other situations; and it consists in attaching to the doors of such ovens a thermometer, in such a manner that the bulb of the thermometer shall be inside the oven, while the scale and tube shall be on the outside of the door or visible to the eye.

COTTON GIN.—A. A. Porter, Griffin, Ga., has just patented a new and improved cotton gin, which is said to be an important improvement. The invention consists in an improved arrangement of means for causing the cotton being fed into the gin to have a to-and-fro movement in a lateral direction, for bringing it more perfectly into contact with the saws, thereby more thoroughly separating the seed, and, at the same time, working the fiber evenly. Mr. Porter is desirous that planters should investigate and test the merits of his machine confident that his invention will be a benefit to them.

SMOKING PIPE MOUTHPIECE ATTACHMENT.—J. P. Courtney and William H. Kelagher, Brooklyn, N. Y.—This invention relates to improvements in smoking pipes whereby the salvia or liquid from the mouth of the smoker is prevented from entering the stem or tube of the pipe.

CARTRIDGE BOX.—John I. Pittman, New York city.—This invention relates to a new and improved cartridge box, designed more especially for holding metallic cartridges. The object of the invention is to obtain a simple and economical means whereby the cartridges may be firmly retained in proper position in the box, readily withdrawn from the latter as required for use, and the proper or usual number allowed to put into the box.

JOINTS OR CONNECTIONS FOR RAILWAY RAILS.—Charles H. Crosby, Boston, Mass.—This invention relates to a new and useful improvement in that class of joints and connections for railway rails, in which screw bolts pass transversely through plates placed at both sides of the rails and also through the rails.

STALK CUTTER.—R. B. Parks and J. R. Parks, Neponset, Ill.—This invention relates to a new and improved machine for cutting the standing stalks of Indian corn or maize into short lengths, so that they may be left upon the ground and plowed under, and cause no difficulty or trouble in the cultivation of succeeding crops.

FENCE.—J. J. Reicherts, Delaware, Ohio.—This invention relates to a new and useful improvement in fences for door yards and for all other purposes to which the same may be applicable.

GATE LATCH.—J. A. Martin, Strasburg, Pa.—The object of this invention is to provide a simple and effective gate latch which is not liable to get out of repair, and which supports part of the weight of the gate.

BLIND FASTENER.—Simon F. Stanton, Manchester, N. H.—This invention relates to an improvement in fastening window blinds (either closed or open), and it consists in attaching a semi-circular notched bar permanently to the window frame, and a spring bolt to the blind, whereby the blind is securely held either closed, or in any desired position when open.

PRESS.—J. Berkeley, Washington, Texas.—The filling and pressing chamber is divided into two parts, one of which is fixed to the wagon frame near the front end in a permanent manner, the other part to which the material is supplied to be passed, and which is provided with the follower, is arranged upon trunnions near the rear end of the wagon and is turned on the same with the rear end down to be filled; when filled it is restored to the level of the frame, and communicates with the fixed portion into which the material is forced by the follower, which is operated by a windlass and cords working over pulleys properly arranged. The sides of the fixed portion are arranged to open to discharge the bale.

DERRICK.—Angus Campbell, Downieville, Cal.—This invention relates to various improvements on derricks, whereby the operation of loading and unloading articles from and into ships, and other receptacles, can be greatly facilitated. It also consists in the use of a truck which slides on the boom, also in the application of an endless rope for bracing the boom without interfering with the motion of the truck, and without overstraining the topping lift.

COMPOSITION FOR THE CURE OF HOG CHOLERA.—W. B. Robuck, Oxford, Miss.—The object of this invention is to provide for public use a cheap specific for hog cholera.

GOBLET.—Thomas Leach, Taunton, Mass.—In this invention the bowl of the goblet is of glass and the standard of silver, or other metal, the two parts being connected by a screw joint, so that they can readily be taken apart, in order that, if the bowl should get broken, another may be inserted in its place, and thus a new goblet be produced at a comparatively slight expense.

GANG PLOW.—Wm. Mason, Independence, Oregon.—The object of this invention is to construct a simple and strong gang plow which can be more easily and conveniently operated than those now in use.

HAY AND COTTON PRESS.—Elias Evans, Montgomery, Ala.—This invention relates to that class of hay and cotton presses in which the bale is formed at the top of the press box, and consists in an improved apparatus by which the cover of the box can be swung out of or into place with greater convenience and dispatch than heretofore.

EVAPORATING APPARATUS.—Elijah Chitister, Chatham, Iowa.—This invention consists of a furnace arranged in three or more sections and provided with ways for sliding the pans transversely over the furnace, and provided also with suitable pans, which, after being charged with the liquid to be evaporated, are placed on the furnace and transferred from one section to another, where fires of varying intensity are maintained, in the order calculated to produce the best results.

PROCESS FOR BLEACHING IVORY, BONE, AND OTHER SIMILAR ARTICLES.—D. K. Tuttle, New York city.—This invention relates to improvements in the process of bleaching ivory, bone, and other similar articles, and has for its object to cheapen the cost and improve the quality of the articles bleached, and it consists in exposing the said articles to the action of light in a bath of spirits of turpentine.

HARNESS COCK EYE.—S. D. Bingham, Maumee City, Ohio.—This invention has for its object to furnish an improved harness cock eye, simple in construction, durable, easily adjusted, and which will diminish the cost of the construction of the harness very materially.

SEED PLANTER.—John S. Robb and Samuel P. Allison, New Cumberland W. Va.—This invention has for its object to furnish an improved machine, designed especially for planting potatoes, but which shall be equally applicable for planting all other seed requiring to be planted in hills or drills, and which shall be simple in construction and accurate in operation.

BURGLAR ALARM.—M. Pierson and M. D. Manville, Adams, N. Y.—This invention has for its object to furnish an improved alarm for attachment to doors, windows, drawers, etc., which shall be so constructed and arranged that it shall be impossible to open the door, window, or drawer to which it is attached without a continuous ringing of the alarm.

PLOW.—Samuel Prentiss and George Flint, De Soto, Mo.—This invention has for its object to furnish an improved plow, simple and durable, which may be used with equal facility for breaking up new ground, for plowing old or cultivated ground, or for subsoiling, and which can be run at a greater depth, with less draft than is possible with the ordinary plows.

LAND ROLLERS.—Neal S. McLay, Olathe, Kansas.—This invention has for its object to furnish an improved land roller, which shall be so constructed and arranged that the rollers may adapt themselves to rough or uneven ground, so that the entire surface of said ground may be suitably rolled.

CULTIVATORS.—John G. B. Gill, Chester Court House, S. C.—This invention has for its object to improve the construction of the cultivator known as the "Buckeye Sulky Cultivator," so as to make it more durable and more convenient.

IRON FRAME GATE.—W. F. Whitney, Milwaukee, Wis.—This invention has for its object to furnish an improved gate, which shall be light, strong, durable, simple in construction, and adapted to any situation.

WEIGHING SCALE.—S. S. Hamilton, Taylor's Falls, Minn.—The object of this invention is to provide a weighing scale which is simple, durable, compact, and not liable to get out of repair, and which will indicate with delicacy and accuracy the weight of the article weighed.

HYDRANTS.—Louis W. Werner, St. Louis, Mo.—The object of this invention is to provide a hydrant which is simple, effective its operation, and easily taken up to repair or clean out when occasion requires.

THRESHING KNIFE.—Henry Spaulding, Fletcher, Vt.—The nature of this invention relates to the form of the threshing knife usually affixed in the concave of threshing machines. It consists in forming the said knives with two cutting edges, and affixing the same to the concave in such a manner that the knives may be reversed to present a new edge when the other has become dulled from use, thereby enabling the machine to be run twice as long as when knives with only one edge are employed.

ORE CONCENTRATION BY CENTRIFUGAL FORCE.—S. F. Pearce, 32 Dey street, New York city.—The concentration of ores by a mechanical process, without the use of water or currents of air, has been successfully accomplished by the application of centrifugal force, acting on the ore (previously crushed dry by any method), and by which it is caused to fly off from a central point and fall freely into a series of annular receivers, by which means it is separated according to its gravity, the heavier particles falling further from, and the lighter nearer to the center. A sketch of the apparatus, with a description, will be given in a future number of this paper. Patent dated August 11, 1868.

FURNACE FOR ROASTING AND CALCINING ORES.—Ernst Westman, of Stockholm, Sweden.—This invention relates to a new furnace for roasting and calcining ores by means of gases that are produced by the combustion of suitable fuel; and the invention consists in such an arrangement of parts, that ore of suitable quality can be perfectly freed from impurities, and that the process can be quickly and conveniently carried on.

SAFETY ATTACHMENT TO CARRIAGES.—Claude Ducreux, New York city.—This invention consists in so connecting the operating lever with the brake and detaching apparatus, that either the brake alone, or both the brake and the detaching apparatus can, by one move of the lever, be operated. The object is to allow the same lever to apply the brakes of the carriage or wagon moves down hill or is drawn too quick, without necessitating at the same time the detaching of the horses.

SECTIONAL BUREAU.—Elias Gill, New York city.—This invention relates to a new bureau, which is so constructed that it can be readily packed together into a small compass when to be transported from one place to another. The invention consists in constructing the bureau of a series of sections or boxes, of which the upper ones are made smaller than the lower, so that each box or section can be packed into that immediately below. Each box has sliding or other doors in front or side, to allow access to its contents. The lower section is provided with a removable back or cover to allow the insertion of the upper boxes, while each of the upper ones may be entirely open at the bottom.

METHOD OF TEMPERING STEEL.—G. Davis, Elizabethport, N. J.—This invention relates to a new manner of tempering already completed steel or other tools and articles, and consists of a mixture of sand or other neutral substance, and water, which mixture is placed into a barrel or other suitable receptacle. The sand and water are mixed in such proportions that the required temper may be produced. The tool is heated to a red heat, and is then immersed in the mixture.

WATER ELEVATOR.—G. M. Atherton, Friendsville, Ill.—This invention relates to a new water elevator, which is so arranged that the crank handle can be turned continually in one direction, and will still operate to alternately hoist up one bucket and to lower the other; and which is further more so arranged that the little water remaining in a bucket cannot freeze the valve to its seat, and so that the buckets will be kept separated, and will be emptied in a certain desired place, and in one certain position.

KILN FOR BURNING FIRE-BRICK TILES AND OTHER ANALOGOUS ARTICLE OF MANUFACTURE.—Jas. Green, St. Louis, Mo.—The object of this invention is to provide a permanent kiln for burning fire brick tiles and the like with economy and facility, and consists in the arrangement of flues, fire passages, draft passages, stacks with other parts perfecting the whole.

SEWING MACHINE ATTACHMENT.—Mrs. Anna Rogers, Quincy, Ill.—This invention consists of an improved method of actuating an adjustable vibrating tuck creasing device and in the combination therewith in one attachment of an improved tucking gage.

COMPOUND LEVERS.—John Simpson, Marietta, Ga.—This invention has for its object to furnish an improved device for converting rectilinear into circular motion which shall be convenient and effective, and less liable to become set upon the dead point than the ordinary means for this purpose.

HYDROCARBON BURNER.—Louis Verstraet, Paris, France.—This invention refers to an apparatus for the direct combustion of any petroleum and other mineral oils, for the purpose of heating steam-boilers and other industrial and domestic fireplaces, and is intended to provide a special apparatus for burning the oils in a single jet by spreading them in a sheet on a furnace.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, an Extra Charge will be made.

Garrett & Brown, Manchester, Tenn., wish to correspond with a first-class miller, who can get permanent employment.

Wanted to purchase—the best machinery for manufacturing oat meal, pearl barley, farina, etc. Any person manufacturing this kind of machinery will do well to send circular and price lists to F. Van Seggern, Louisville, Ky.

Brass goods for plumbers, pipe fitters, and machinists. Phillips and Cluleys, Pittsburgh, Pa.

Manufacturers of reapers wanting the best grain dropper invented by a farmer, address the inventor, E. Myers, Creagerstown, Frederick Co., Md.

Cotton gin.—The latest improvement in cotton gins, patented Dec. 22, 1868, is offered for sale. For particulars address A. A. Porter, Griffin, Ga.

For paying investment see "screw wrench" in personals, No. 2, Vol. 20.

Wanted—a set of pulley patterns, diameter 12 in. to 48 in. Ordinary widths of face. Modern style. Napanoch Ax and Iron Co., Napanoch, N. Y.

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