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Improved Machinery for Planing and Molding Curved Forms.

In No. 24, Vol. XIX, SCIENTIFIC AMERICAN we illustrated and described two machines, manufactured by the Combination Molding and Planing Machine Company, designed to plane and cut moldings of straight or irregular forms with rapidity, exactness, and economy of material. In this number we present views of two other machines involving the same principles, and manufactured by the same concern, who claim to the proprietorship of no less than sixteen patents on wood working machinery. The one represented in Fig. 1 is called the Elliptical Molding Machine and is intended to "stick" or cut moldings of an elliptical, or oval, circular, or sinuous form. Its parts are simple and direct in operation; it is adapted to all thicknesses of stock and every variety of pattern. The cutter shaft is horizontal, and the projecting end in front is adapted to receive a number of cutters of different forms, which may be almost instantly adjusted to cut to any depth required. The work to be cut is held and guided firmly and accurately by means of feed and friction rollers in combination with vertical guides which keep the work down to the table by means of adjustable weights.

The engraving is so exact and clear in its details that a mere reference by letters to the principal parts will be sufficient for a proper understanding of the principle and the operation of the machine. The cutter shaft is driven from the pulley, A, on the horizontal shaft that receives power on the pulleys, B, one fast and the other loose. A belt from this shaft is received on a back intermediate shaft, C, from which a quarter turned belt is led on to an upright shaft, D, that in turn, by a similar belt, rotates a horizontal shaft under the working table. This shaft by means of a worm engaging with a gear on an upright shaft drives the feed roller which is set with spurs or teeth, that engage with a perforated metallic strap secured to the pattern on which the piece to be molded is fastened. This pattern with its piece is held to the feed roller by means of two friction rollers revolving on studs that are secured to a sliding piece in the table. They are held against the pattern by means of a weight, E, and can be disengaged instantly for the release of one piece of work and the reception of another by means of the lever, F. The handle, or crank, G, is used to raise or lower the table and its appurtenances by means of a worm, gear, pinion, and rack. The hand wheel, H, turns a screw that moves the head with the cutter shaft forward or back. The weights, I, serve to hold the work to the table, having on the lower end of their shafts horizontal guides for this purpose, which may be adjusted by means of nuts engaging with the threads on the upright shafts.

Fig. 2 represents the Universal Molding Machine, and is a combination of the Variety Molding Machine illustrated in No. 24, Vol. XIX, and the machine just described. It is intended to subserve the purposes of both these machines in establishments of limited capacity. The principles involved, and the operations are the same as those of the other machines, except that it may be used with horizontal or vertical cutter shafts at will. The engraving shows one upright cutter head projecting above the main table, as in the Variety Molding Machine, and another in a horizontal position, as in the Elliptical Machine. This latter cutter, can, however, be turned to an upright position and be made to perform the same work as the cutter head in the Variety Machine. The method of holding, guiding, and feeding the stock, of elevating, depressing, or adjusting laterally the table and cutter heads is the same as before described for the other machines, with this difference: that the working table corresponding to that of the Elliptical Machine is supported on an independent pedestal, so that when not in use, and the room it occupies may be wanted for other purposes, it may be removed. This table can be elevated with its superincumbent work and parts by means of the hand wheel seen in front, a worm, gear, pinion, and rack. The support of the main table is a single casting, very strong, and so constructed as to allow plenty of room for the action of the belts, and yet give a very firm foundation. Letters of reference are deemed unnecessary in describing this machine.

These machines, together with the Grosvenor Saw Bench, illustrated and described in No. 3, Vol XIX, form a set of tools with which all kinds of straight and curved moldings may be produced with a great saving of labor and time. They are manufactured by the Combination Molding and Planing Machine Company, who may be addressed at No. 424 East Twenty-third Street, New York.

Fig. 1

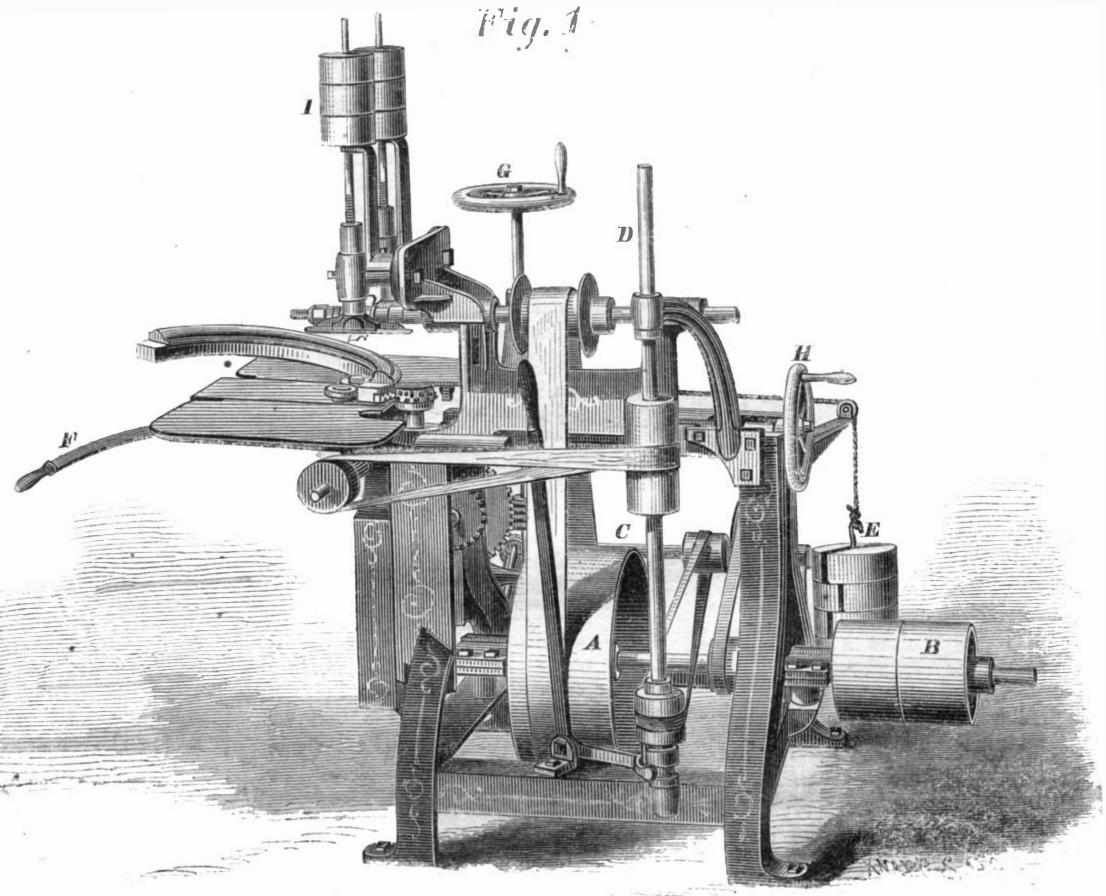
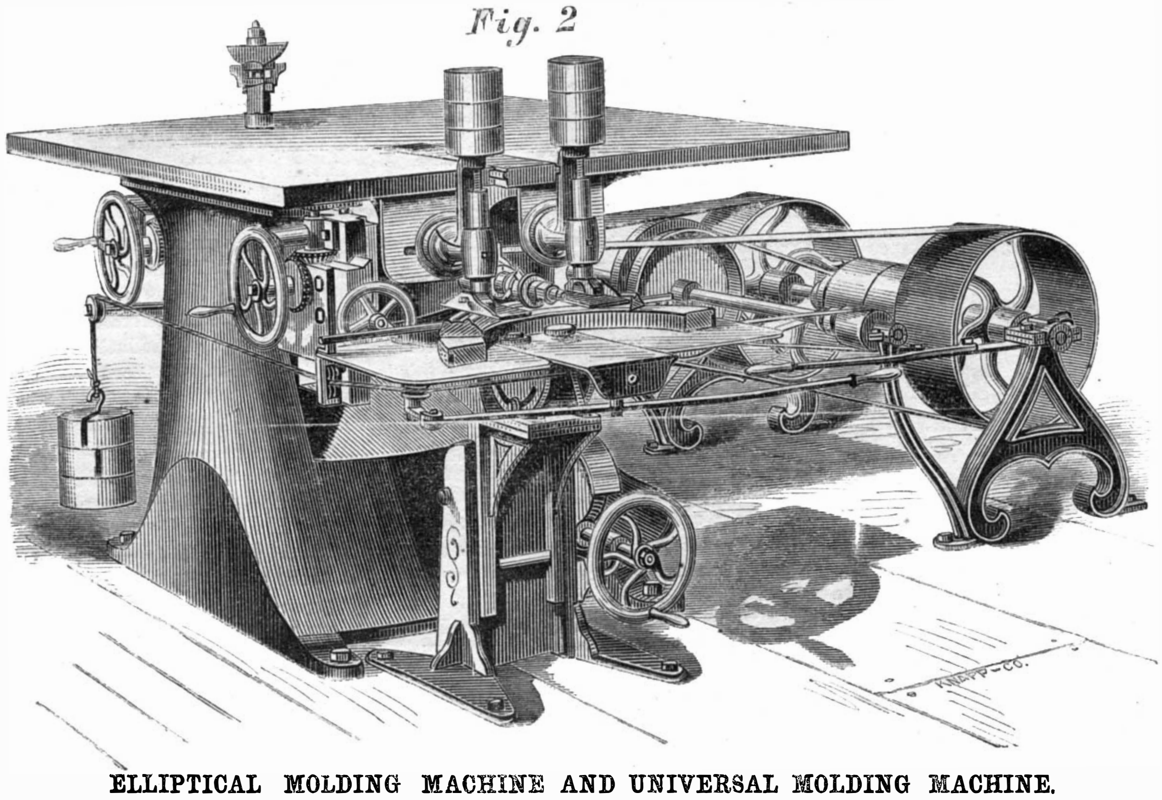


Fig. 2



ELLIPTICAL MOLDING MACHINE AND UNIVERSAL MOLDING MACHINE.

THE EVILS OF PAINTING, AND THEIR REMEDY.

It has been said, and with much truth, too, that "House-painting might, with study, and acquirement of correct taste and more extensive information, resume its rank as a liberal art." There is no reason why it should not. It is an art, and should be recognized as such, and will be when the painter shall have sufficient interest to do something more for its elevation. It is at a low ebb at present; for, while the various other branches of the fine arts have their elaborate volumes of reference, and art journals of deep research and investigation, and latest discoveries and improvements, for the benefit of their artists, the house and sign painter and the grainer are left to their own resources, to catch what they may by individual experiment and the careful observation of their own mistakes.

Though America may boast of many excellent painters, who may not be excelled on the earth, yet they are almost lost amid the vast multitude of ordinary, indifferent, and miserable ones. The long apprenticeship and practice of the former seem almost thrown away, for they stand a very little better chance, in the aggregate of success, than others who have spent little or no time in the study of the business. A poor workman can and will work cheaper than a good one; and, consequently, competition comes into service, and the finished workmen are obliged to learn their trade more thoroughly, that is, learn the art of slighting, before they are able to cope with their competitors, and obtain, like them, an honest living. This spirit is caught up by the employer, and, in the rage to get everything cheap in this go-ahead age, the lowest bidder, without regard to quality, too often gets the job; so, many good and poor workmen naturally fall into that uncertain and unsubstantial manner of doing work that characterizes all the sham, slop-shop works of decorative art. It must be understood, however, that these remarks have only a limited reference, for there are both painters and employers who well understand these practices, and whose correct taste—and liberal pockets—keep them mindful of the purity of the art of decoration. And, in justice to the inferior workmen, it may be remarked that it is not so much a fault with them as it is a want of facilities for learning. There are no published books of any utility; and then painters are very chary of their knowledge, and do not like to impart it too freely.

There should be a remedy for this evil, and there can be. Painters should be more communicative, and not so tenacious of whatever superior method they may have acquired or discovered. It is quite a mistaken idea that one's business would be injured by discovering the secret of a superior method to his brother painter. If all this secret knowledge was more generally diffused among the craft, the benefit would be mutual. Knowledge should not be monopolized, but should be imparted to all alike, and all alike would be benefited. A better style of work would be the result of such a reciprocity, and better prices would be realized (which is a feature devoutly to be wished by a class of painters, who, as a whole, are no more than half paid for their labor, in a vocation so deleterious to health). It would require more time and labor, and just as many hands be employed, and the trade would then be worth learning.

However, one is not to blame, if he has made any discovery which has cost him time and money, should he wish to keep it a secret, or patent it, until he can make his money out of it; yet in all minor matters, it is not only neighborly to instruct one another, but is really an honor to the craft.

The art of painting, in all its various branches, is, perhaps, under present regulations, quite as injurious to health as almost any other branch of mechanical business, especially house and general shop-painting.

It is supposed that painters, in the aggregate, pay an interest on their life of about twenty-four per cent.; that is, they shorten their lives about two months every year for the privilege of following the noxious business, and getting a taste of the colic every other moon. In fact, it is statistically true that the average lives of painters do not come up to the average standard of longevity.

It is well known that painting is an unhealthy business; and to such an extent is this prejudice abroad, that it is with difficulty, in some places, that master workmen can procure an apprentice.

The house-painter is much more exposed, and liable to the poisonous effects of colors, than those who follow other branches, on account of the large quantities of vapor exhaled from lead and the arsenious greens, especially that most brilliant but deadly color, emerald green. This poisonous color, as all arsenious preparations will, gives out exceedingly large quantities of vapor, the inhalation of which very suddenly show itself, and is quite often mistaken for some other disease, and frequently, by physicians, so treated. It causes inflammation of the throat and lungs, and produces, in different parts of the body, small watery pustules, which are exceedingly troublesome. We have known painters to be so afflicted with this affection upon their breast, groins, and armpits, that they were unable, for several days together, to move a limb without great inconvenience and pain.

In England, where much more of this green is used, it has been ascertained from actual observation, and the experience of physicians and other scientific men, that a series of diseases the most complicated have resulted from having the walls of houses washed, painted, or papered with arsenious greens. Cases have been known where whole families have been poisoned by living within the walls of such houses.

Copper, arsenic, and lead are exceedingly volatile, and those persons immured within the walls covered with them are so perfectly enveloped with the vapor arising therefrom that they are continually inhaling it, greatly to their detriment.

A very singular case (and a remarkable and unmistakable evidence of the noxious effects of arsenious vapor) occurred in England a few years ago. A family, a short time after moving into a certain house, were taken suddenly and violently sick. A physician was sent for, who pronounced it a case of poisoning from arsenic. The patients were relieved, but lingered on for some time, and finding they did not recover their health, left the building. Another family moved into the tenement, and were attacked in like manner; still other persons occupied the rooms, and the same results followed, until, at last, it was alleged that the house was haunted, and Madame Rumor set about making up the legends. But science eventually got hold of the matter, when, by investigation, the premises were known to have formerly been occupied by painters, who were accordingly called upon, when it was ascertained that previous to leaving the house they had buried a large quantity of refuse arsenic three feet deep, in the bottom of the cellar. The deadly drug was removed, and people were no longer haunted with this arsenious ghost.

Almost every painter is familiar with the noxious effects of lead, especially when cooped up in a close room, with *drawn flatting*, and perhaps the keyholes stopped up. Few there are who can work three hours thus, who will not, on coming to the fresh air, almost immediately fall, or stagger as though they had imbibed something of a different nature from turpentine. This part of the business will soon produce the painter's colic, and eventually paralyze, unless much care be taken to guard against it.

In England, benefit has been experienced in cases of painter's or lead colic, both by those who manufacture and those who use white lead, in the use of sulphuric acid in very small quantities. One way of using it is to put one dram of acid into ten pints of table or spruce beer, or mild ale; to shake it up well, and allow it to stand a few hours. A tumbler-full twice or three times a day is used. Another way, not so convenient, is to make the beer as follows: Take of molasses, 14 pounds; bruised ginger, ½ pound; coriander seed, ½ ounce; capsicum and cloves, ¼ ounce each; water, 12½ gallons; yeast, 1 pint. Put the yeast in last, and let it ferment. When the fermentation has nearly ceased, add 1½ ounces of oil of vitriol mixed with 12 ounces of water, and 1½ ounces bicarbonate of soda dissolved in water. Fit to drink in three or four days.

The painter is often asked what the painter's colic feels like. He could not, probably, describe it better than to say to those who do not wish to try the experiment, that if the strands of a rope, while being twisted together, should be passed through the bowels horizontally, and the whole abdominal viscera be twisted with it, a faint idea might be formed of the lead colic.—*Haney's Painters' Manual.*

Another Solar Engine.

The London *Scientific Review* announces that similar researches to those made by Capt. Ericsson, announced some weeks since in the SCIENTIFIC AMERICAN, have been made by Prof. Mouchot, at Tours in France. It further states that Prof. Mouchot took out a patent in March 1861, for an apparatus of this description which he allowed to lapse. However, in 1864, he constructed a solar boiler on the same principle which worked at Mendon with satisfactory results. On the 2nd September, 1866, he brought a machine of this description to the palace of St. Cloud that it might be seen at work by the Emperor. It was a small steam engine worked by a solar boiler, but the bad state of the weather interrupted the experiment. A little later, however, the Emperor having gone to Biarritz the machine was taken thither and the experiment succeeded. Since that time M. Mouchot has contrived various kinds of apparatus on the same principle for cooking meat and vegetables, distilling spirits, baking and latterly steam and hot air engines. Prof. Mouchot also announces a work upon the subject in preparation and soon to be in press.

THE PRIMEVAL FLORA---LECTURE BEFORE THE AMERICAN INSTITUTE, BY PROFESSOR DAWSON.

Reported for the Scientific American.

The above topic formed the subject of a very interesting lecture by President Dawson, of McGill College, Montreal, at Steinway Hall, in this city, on the evening of the 23d December. Notwithstanding the lecture embraced altogether too wide a field for anything like thorough treatment, the happy style and popular method adopted by the lecturer, made it very acceptable. After the usual introduction of the lecturer to the audience, President Dawson said: An eminent authority has defined geologists to be a class of amiable and harmless enthusiasts, who are happy and grateful if you will only consent to give them an unlimited quantity of that which, to them, has, perhaps, the most value of all things, namely, past time. I confess to this definition of geologists, so far as my subject this evening is concerned, for I shall have to make a large demand upon your faith as to the extent of the past time, and shall have to ask you to give me all of it which you reasonably and conscientiously may. Geology, indeed, works strange revelations in our view of things, new and old. The primitive forests, and even the gray rocks and hills themselves are things not primitive and unchanging, not things, comparatively, of yesterday, the successions of olden forests and olden rocks that in dim and ghost-like procession recede from our view into the past of an antiquity, compared with which all human antiquities are things of yesterday. The murmuring pines, and the hemlock, bearded with moss and in garments green, indistinct in the twilight, may stand like Druids of old with voices sad and prophetic; but they belong not to the forest primeval of the earth's younger days, though they may point backward to perished predecessors of truly old date, truly primitive and geological antiquity. It is to them that I must try to carry you back in imagination this evening, to awaken those slumbering ages and make them green again in your eyes and vocal in your ears. Transferring our thoughts to these old forests, and imagining their strange fantastic forms, and the singular creatures that lived beneath their shade, we shall find ourselves in a new world different from that which we inhabit, and differently peopled. Could we marshal in one view four or five planets, each clothed with the peculiar flora, and inhabited by the peculiar fauna of a distinct geological period, we should truly have before us so many distinct worlds with nothing to connect them with each other save only certain similarities of plan and conception. But when we view these several worlds as successive, and destined the one to prepare the way for the other, we can perceive relations of the most remarkable and unexpected character, and have presented to us a long protracted scheme of creation too vast to be contained on the surface of our planet at any one period, and representing with our present flora all the possibilities of vegetable existence, and all the uses, present and past, which plants can serve. I have selected as the subject of this lecture one small department of the vast field of fossil plants, a department of peculiar interest as relating to the oldest known plants, and which, as a special and favorite study of my own I must endeavor to make attractive to you. But I must not rest contented with this, but in justice to the subject must try also to present it in an orderly and systematic manner. I must endeavor to give you something like a connected sketch of that primeval flora which is the subject of this lecture; and in order to do this, I must first say a few words on the relations of their primeval flora to existing plants; 2d, I shall say something of their relations to the geologic time; 3d, I shall enter upon the subject proper by describing to you some of the more remarkable plants that flourished in that primeval age; and, 4th, I shall conclude with noticing some of the uses of this primeval flora to us, the practical use it serves to our present race; and I shall endeavor to give you, if possible, some idea of the light which geology gives us as to the first appearance of plants on our planet, and how far back they can be traced in geologic time. First, then, I shall speak for the benefit of those who may not have pursued the study of botany, of the relations of existing planets, and the relation of the fossil flora to them. Taking the whole of the plants known to us, we shall find upon examination that they may all be divided into two great series; first, that series of plants in which we observe distinct flowers, and fruit containing seeds. These constitute the phenogamous plants of the botanist. Then we have a great class of plants of a lower and humbler organization, which are destitute of true flowers, and which instead of producing seeds, produce granules, performing the functions of seeds, called spores. These are the cryptogamous plants of the botanist. The whole vegetable kingdom is divided into these two great classes. Now, taking first the phenogams, we shall find three classes of them. We have, first, that group of plants to which all our trees and shrubs and the greater part of our cultivated plants and weeds belong—the exogens, which have a distinct pith, and wood, and bark

Then we have a class in which these features are more or less mixed through the entire structure, and in which there is little distinction of wood and bark, and of which the palms of the tropics and the grasses of our own latitude are examples. These are called endogens. A third class are the gymnosperms, which have naked seeds, specimens of which are the well known pines and the sago of the tropics. Thus, to recapitulate, we have three groups of the phenogams, of which the oak or maple, the palm, and the pine tree, are respectively representatives.

In the cryptogams we may also make a three-fold division respectively represented by the ferns and club mosses, the common mosses, and lichens, fungi and seaweeds.

Next let us see what relation these primeval flora bears to that of modern times. Two relations are possible: First, that the primeval flora may belong to a different classification altogether; and second, which is the true supposition, that the whole flora of the earth, from the earliest geologic times, comes under one classification. This shows that, from the beginning of geologic time, one plan has been followed out in the construction of the vegetable kingdom, and that the whole vegetable kingdom consists not of the plants now living upon the earth, but includes all the plants that have ever lived upon it. Again, there is another possibility, that the primitive flora may include representatives of all our modern classes of plants, or only some of them. The fact is, that it includes mainly representatives of some of them, and those of a medium grade, neither the lowest nor the highest, so far as the land flora is concerned. The fossil plants are not chiefly exogens or endogens, but gymnosperms. On the other hand the acrogens, or the highest group of the cryptogamous plants in our day were then the most abundant. The primeval flora, therefore, embraced the higher cryptogams and the lower phenogams. If we had known nothing of vegetation but that manifested by the primeval flora we should not have known the possibilities of the vegetable kingdom, either in its highest ranks or its lowest ranks, but only in the middle of the scale. Next let us glance at the relations of the primeval flora to geologic time. The oldest rocks we know, the eozoic, have afforded no plants, so far as we know, at all. The next stratum, the paleozoic, includes the oldest land plants we know. But in the mesozoic period we arrive at a different flora, and in the cainozoic, or modern period, we have two other floras. It is the paleozoic flora only of which I shall speak to-night. During the whole of the paleozoic period, the seaweeds have existed. In the earlier periods the classes of acrogens and gymnosperms far exceeded the exogens and endogens, while the reverse is the fact at the present day. The warm and moist climate of portions of the southern hemisphere at the present day, now have a flora more nearly resembling the early epochs than any other portions of the earth. The uniformity of the flora of that early period indicates a temperature nearly uniform throughout the earth. At present we have in our atmosphere but a small quantity of carbonic acid gas. If we had more, it would tend to make the climate more uniform, by preventing the radiation of heat from the earth. The carbon locked up in our coal mines, and then existing in the atmosphere, may therefore have been at least one reason for the uniformity of climate on the earth in the paleozoic period, the flora of that day indicating a warm and moist climate. Next, looking to the flora of the plants, we will turn to the carboniferous period, when there was a vast amount of vegetation, afterward made fossil and becoming coal. In that moist, warm, but unwholesome atmosphere, we find the sigillaria, or seal-tree, one of those most abundant in the swamps of the carboniferous period. Here we have a large tall stalk, without branches, covered with large leaves; or perhaps divided into a few branches. We have remains showing the ribbed structure of the stalk, and the scars of the leaves. There are no trees in our latitude resembling it in structure. We know of the fruit of the sigillaria only by the abundance of a certain nut that is found around them. Trees of two and three feet in diameter were not uncommon. The root of this tree is more remarkable even than its stem, having attracted the attention of geologists before the stem, and obtained the name of stigmaria. These roots are bifurcated and spread out in a remarkably regular way, all the little rootlets spreading as regularly as leaves. These roots occur very often in the coal formation without the stems; and at first it was supposed that they were the whole of the plant. The first process in the formation of a bed of coal was usually the growth of a forest of sigillaria.

The next class are the calamites. The lecturer here related an anecdote of an unlearned individual who having been shown some specimens of ferns and calamites, the former being called filices, reported to his friends that he had seen the savant's "felicities" and "calamities." In one sense the calamites may be justly styled calamities, for they had been the subject of more dispute on the part of geologists perhaps than any other fossil plant. They seem to have grown on muddy flats along the margin of the sigillarian woods, resembling equiseta or mare's tails; and they are still preserved in coal formations in large numbers. The calamites seem to have preserved the sigillarian forests from the effects of inundation, by causing the mud to settle before the waters passed into the forests. The calamites thus contributed very much to the purity of our coal beds. The next plant is the lepidodendron, or scale-tree, of a size equal to the sigillaria, resembling our ground pines or club-mosses. This tree was more plentiful in the earlier coal formations than in later periods. Many other diagrams and petrifactions of fossil plants were here exhibited. The plants of the carboniferous period would have presented to our eyes a very monotonous appearance; for it was characteristic of the flora of that period that there was a large number of species, but few genera. There were also some plants more familiar to our eyes. The ferns are to be found in the coal beds preserved as beautifully as they could have been preserved in an herbarium. They resembled more closely the ferns of New Zealand or the Hebrides than the ferns with which we are familiar. Some of these ferns grew to the dignity and beauty of the palm-tree itself. One species was peculiar, having only two leaves at a time. We find sometimes in the coal-beds things looking like enormous brooms, which are tree ferns, with roots sent out to straighten the stems. We also find in the coal formation varieties of pine, the wood of which much resembled our modern pines. It is remarkable that the pine is widely diffused at the present day; and it is not wonderful, therefore, that they should have existed in the carboniferous period. Those pines have features more nearly resembling those of Australia and New Zealand than those of our climate. When wood is buried in the earth and its cells filled with water holding silica or lime in solution, they become filled with stone, and the wood becomes coal; and this is the form in which we find these fossil remains. By removing the mineral we can observe the vegetable structure of the plants, and determine their character. Next to the soil on which we tread, the most valuable substance we have is mineral coal, which is derived from the plants of the carboniferous period. A bed of coal is usually composed of the remains of the trunks and bark of sigillaria trees. Examining coal with a microscope, after proper preparation, we can see the structure of the wood from which the coal was derived. Of eighty-one distinct seams of coal in Nova Scotia, every one but two or three had sigillaria, either in the coal or immediately above or beneath it. The top of a coal seam is merely the debris of the last forest that grew on this swamp where the coal was produced. Great Britain annually consumes 100,000,000 tuns of coal, and we know of nothing that will supply its place. The consumption of coal in America is already equal to the labor of 150,000,000 horses, and our coal beds are as yet hardly opened. All this power is extracted from the sunbeams of the paleozoic period. (Applause.) What did these magnificent forests grow for? There seem to have been no higher animals to enjoy them. We know of no birds that lived among their branches. We know of a few insignificant reptiles that crawled beneath them, but we know of nothing higher in that age. What were they created for? For two great purposes. First, to purify the atmosphere so that it might be made suitable for the higher animals that were to live in a future geologic period; and that very process of purifying the atmosphere was made the means of laying up those enormous stores of fossil fuel upon which so much of our modern civilization is based. See how grand are the economies of nature, preparing far back in geologic periods before man existed, for the existence of the present state of the arts in the world. Next to coal in its value comes iron; and although we are not so dependent upon the coal formation for iron as we are for coal, still we get an immense quantity of iron from the carboniferous rocks, accumulated by the agency of these very plants; for as they went to decay, and were converted into coal, they helped to gather together the particles of iron out of the clays and sands, and to store them up for us in iron ore. Therefore we owe to the growth of those old forests not only our coal but a large portion of our iron. And whether we look to the value of the coal in boiling the teakettle, of which Prof. Silliman spoke to you in the last lecture, or to the use of the iron which makes our iron horse, and the steam engine of our factories, we owe it all to the primeval plants, or rather the Maker and Creator of these old plants. Now let me trace these plants a little further back than the period of the coal formation. If we go back from the carboniferous rocks to the Devonian, we shall find a different flora, which no doubt helped to purify the air, and prepare the world for the carboniferous flora. We have in Canada a bed of coal two or three inches thick, belonging to that epoch, and it is the only one I know in America. In this drawing, some of the plants of that period are represented; and here you find the sigillaria, the lepidodendron, the calamites, the pines, etc., as in the later period; so that you see that the Devonian flora was really not very different from that of the carboniferous period. The species are mostly different but the generic forms are the same. As a whole the Devonian flora may be characterized as less massive and magnificent, more delicate and slender in its proportions; not less beautiful but less useful perhaps in the accumulation for us of vast stores of fuel. If we go down below the Devonian rocks into the Silurian, we find a few plants; but in the lower Silurian formation we hardly find any traces of plants. Nearly all the rocks known to us of that age were marine rocks. Prof. D. was not hopeless of the eozoic period even. We have as yet found no plants there; but we have found carbon. We have found plumbago; and even in later formations the remains of plants have sometimes been converted into black-lead in the eozoic strata, occurring in beds, so as much to resemble the remains of plants. They have been sea plants. If they were land plants we may guess what they were—anophytes and thallophytes, gigantic mosses and gigantic lichens. If we were to walk among those ancient forests of mosses, if they really did exist, we should be in a world something like what this would appear to an insect creeping upon the mosses of our woods. I have given you but a faint outline of a great subject, on which treatises might be and have been written, which would afford the material for a course of lectures more interesting than a single one can possibly be. The chief interest of the subject, no doubt, is to the botanist and geologist. The vegetable kingdom now is most beautiful and most varied, especially when we look at it as presenting forms of plants adapted to every climate and every situation upon earth, all of them finding their proper place and their own due season. But the subject before us carries us back into geologic times, and shows us a plan too large to be realized on one earth.

The plan of the Creator was so vast that the whole surface of the earth was not big enough to hold it. It required a series of earths, one after the other, to develop it, just as it has required a series of ages to develop the history of the human race. We have in these old plants something that adds enormously to the variety of the vegetable kingdom; something that shows us how small is our own knowledge, and how great and capable of extension is the plan of the vegetable kingdom. And when we consider further that we know of these fossil plants only what their remnants have taught us, it affords a widening field of wonder and of thought. As it is more interesting to the botanist to go out and collect plants for himself than to study them in the class books, so this subject is of the deepest interest to those who will examine the primeval flora and the coal formations; who will split open the rocks and see the forms that no one ever saw before, and perhaps make discoveries of facts which the world never knew before concerning that remote period of time. I must plead guilty as a fossil botanist—I mean a botanist studying fossils [laughter]—to having the deepest interest in this subject. And it arises in part from the very fact that different names are sometimes given to the same plant—as the tree is called sigillaria, the root stigmaria, and the nut still another name; and it requires much observation and study to discover and to show that these different names all belong to what was really one and the same plant. As our knowledge increases we may be able to dispense with many of these old names, which is more than can be said for modern botany. What would we have been without these old plants, without this great provision made for us in primitive times before man existed upon the earth? These plants form a part of the same plan to which we belong, and undoubtedly that plan existed at the time these old paleozoic plants grew. And now, I may say, even in this Christmas time, as we gather around the hearth, although our coal fire does not burn, and cackle and blaze like the old yew log of our ancestors, yet the trunks of our old sigillaria, burning upon our hearths to-night, send forth a quiet, kindly look, befitting their great age and long burial in the earth. And the happy hearts that gather around the Christmas fireside may thank God that we have had these great stores prepared for us in the times of old, and that we have hearts and minds fitted to enter somewhat into that great plan which stored them up, and for the enjoyment in a measure, even of the beauty of the plants that lived so long ago.

THE EVOLUTION OF THE NORTH AMERICAN CONTINENT---LECTURE BY PROFESSOR HALL.

Reported for the Scientific American.

The above was the subject of a lecture by Professor James Hall, State Geologist of New York State, before the American Institute at Steinway Hall, New York City. The lecturer was introduced by Judge Daly, who referred to the interesting character of the preceding lecture, delivered, as he said by a distinguished Canadian geologist. We shall to-night have the pleasure of listening to a distinguished geologist of our own State, whose reputation, however, is not limited to our own state or the United States. His reputation will be perpetuated by that noble monument, the Natural History of New York, published under his scientific supervision, and of which more than one fourth is the work of the speaker who is about to address us. It is not too much to say that this great work is unequaled by any similar work in existence not comprising a greater area of the earth's surface.

In reply to the complimentary introduction of Judge Daly, Professor Hall said: I am unprepared to say a word in response to the complimentary introduction of your president, but I will say as an adopted citizen of the State of New York, that the natural history of the State is a monument of which, in succeeding generations, every man, woman, and child will have reason to be proud. It has been carried on many years, amid many conflicting circumstances. For the humble part I have had in the work, I have had many pleasures, many griefs and sore trials. But when these are all past, those that follow will reap the benefit of a work that has developed more of natural science than any other American work; which was, in fact the earliest development of natural science upon the American continent

Professor Hall then proceeded to the discussion of the topic of the lecture, the evolution of the North American continent. The lecturer made such frequent references to diagrams upon the blackboard and to charts, that it is impossible to give in a printed report, without diagrams, the arguments by which he sustained his propositions. We shall therefore limit ourselves to an outline of the lecture, giving as far as possible the order in which the continent was evolved as stated by the speaker.

A period existed, ages upon ages ago, when the surface of the earth was entirely covered with water. Under this universal ocean the solid nucleus existed, and by gradual cooling of the earth's crust or by other causes, upheavals took place. These upheavals occurred first at the northern portion of the globe, and extended until a portion of dry land of the so called granitic formation extended down as far as Nova Scotia—at that period an island—and to the great lakes, and westward nearly to the Rocky Mountains. The whole of the continent remaining is formed of sedimentary deposits from the currents which existed in the ocean then as now, layer upon layer of different periods and characters, many of which are from thirty to forty thousand feet in thickness.

Upon every portion of the surface of the earth, we have mountain chains, plains, and valleys; and we have rocks, loose materials, sand, pebbles, gravel, and other materials of that kind, which are distributed over the surface. These are distributed, not regularly, but according to certain laws, which have prevailed in all geologic time. This pebble, for example, which I have before me, has at one time been an angular fragment of rock, broken from a rock which had itself been, at a still earlier time, a loose mass of sand. It has been consolidated. It has become rock. It has again become broken, and these pebbles have been triturated by the motion of the water, the action of the sea, or of rivers and streams, until they have been rounded, the corners worn off, the finer materials being gradually worn away and disappearing, being reduced by the water to an impalpable condition beyond our reach. The harder particles of material like this makes the sand which strews the sea beaches every where. The sand was not from the breaking down of sand stone, but from the breaking down of materials containing sand. While the finer and more impalpable portions have been widely separated, the harder portions, which are a silicious sand, remain to make sea beaches and river beaches. In this respect nature is constantly active. There is no moment of time when this process, this degradation of the surface of the globe is not going on. During every shower, or if you will go back to the first of all this, the evaporation of water by the action of the sun's rays, in the ocean and upon the surface of the earth, lifting it into the atmosphere and precipitating it again upon the surface, transfers the loose materials into the smaller streams, thence into rivers, and thence into the ocean where they are spread out evenly from the facility of their transportation by currents, the coarser materials being first deposited, and then the finer. And the action of the frost annually prepares these materials for the subsequent action of the rain. The water percolating into the crevices of the rocks, freezes, and by its expansion in freezing separates them, until, year by year, more and more of the rocky mass is broken down, and the material prepared to be transported by the rain storms into the ocean.

The continent has been produced step by step during several geological formations; it has never been elevated above the ocean as an entire continent; it has been produced from sediments which have been made by the distribution of materials from pre-existing continents, pre-existing materials lying above the surface of the water. In the northern portion we find the earliest continent, and the breaking down of its materials has given us the silurian, devonian, and carboniferous formations. Constantly have the materials of the land, during all the period subsequent to the carboniferous, been carried westwardly and southwardly, and spread over that portion of our continent. And then, subsequent to this, all this portion of our continent has been elevated. The North American Continent, so far as it is known, although there have been numerous minor oscillations, has had three great phases: First, that in which this portion of the continent alone was above the sea (indicating the northern portion upon the chart); second, that in which the continent extended southward to this second line; and, third, that in which the whole of the western and southern portions have risen above the sea. In each of these epochs there have been distinctly marked the characteristic conditions of ocean and of dry land, indicated by fossils in immense numbers; so that we are able to trace step by step, in each one of these geological formations, each thousands of feet in thickness, not only the characteristic fossils of each successive bed, but we can easily subdivide them. So that in this portion, from the base of the silurian to the devonian, we recognize 20 or 30 different epochs, each marked by its characteristic fossils, with its fauna and its flora as distinct as upon the shores of the country at the present time. Taking the shores of the United States at the present time, and observing the number of animals living along the coast, we have that repeated some 20 or 30 times in this one epoch; each of these having been superseded by and given place to another, and so on in succession, during the silurian period. When we consider that these various animals have lived and died, that each has occupied its place for successive generations, for we do not know how long a time, when we consider that this country has been covered entirely by subsequent deposits, and other creations have taken their place, and so on, while accumulations hundreds of feet thick have been spread over them, when we remember that hundreds, and even thousands of these animals have lived and died, perhaps in each of those 20 or 30 subdivisions of the time, and thus on fauna after fauna, and flora after flora, through all these epochs, you have at last an incomprehensible number of generations of animals, a result which could only have been reached by a process carried on for an infinitely long period of time. One point which I have endeavored to impress upon you is that while this has been going on, there has been, so far as our own continent is concerned, a constant evolution of dry land. If we begin at the latest period, and go backward through these periods, you have in them all the distinction of ocean and dry land, the latest land being formed from the sediment distributed by the ocean, until at last we trace back the continent to the time when it was included within this area (indicating the northern portion). But we have nothing thus far of the original crust of the globe—nothing which geology can tell us of a nucleus which has been of melted matter. Still further north is a portion of the continent we know very little of. It is possible that this may be of older rocks. We know that there are older rocks that are stratified rocks, not only on this continent but on the continent of Europe; but we have no evidence that there were ever any rocks earlier than the sedimentary rocks. The granite of the Rocky Mountains is as much stratified as that of Northern New York; and wherever these strata are found we know that they have been deposited by water. Even in the old Laurentian rocks, those granite rocks of the North, there are same portions of the rocks containing pebbles derived from pre-existing stratified rocks. When we know that in the old sienite of the northern portion of this country we have pebbles which are stratified, like that which I hold in my hand, showing the remains of sediment, particles of sand transported to another place, and there becoming rock previous to the deposit of the materials which have been converted into gneiss, sienite, and granite, we know that there must have been other stratified rocks older than our granites, previously existing and broken down, pebbles from which were transported and imbedded in the sediments now constituting those oldest known rocks. So that we go back not only as far as we can absolutely see the rocks, but still farther, and we demonstrate that there are still earlier periods, when there were deposits of rocks yet to be discovered by geology, earlier than the earliest rocks we know, lower than the lowest rocks we know; and these being stratified rocks, we may say that water from the beginning of our knowledge has existed upon the surface of the globe. We have, then, no knowledge whatever of the primary nucleus. We see that by the action of water materials have been transported from one part of the surface of the globe to another, covering the former ocean beds with enormous accumulations of sediment; which, after a time, by this change in the relation of the parts, and by the increase of temperature beneath the landed part, have risen up and become, step by step, islands or continents. It is by this process that, age after age, the American continent has assumed its present form. But I desire to impress upon you this one truth; that we have, in our geological investigation, succeeded in going back one step beyond the existence of water and stratification —one step toward this original and so-called primary nucleus, a nucleus of molten matter. This original nucleus that has been talked about in geology, has produced no effect upon the surface of the earth; neither upon its mountain chains or any other of the great features of the continent. Neither have these features been produced by it or by materials derived from it. I have shown that in the form of the continent the materials composing it have been derived from the breaking down of pre-existing materials transported and deposited along certain lines, or spread out in mid-ocean and there accumulating uniformly. The inequalities upon the surface of the country are not due to any special action along these lines of elevation. Those mountain ranges, whether the Rocky Mountains of the West, the Appalachian chain of the East, or any other chain of mountains, so far as we know, are not due to any action or any forces along those lines, but only to the greater currents in the bed of the ocean near those lines, as I have shown you regarding the Appalachian chain. Everywhere the same law has prevailed. The transporting power of the ocean has deposited in the line of its currents larger quantities of material. The elevation has been a continental one, and not the elevation of a mountain or of a chain of mountains. The elevation of the eastern portion of the North American continent has nothing to do with the mountain chains constituting a portion of the continental elevation. Going back, then, step by step, from the more recent to the earliest times in relation to which we have any evidence whatever, we have no proof that the action of the interior of our globe has produced any of the great features of the globe. This idea of a great primary nucleus is only theoretical. It has not in it anything tangible. The earliest rocks of which we have any knowledge were deposited by the ocean under conditions similar to those which now exist. The conditions of the ocean currents are the same now that they have been from the earliest time. From the earliest history of the American continent, from the earliest history of any other, we know that the ocean currents have prevailed as they now prevail, moving northward and southward; and here, at least, the transporting power has generally been from the north toward the south and west; and we have abundant evidence that all the materials composing our continent have been derived in that way from the transporting agency of currents of water alone.

The Rabbit Plague of Australia.

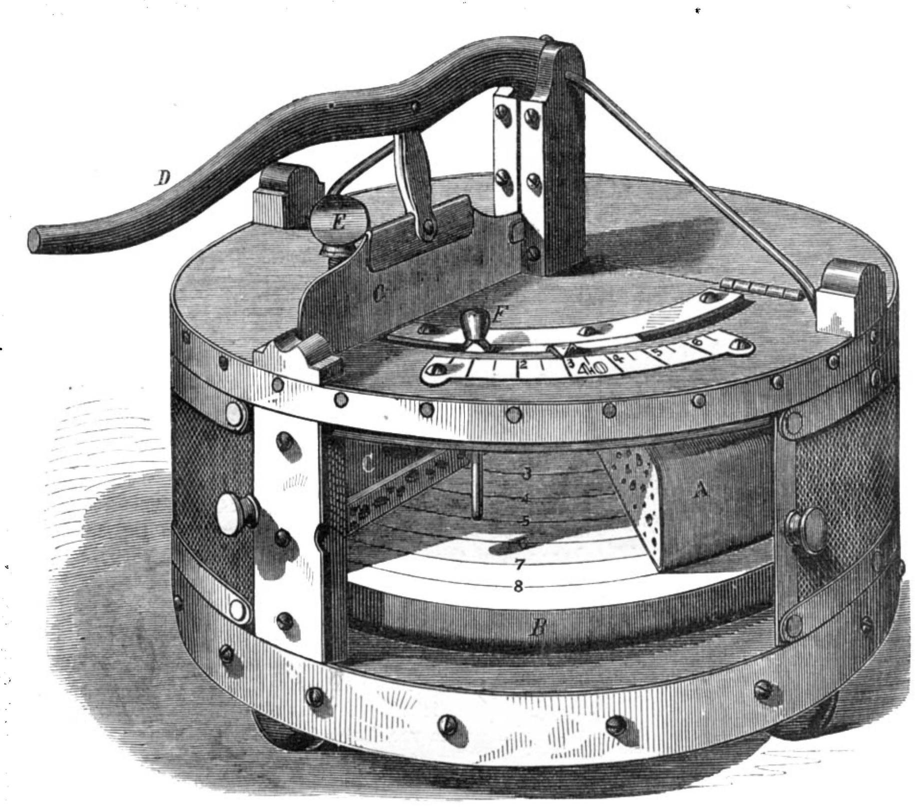
The rabbit originally brought from England into Australia is now threatening to become a plague of almost Egyptian magnitude in the distant and thinly populated plains. Only a year or two ago not a rabbit was to be seen save as a curiosity in a hutch; but the wild rabbit, most prolific of importations, has so increased in numbers in some parts of the country that it threatens to starve the very sheep out of their runs. Mr. William Robertson, a large landholder and squatter near Colac, has been put to a cost of four or five thousand pounds in the, as yet, abortive effort to exterminate these now considered vermin, and he estimates that it will cost him £10,000, in wages to trappers and killers before he will have achieved any marked success in abating the nuisance. "At the same time they are spreading more or less in all parts of the country, and I have seen them scampering about even in gardens near Melbourne. As food they greatly affect some of the most beautiful of our flowers—nothing, however coming amiss to them—and they are, therefore, becoming the terror of horticulturists. Now that the plague is on us in full force we can, of course, all very easily account for what no one foresaw. Any equally prolific animal, equally well circumstanced as to climate and feed, must become equally numerous in any country as thinly populated as ours. In England the wild rabbit meets with many destroyers; here there are very few. In England rabbit killing is sport; in Australia it is generally work to be paid for. Dead rabbits are daily hawked about the streets at six pence each, and the market is always glutted."

The Sword-Fish.

A marine insurance case is now being tried in England, which involves a serious question as to the power of a sword fish to inflict damage and endanger lives. The ship *Dreadnought*, an East Indiaman, was recently taken into port leaking badly from a small hole below the water line. Her owners demanded the cost of repairs from the insurance company, claiming that the hole was made by a sword fish. If it was not made by some external force, nothing can be collected. The insurance company answers that there is no instance on record in which a sword fish, having punctured the side of a vessel, has escaped without leaving his sword in the hole. The plaintiffs prove that a few hours before the discovery of the leak, the crew had seen a very large sword fish in the water, and had tried to capture it with lines and hooks. Prof. Owen delivered a scientific lecture on the sword fish from the witness-box during the trial. The sword of this fish, is the hardest bony material known; it has a sheath harder than the enamel of human teeth; within his personal experience the sides of two ships have been pierced by this submarine stiletto; the blade was usually left in the wound, while the hilt, or in other words. the fish itself, broke away. He quoted examples of this wonderful weapon being driven through fourteen inches of copper sheathing, felt, deal, and oak; his evidence simply demonstrated the enormous power of this formidable monster. In the case before him, Prof. Owen admitted that the fish, having passed its dagger through only three inches of wood, might possibly have withdrawn it. A precisely similar illustration was presented to him several years ago, except that the sword was broken, and actually stopped a leak which might otherwise have been fatal to the ship.

Improved Safe for Preserving Cheese.

Safes for protecting cheeses, when cut, from the attacks of flies, are common enough; they are used in every well managed grocery; but their contents are often mutilated in so miserable a style that the satisfaction in purchasing a bit of cheese is alloyed by the consideration that its shape is such that it cannot be subdivided into convenient and symmetrical portions, and if one calls for a certain amount, it will be either



BULGIN'S IMPROVED CHEESE SAFE AND CHEESE CUTTER.

short or excessive in weight. This is an annoyance to the purchaser and a loss to the seller. The object of the device shown in the engraving is to obviate these difficulties.

The safe is in general construction similar to those in common use, the sides being covered with wire gauze. But the cheese is received on a revolving circular platform, one half of the cover and side opening to admit it in the usual manner. The face of the platform is divided into concentric circles numbered to show their relations, or the relative weights of the cheeses the platform receives. The cheese, A, being placed on the platform, B, concentric with one of the circular lines, it is cut by means of the knife, C, worked by the lever, D. The thumb screw, E, has a flat revolving head on its lower end that engages with the top of the cheese by which it may be held in position while being cut, and be prevented from rising when the knife is withdrawn. The pin, F, passes through the cover or top of the safe, the knob being used to slide a segmental strip having a pointer that designates on a fixed and graded segment the proportionate weight or amount of the cheese to be cut, the downward projecting portion of the pin coming in contact with the cut face of the cheese, and serving as an additional guide to the amount to be cut. The front of the safe is composed of two sliding doors seen open in the engraving.

Patented July 7, 1868 to Edwin G. Bulgin. Letters of inquiry may be addressed to W. G. Bulgin, Vienna, N. J.

GLASS--ITS COMPOSITION.

The discovery of glass was no doubt in the first instance accidental. Whether credit is given to the statement of Pliny in regard to its origin or not, it is scarcely conceivable that in the manufacture of pottery, and some other arts known from the earliest periods, the materials of which glass is composed should not have come together and have been fused so as to have become glass. His account is that glass was discovered by mariners, who, compelled to seek the shore as a refuge from a severe tempest, discovered glass in the ashes of a fire with which they cooked their food. Whether this event ever happened or not, it is quite certain that it might have happened, as the sand of many beaches, with the ashes of some kinds of fuel would, when fused together inevitably form glass, as will be seen upon a consideration of its composition.

Glass may be composed of various materials, but one is essential to all glass, viz., silica. The other materials may be potash, soda ash, lime, alumina (the oxide of aluminum which with some impurities constitutes the various clays), minium (red oxide of lead, red lead), magnesia, etc., which may be varied in their proportions to suit the quality of the glass required; the purity of the materials, of course, regulating the fineness of the product.

Silica is the oxide of a metal called silicon or silicium. It is found nearly pure in quartz, and is with various coloring matters, the substance of agates, opals, flints, etc. Its purest native form is that of rock crystal, of which beautiful specimens are found in England, Scotland, California, and other parts of the world. These crystals are cut into proper shape for ornaments and lenses for spectacles called pebbles. The latter are considered superior to those made of glass. Sand and sandstone are quartz more or less pure. Glass can be made with quartz and flints pulverized, but sand if sufficiently pure is preferred, as it obviates the expense of pulverizing. Sand to be useful for making clear white glass, should be free from earthy matters and certain metallic oxides. The latter give various colors to glass, and when present to any great extent, unfit the material for anything but the coarser varieties of work, as green bottle glass, etc.

Silica has been shown by chemists to be an acid. As it is insoluble in water however, its acid properties do not readily appear. Alkaline solutions, and hydrofluoric acid, dissolve it very readily. With the alkalies, alkaline earths, and some of the metallic oxides it unites to form salts called silicates, for the most part insoluble in water, or in acids, except hydro-fluoric acid, but soluble in strong alkaline solutions. Thus a strong solution of potash will eventually dissolve through an ordinary glass bottle if kept in it long enough.

Glass is a fused mixture of some of the silicates of potash, soda, lime, magnesia, alumina, and lead. These silicates might be formed separately and fused together afterwards, but the requisite homogeneousness is better obtained by mixing in the proper proportions the materials of which they are composed and melting them together, the combinations taking place during the "melt."

The process of melting is performed in large pots made of refractory clay, placed in a conical furnace with a chimney at the apex. The heat is carried to a very high point to insure perfect combination and fusion, and is continued from ten to thirty hours, according to the kind of glass to be made. The heat is kept up as constantly as possible day and night, as much loss would accrue by allowing the furnaces to cool and re-heating them. In order that the temperature of the furnace shall be kept as even as possible the coal is added lump by lump, being thrown in through a small hole in the side of the furnace by a man who performs only that special service. Each furnace contains a number of these pots with an aperture to correspond with each, at proper intervals around the cone. From each of these apertures the fused glass is taken as wanted and manipulated so as to form the various articles of glassware in use. These manipulations, comprising what is technically known as "glass-blowing," will form the subject of a future article.

Dr. Ure makes the following classes of glass, based upon their chemical composition:

1. Soluble glass, sometimes called waterglass—a simple silicate of potash or soda, or both of these alkalies—so called because it is soluble in water.
2. Bohemian or crown glass; silicates of potash and lime.
3. Common window and mirror glass; silicates of soda and lime; sometimes also of potash.
4. Bottle glass; silicates of soda, lime, alumina, and iron.
5. Ordinary crystal glass; silicates of potash and lead.
6. Flint glass—silicates of potash and lead with larger proportion of lead than crystal glass—so called because it was made originally with powdered flint.
7. Strass; same as preceding with still more lead.
8. Enamel; silicate and stannate or antimoniate of potash, or soda or lead. A stannate of potash or soda is a compound of stannic acid, formed by the combination of oxygen and tin, with either potash or soda. An antimoniate of potash or soda is a compound of antimonic acid, formed by the chemical union of antimony, and oxygen with one or the other of those alkalies.

The quality of glass depends very much upon the method of manufacture as well as the materials employed. In particular the process of annealing is a very important one, as if this be neglected or imperfectly done, articles of glass are so brittle as to be almost worthless for any practical use. The manner in which annealing is performed will be hereafter described. To give the proportions used in various manufactories for the different kinds of glass would occupy too much space. We give, therefore, an analysis of only one variety, the best English crystal glass, made by the chemist Berthier.

Silicic acid	59·20	parts.
Oxide of lead	28·20	"
Potash	9·00	"
Oxides of iron and manganese	1·40	"

Now it will be seen that in this glass there is iron, which we have stated gives a green color to glass; in fact it will be seen below that it is capable of giving many other colors; but it also contains manganese, which in common with arsenic possesses the property of decolorizing the alkaline silicates when colored by other metallic oxides.

This leads us to the means whereby color of any desired tint can be imparted to glass. In an article published in No. 2, current volume, an allusion was made to the use of the oxides of cobalt, copper, gold, etc., as surface colors for glass. When these and some other oxides are melted with the silicates, they become a part of the mass and color it throughout without impairing its transparency. Thus, oxide of cobalt gives a brilliant blue; oxide of copper, green; oxide of gold, a ruby red; oxide of antimony, orange yellow; uranium, a delicate greenish color very beautiful but costly; suboxide of copper, brilliant red, but renders the glass almost opaque, etc., etc. A dirty yellow may be given to glass by the admixture of soot or powdered charcoal. The beautiful Bohemian ruby glass is of very complex composition. It contains gold, peroxide of tin, peroxide of iron, oxide of lead, magnesia, lime, soda, potash, silica, and arsenic. Manganese gives a splendid amethystine tint to glass.

Some of these colors change after the glass is made. This is the case with the copper red, which at first is nearly colorless, but becomes red upon reheating after it is cooled. Blueish or greenish colored glass becomes by exposure to sunlight almost colorless from the combined effects of air and light. Glass containing lead is frequently affected by sulphureted hydrogen gas, becoming opaque upon its surface from the formation of sulphide of lead. The glass used by chemists is for the most part free from lead; the presence of the latter being in many cases a serious inconvenience.

M. Bontemps has shown that all the colors of the solar spectrum can be obtained by the use of oxide of iron in different proportions and by different degrees of heat. Similar conclusions have been arrived at in regard to the oxide of manganese. These differences of color are ascribed not to chemical combinations but to molecular conditions.

Most crystal glass is partially dissolved by boiling water, as it has a very large proportion of alkali. Glasses rich in alkalies have also a more powerful attraction for water than others.

The extent to which articles of glass now enter into domestic use, as well as certain branches of the arts, renders this material one of great interest and importance. Its peculiar nature gives rise to very peculiar methods of manufacture, which in the skill and taste required for their performance and the beauty of their product are unexcelled by any other department of industry.

The chief seat of the glass manufacture in the United States is Pittsburgh, which contains in the city proper and its immediate vicinity sixty-eight glassworks, making over half the glass consumed in the country. In a subsequent article we shall take our readers through some of these busy hives, and show them by what unique means and adroit operations some of the beautiful glass articles in common use are formed.

The Zirconia Light.

Messrs. Tessie du Motay & Co. have patented an invention for improvements in preparing zirconia, and the employment of the same to develop the light of oxyhydrogen flame. The specification is as follows: "Zirconia, or oxide of zirconium, in whatever manner it may be extracted from its ores, can be agglomerated by compression; for example, into sticks, disks, cylinders, or other forms suitable for being exposed to the flame of mixtures of oxygen and hydrogen without undergoing fusion or other alteration. Of all the known terrous oxides it is the only one which remains entirely unaltered when submitted to the action of a blowpipe fed by oxygen and hydrogen, or mixtures of oxygen with gaseous or liquid carbonated hydrogens. Zirconia is also, of all the terrous oxides, that which, when introduced into an oxhydrogen flame, develops the most intense and the most fixed light.

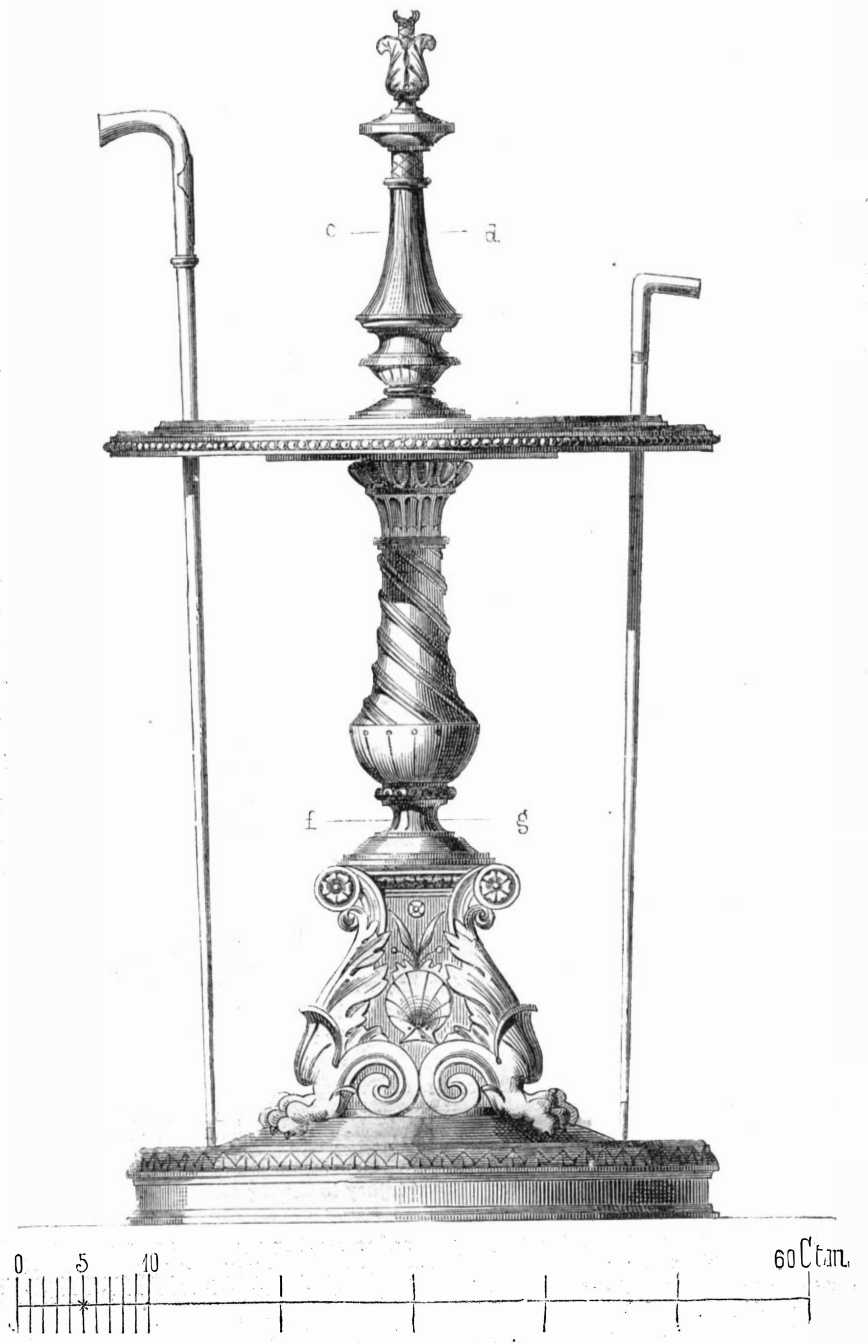
"To obtain zirconia in a commercial state I extract it from its native ores by transforming by the action of chlorine in the presence of coal or charcoal the silicate of zirconium into double chloride of zirconium and of silicium. The chloride of silicium, which is more volatile than the chloride of zirconium, is separated from the latter by the action of heat; the chloride of zirconium remaining is afterwards converted to the state of oxide by any of the methods now used in chemistry. The zirconia thus obtained is first calcined, then moistened, and submitted in molds to the action of a press with or without the intervention of agglutinant substances, such as borax, boracic acid, or clay. The sticks, cylinders, disks, or other forms thus agglomerated, are brought to a high temperature, and thus receive a kind of tempering or preparing, the effect of which is to increase their density and molecular compactness.

"I can also compress in molds shaped for the purpose a small quantity of zirconium capable of forming a cylinder or piece of little thickness, which may be united by compression in the same mold to other refractory earths, such as magnesia and clay. In this manner I obtain sticks or pieces of which the only part exposed to the action of the flame is of pure zirconia, while the remaining portion which serves as a support to it is composed of a cheap material.

"The property composed by zirconia of being at once the most infusible, the most unalterable, and the most luminous of all the chemical substances at present known when it is exposed to the action of an oxhydrogen flame, has never before been discovered, nor has its property of being capable of agglomeration and molding, either separately or mixed with a small portion of an agglutinant substance.—*Chemical News.*

Stick and Umbrella Stand.

We herewith reproduce from the *Workshop*, published by E. Steiger, 17 North William street, New York, the annexed



STICK AND UMBRELLA STAND.

unique and beautiful design for an umbrella stand, which speaks not only for itself but the excellent character of the publication.

LYCEUM OF NATURAL HISTORY.

This Society met at its rooms at the Mott Memorial Library on the evening of December 28th, and after the usual preliminary business, Dr. Schweitzer, of the School of Mines, stated that he had made a qualitative analysis of the green substance discovered by Mr. E. G. Squier in the Peruvian girl's dressing case. It contained silicate of lime with some alumina. He did not consider his investigation satisfactory, as owing to the small quantity given him, he was unable to make a quantitative analysis.

Professor Eggleston (in the chair) inquired what was the coloring matter. Was it of an organic nature?

Dr. Schweitzer—Undoubtedly so. The coloring matter was of a decided grayish blue, which on ignition turned white.

Dr. Feuchtwanger stated that near Rockwell, in Canada, he had met with specimens of phosphate of lime which when broken open showed crystals which contained a round hole. he asked for explanation as the phenomenon was extremely rare.

Professor Eggleston pointed out that this hole occurred at the conjunction of the crystals. He supposed it was caused by some accident in the course of formation.

A member stated that it had a geodic aspect.

Professor Joy said: It will be in the recollection of members that Professor Graham, Master of the Mint, discovered on May 16, 1867, the occlusion of hydrogen gas in meteoric iron. It would now appear that he had discovered a new metal, or rather had demonstrated the existence of a very old metal. In a letter to Professor Horsford that eminent scholar states that he is preparing a paper for the Royal Society on certain experiments of his with palladium, magnesium, and hydrogen, which have resulted in the discovery of what appears to him to be a white magnetic metal, hitherto unknown, with a specific gravity of 2. He thinks it is the metalic base of hydrogen. This, said Professor Joy, is a discovery of remarkable importance—one that the gentleman who prepares the cable telegrams for us would have announced at once had he sufficient knowledge of its interest. We must, however, now wait for further particulars until we find them in the proceedings of the Royal Society.

Professor Eggleston spoke briefly and emphatically of the importance of this discovery.

Professor Joy said—The regular subject for our discussion this evening is pisiculture, a study of comparatively recent date. It was in 1763 that a German named Jacobi first published in the *Magazine of Hanover* a paper on the subject. It did not, however, attract much attention, and his discovery appears to have been lost and practically forgotten. In 1840, or thereabout, a fisherman of the department of the Vosges, named Reme, entirely illiterate, discovered by his own observation, the art of artificially propagating fish. In 1843 the administration of that department took the matter up, and in its official journal, published in 1844, a report on the subject. It was not until 1848 that the French Institute took up the subject. In 1855 he had purchased at the French Exposition a guide to fish culture. Little progress had been made in the art hither o, so that in the year almost elapsed we are barely on its threshold. He asked Mr. Gilmore to state his experience on the subject.

Mr. Gilmore said that, interested as we all are in the study of natural history, it did not seem to him that sufficient attention has been paid to the fish. His observation had shown him that fish were most intelligent. When in Japan, he had seen in the fish pond of one of the American Vice-Consuls, fish that knew the Consul, and would approach him, while timorous of every one else. He knew this to be characteristic of tame carp he had seen in various parts of Europe. It struck him that the tunny—a fish well known in the Mediterranean for several thousand years—knew America before the *genus homo* did, at least before Europeans. It was well known that the tunny in the autumn season rushed up the Mediterranean in hordes like buffaloes to the Black Sea, whence after spawning they returned, and in the month of March were seen pouring through the straits of Gibraltar westward. They then disappeared, and it was stated by some—even by naturalists of position—that they remained inanimate at the bottom of the sea. Some time ago when coming across the Atlantic he was walking one night on deck with the captain of the steamer, who had called his attention to the fact that at certain seasons he met large shoals of tunny crossing the Atlantic. It did not surprise them, therefore, to find that in the month of September large numbers of tunny are found in the neighborhood of the Gulf of St. Lawrence and the coast of Labrador. Recurring to the subject of artificial fish propagation, he stated that it was known to the Chinese twelve hundred years ago, who made use of their large inland rivers to support their teeming population. About fifty years ago it was introduced into England. He thought that it made greater progress in America than in had in England. He had heard there of the exertions of Mr. Seth Greene of this country. Mr. Frank Buckland, formerly an officer of the army, and now her Majesty's Commissioner of Fisheries, had paid much attention to the subject. Mr. Gilmore then proceeded to describe the artificial culture of salmon and trout. It was well known that the salmon was migratory. The season of its migration varied according to the temperature of the water. They ascended the rivers early if the water was cold, and not until December if it were warm as in the South of England. They ascend the river with but one object, which is to deposit their ova. After overcoming all difficulties intervening, they ascend as near as possible to the head water of the rivers. The female then forms a deep furrow in the sand and deposits her ova. While doing this she guards them against all the other denizens of the waters. When she has accomplished her task, the male fish comes and deposits the milt which impregnates the eggs. Both then cover up the eggs with sand. Those anxious to propagate the fish artificially throw a net over the female when she comes to deposit the egg, and by bending her back slightly over a pannikin, the eggs are expressed. There are generally 1,000 eggs to every pound a salmon weighs. Suppose then in the case of a twenty-pound salmon but half the eggs are matured, what an immense amount of fish is produced by one salmon! After the ova are expressed the milt are obtained in the same manner from the male fish, by dropping it into the pannikin the ova are impregnated. They are then placed in boxes built with steps, which, however, are hollow and partially filled with sand. The water passes in through a pipe from the upper step. By the action of the water the fish are hatched. It sometimes takes one hundred and sixty days to hatch them. Salmon in their first form are ungainly, having depending from them a little bag. This after six weeks passes away, being used by the fish as its nutriment. Having grown quite lively, they are removed to ponds, care being taken not to allow fish of different ages to live together, for they are cannibals and devour those younger than themselves. After a time they are allowed to go down to the sea, and it is noticeable that salmon always return to the place where they were bred, making allowance, of course, for those that are destroyed. He had made an estimate of the value of artificial cultivation of trout and salmon, from observations made at tanks on the Tay and in Vermont. Ova sold $8 per 1,000. In pond No. 1 there were 10,000 fish fed daily by three quarts of curds. In pond No. 2 there were 8,000 fish of the second year fed upon six quarts of curds daily. In the third there are 7,000 fish fed upon twelve quarts of curds. The total return which these fish produced, was $4,350, and the net profit $3,644. From this he inferred that the cultivation of fish was well worthy of adoption.

Mr. Waterhouse Hawkins, in a response to a request from Professor Joy, added some particulars to what Captain Gilmore had stated. He wished that that gentleman had said something about the cultivation of the delicious fish called char. It was conducted in the same manner as that of trout and salmon. Some two years ago, while acting as the honorary secretary of the Acclimatization Society, in the absence of Mr. Buckland, he undertook to propagate some char. He received the ova from Windermere. They were in—some 30,000—admirable condition. He treated them as Mr. Gilmore had already described, but the gravel was boiled to remove all its inhabitants previous to being used in the troughs. The impregnated ova were removed to the ponds just before the pellicle burst, as soon as the eyes appeared. Mr. Hawkins then detailed his efforts to send some ova to the Duke of Argyll, and strongly impressed on the lyceum the value of pisciculture. In compliance with a request of Professor Joy, he explained, by means of the blackboard and one of his inimitable freehand sketches, the difference between the salmon, trout, and char.

Mr Gilmore at the suggestion of Mr. Hawkins, detailed the circumstances which led to his discovery of the char in this country. He had caught some magnificent fish in this country of striking appearance and luscious taste.

No other matter matter coming before the lyceum it adjourned.

A Coal Miner in the British Parliament.

Mr. Carter, alderman and coal merchant, is the liberal colleague of Mr. Baines in Leeds. The *European Mail* says he is a remarkable man and perhaps may astonish the House. He began life as a worker in a colliery, and by his own unaided ability has risen to be a merchant, alderman, and member of parliament. He has had but little school education, but from assiduously reading bluebooks he has got to be fairly instructed in politics. He is a fluent speaker, and is never at a loss for a word. He speaks with the real Yorkshire burr; has not an H in his vocabulary; and if any preceding speaker says anything with which he (Mr. Carter) cannot agree, he says "I am of the *contrairy* opinion." His manner is energetic, even forcible; and takes with the Leeds clothweavers. He is in politics a radical of the radicals—bold, defiant; denouncing the church, denouncing the state, the army, the navy—denouncing, indeed, everything. He is president of the Leeds branch of the Reform League, and is said to be the only member of that illustrious association returned to parliament.

Military Cart.

This is a cart which was designed by Mr. W. J. Addis, executive engineer to the Local Fund Works at Bombay, to meet the exigencies of the Abyssinian War, comprising many essential points, and differs from any existing construction. The wheels are formed of segmentary parts of wrought iron, circumferenced with wooden fellies, and tired in the usual manner. By this arrangement the shrinkage is reduced to a minimum, so that the wheels are better adapted for hot climates. Among other advantages, it is calculated to be more durable than the ordinary wooden wheel, and runs much easier. The nave is flush with the spoke and tire, thereby lessening the risk of collisions. The axles are two in number, nine inches in length, and work in two plummer blocks fixed in the frames of the cart, and and are easily arranged in case of damage. Another palpable advantage is that the pole is so arranged as to admit of the cart being drawn back without the necessity of turning, while it can also be wholly withdrawn and passed through the center of the box in the body of the cart, which contains a tent, and it can also be used as a tent pole.

How to Preserve Sodium Untarnished.

Many teachers, particularly in our high schools, have sodium preserved in the usual way, under naphtha. But the beautiful metallic luster is not seen under these circumstances; and if the metal is taken out and a fresh cut made, this only shows the luster for an instant. By the following artifice the *metallic appearance of sodium may be permanently exhibited.* Take two test tubes, one a little smaller than the other, so as to slip into the latter without leaving much space between the two glass walls, put some carefully cleaned sodium in the wider tube insert the more narrow tube, having previously given a thin coating of beeswax to the upper part of this latter; then gently heating the whole on a sand bath. The sodium will fuse, and by a gentle pressure, the inner tube was pressed down, so as to force the fused metal over a large surface between the two tubes, while the air is totally excluded by the beeswax. I have kept sodium for more than six months in this way, and it is now as bright and brilliant, as when first put up.—*Prof. Gustavus Hinrichs.*

New Method of Mixing Mortar.

A correspondent from Syracuse, N. Y., sends us an account of an invention perfected in that city for mixing mortar, which is simply this: The lime is first slacked in a vat with water enough to make it to a paste, and allowed to retain its heat for about twenty-four hours—it is next run off into a second vat, from which it is pumped by a chain pump to a revolving cylinder that has a large quantity of spikes on the inside. As it flows from the cylinder, it passes through a sieve of ten meshes to the inch, and every particle that is used has to go through these very fine holes no larger than a pins' head. From this machine it falls into a large vat, from which it is pumped as required to a similar revolving machine called the mixing machine, into which it flows in a continuous stream, and sand, previously sifted, is added at the rate of about eighty bushels per hour. The mortar made in this way is said to be of a very superior quality.

INFLUENCE OF THE OXIDES OF CHROMIUM AND TITANIUM ON THE COMPOSITION OF PIG IRON.

BY AUG. A. AND S. DANA HAYES, ASSAYERS TO STATE OF MASSACHUSETTS.

Within the last four years we have been frequently employed in chemical investigations of the altered characters of some pig irons, which resulted apparently under the usual circumstances in the reduction of uniform ore.

In these cases the amount of carbon united with the iron had been diminished, without the introduction of other matter, in quantity sufficient to influence a change in this connection, and generally no variation in the composition of the ore was known or suspected. We had analyzed the ores in some of the beds in former years and regarded them as well adapted to the production of pig iron of good quality; but in pursuing the research we were convinced that the change in quality of iron could be traced to altered composition in the ore of part of the beds used for supplying the furnaces.

The correctness of this view was confirmed by our analyses of many iron ores, in some of which we found the oxides of chromium or titanium, existing where they were not indicated and connected with the ore in beds which have been considered as pure iron ores.

Both the oxide of chromium and oxide of titanium, seem to act in the furnace or the crucible in a way to withdraw a portion of the carbon, or prevent that true union of carbon with a portion of the iron, which constitutes gray pig iron, without the metals of these oxides really alloying with the iron and thus indicating the cause of change. We have analyzed samples of pig iron where the alloys of chromium or titanium existed in the pigs, and where the oxides accompanied the ores in the beds, but we were not prepared to find an influence exerted on the quality of the pig metal *without the refractory metals forming a part of the composition.*

The occurrence of oxide of manganese with iron ore is common, and titanium compounds are often found in both magnetic and brown iron ores, as insoluble substances, in small proportions, and these compounds combine with and are removed by the fluxes without injury to the pig metal. These compounds of titanium are the cause of the often superb blue color of the cinder, produced under varying conditions of glassy or stony character, and must be carefully distinguished from those we regard as more detrimental in their influence on the metal.

In a number of analyses of iron ores we had found both oxide of chromium and oxide of titanium in a state rendering them soluble in diluted acids, and in a condition to escape detection in the ordinary modes of analysis. Both magnetic and brown iron ores have been found to contain either oxide of chromium, or oxide of titanium in this soluble state. Among the samples from contiguous beds, this diversity in composition made by the presence of some oxide of chromium or oxide of titanium existed; and while the bulk of a bed of ore was pure, continuations of the bed, or associated ore, yielded notable weights of oxide of chromium or oxide of titanium in the different samples.

The suggestion we would make to the iron master in view of these facts is, the possibility of the quality of the pig metals in anomalous cases being greatly influenced by the admixture of some ore, containing the oxides of chromium or titanium, with the basis ore of good quality. This may take place by the main bed being crossed by veins of mixed ore, or by the workings passing into contiguous beds where one kind of ore is used. In other cases, where the iron master can gain the great advantage arising from mixing ores, one of the kinds may contain the contaminating oxides and injure the iron.

We subjoin some results of analyses showing the proportion of oxide of chromium to the metallic iron contained in the ores:

1st. Magnetic ore—iron, 49; oxide of chromium, 1·40. 2d. Hematite ore—iron, 42·47; oxide of chromium, 1·60. 3d. Brown Massive ore—iron, 54·32; oxide of chromium, 1·90. 4th. Same —iron, 46·70; oxide of chromium, 1·04.

More traces have been discovered in some cases, while in other instances a larger proportion of chromium formed an alloy with the iron produced from the ore.

"ARE PAINTED LIGHTNING RODS ANY PROTECTION?"

BY JOHN H. PATTERSON.

We do not believe that paint or rust totally destroys the conducting power of a lightning rod; only in proportion to the amount of impurities with which it is coated. There is, doubtless, a point beyond which a conductor will cease to be one, because the impurities upon it may be so great that it will possess no more facilities for conducting the fluid to the earth than the building itself. It would all depend upon the extent of the charge, and whether there was any tin or zinc spouting in connection with it. The very best scientific authority says that iron has 12° of conducting power, tin 14°, zinc 24°, and copper 92°. All admit that electricity will follow the best conductors only. If such is a fact it cannot be reasonably supposed that if such spouting was in contact with a perfect iron rod, that a charge of electricity would follow the main conductor to the earth. Would it not rather leave the iron rod and pass over the spouting? It certainly would if the theory alluded to is correct. Whether or not the lightning rod was painted, it is natural to suppose that combustion would ensue. The explosion might not be very great, and no serious damage might be done, and no lives lost, yet that does not refute the principle. Every few days we read of the freaks of lightning, and upon buildings, too, protected by iron rods. Why is this? Professor Douglass, of the University of Michigan, in an elaborate paper upon this subject says, that the design of a lightning rod is to prevent a stroke of lightning by silently relieving the positive atmosphere of its overcharge. This idea looks very reasonable, for Dr. Franklin said that explosions only occurred when conductors could not discharge it as fast as they received it. Now if a conductor cannot discharge the fluid there must be a cause for it. Either it is not large enough, is not perfectly applied, or it is coated with impurities. We know that an ordinary iron rod will conduct off an ordinary stroke of lightning, for it has been seen; but when an explosion occurs it cannot be stated which of the other two causes is the particular one unless the conductor is in direct contact with spouting of a superior conducting metal. Then the case is very clear. If it is in contact with such spouting, the idea that electricity follows the best conductors is correct. If the rod is insulated from both building and spouting, then the cause must be the impurities on the rod, be they paint or rust.

Lightning rods of a proper metal, copper, applied in a proper manner, are certainly a means of protection.

A recent writer quotes Professor Henry to prove that conductors should be brought in contact with the spouting on a building. This principle is certainly true respecting copper, but for the reasons given above, we hardly think it correct to expect electricity to leave a good conductor (the zinc spouting) for a poor one (an iron lightning rod), and we do not believe that Professor Henry desires to be so understood.

There can be no doubt but what the conducting power of a lightning rod is affected in proportion as it is coated with impurities of any character. If electricity, in its passage to the earth, passed into the conductor, there might be some reason to suppose that paint would not interfere with it; but when it has been demonstrated by scientific investigation that it resides only upon its exterior surface, we are not at a loss to understand why the surface of a lightning rod must be free from such impurities. That electricity does not enter into a conductor, we will refer to "Silliman's Natural Philosophy," page 540; "Olmsted's Philosophy," by Snell, page 327, and "Nichol's Cyclopedia of Physical Science," article—Electricity. In "Parker's Philosophy," page 280, we read: ". . . . and paint destroys the conducting power of a lightning rod."

We are aware that our ideas are at variance with one of the most distinguished scholars in the world—Professor Henry—and, of course, we do not think of setting aside his authority; but we have given them, and let them go for what they are worth. In this connection we refer to a letter from Professor Henry, of the Smithsonian institute, in which he says:

> The paint with which lightning rods are usually covered consists principally of carbon, and as this is, in itself, a good conductor, it could hardly interfere with the conducting power of the rod. Beside this, though the electricity tends to pass at the surface of a conductor, it in reality passes within the metal, as a wire which fully conducts a discharge from a battery, may be coated with non-conducting varnish or sealing wax.
>
> The office of a lightning rod is to protect a building from a discharge from the heavens. As a general thing its effect upon a distant cloud must be too small to silently discharge its redundant electricity, though in some rare instances it is possible that it may so reduce the intensity of the cloud as to prevent a discharge, when, without such reduction, a discharge would take place.

JOHN MACADAM---INVENTOR OF MACADAMIZED ROADS

BY JAMES PARTON.

Few persons are aware who ride over the excellent macadamized roads of the Central Park, that Mr. Macadam, the inventor of the roads which bear his name, was once a resident of New York, and probably often walked or rode over the fields and farms which then occupied the site of the park. Yet such was the fact. Though born and buried in Scotland, he lived for some years in New York; and, possibly, the horrid condition of American roads before the revolutionary war, may have first impressed upon his mind the urgent necessity there was for a better road system.

John Loudon Macadam was born in 1756, in Ayr county, Scotland, not far from the birthplace of Robert Burns. His family was ancient and highly respectable. When he was little more than an infant, one of his uncles, William Macadam, accompanied the British forces which came to America under Lord Loudoun, during the old French war, for the conquest of Canada. This William Macadam, it appears, had something to do with supplying the British army with provisions; and when the war was over, instead of returning to Europe, he settled in the city of New York, where he became a thriving merchant. When John Macadam was fourteen years of age, his father died, and the boy was sent to America to become a member of the family of his uncle William, who procured him a place in the counting-house of a friend.

This was in 1770, when New York was a quaint old place, half English, half Dutch, situated at the end of Manhattan Island; the residue of which was verdant with woods and farms, and adorned with the villas and mansions of the wealthier citizens. People who are only acquainted with Manhattan Island now, when its beautiful groves are gone, its commanding bluffs dug away, its surface excavated and excoriated for railroads and streets, can form no idea of its loveliness a hundred years ago, when Johnny Macadam was a junior clerk.

Five years after his arrival here, the revolutionary war broke out, and he was compelled to side for the king or the colonies. Being but nineteen years of age at the time, and of Scottish birth (there is a great deal of Tory blood in Scottish veins), he espoused the cause of George the Third, along with his uncle William, and a majority of the wealthier merchants of the city. In 1776, when he was still but twenty years old, General Washington was compelled to abandon New York, which, for the next seven years was in the hands of the British. After a time, this young man received the valuable appointment of prize-agent for the port of New York, which gave him a percentage upon the prizes brought in by British privateers and men-of-war. His percentage was probably pretty liberal, for he is reported to have gained a considerable fortune from his office.

Far indeed was it from the thoughts of the New York loyalists that the time would ever come when it would be beyond the power of their king to protect his faithful subjects in Manhattan. And yet that time came. In 1783, John Macadam, then twenty-seven years of age, with all the other Tories of note, was obliged to leave New York, and abandon so much of their property as they could not carry off.

On reaching his native Scotland, however, Macadam was rich enough to buy an estate in the county of Ayr, and that estate was large enough to make him an important man in the county. We find him soon a county magistrate, a trustee of the public roads, and Deputy Lord Lieutenant—offices which are never bestowed in Great Britain except upon persons of wealth and social importance. It was while he held the office of Ayrshire road trustee that he began seriously to study the subject of road making. At that time roads were universally bad, except where Nature herself had made them good.

"A broad-wheeled wagon," wrote Adam Smith, in 1774, "attended by two men, and drawn by eight horses, in about *six week's time*, carries and brings back, between London and Edinburgh (494 miles), near four tun weight of goods."

Dr. Franklin, writing in 1751, speaks of traveling seventy miles a day in England, by a post-chaise, as a most extraordinary achievement—killing to man and beast. Much of the soil of England and Scotland is a deep, rich clay, which makes the best farms and the worst roads in the universe; and yet it is particularly well adapted to the system of Macadam.

What it was which suggested to him the simple expedient of covering the soft miry roads with broken stones, averaging six ounces each in weight, has not been recorded. We only know, that, during the long wars between England and France, he held important appointments under the Crown, which made it his duty to superintend the transportation of supplies.

He then renewed the study of roads, and pursued it with all the unflagging perseverance of a thorough Scotchman. At his own expence, he traveled thirty thousand miles for the observation of roads, which occupied him more than five years, and cost him more than five thousand pounds sterling. I presume his idea was entirely original; for we cannot find any trace of a macadamized road previous to his day. The only notion which existed, previous to his time, of making a permanent road, was to pave the whole surface with pebbles, blocks, or slabs of stone; either of which was far too expensive to become general.

It was not until 1811, when he was fifty-five years of age, that Macadam made his celebrated report to the House of Commons, in which he described the condition of the roads of Great Britain, and gave an outline of his system for repairing them. In 1815, a district was assigned him for an experiment. Need I say that he met with nothing but opposition, not only from every one connected with the old road system, but even from the farmers through whose lands the first macadamized road was to be made! Such was the prejudice against his plan that he could not get the old road-makers to execute his orders, and he was obliged to get his three sons to come and assist him in superintending the details.

But the tide soon turned. A good macadamized road is an irresistible argument; and there soon arose a rage for making such roads, as furious as the former prejudice against them. Four years after he began operations, there were seven hundred miles of macadamized road in Great Britain; and, before the death of the inventor, out of the twenty-five thousand six hundred miles of high roads in England, there were not more, it is said, than two hundred and fifty miles not macadamized.

John Macadam was a strangely disinterested man. He not only refused to receive any reward for his services, including an offered knighthood, but he would not take a contract to make or repair a road, and he declined some pressing and liberal offers to take charge of the roads in foreign countries.

He was twice married; first, during his residence in New York, to a Long Island lady; and again, in his seventy-first year, to another American lady, Miss de Lancey, of New York, a member of the family which has given its name to one of our streets. He died in 1836, aged eighty years.

I have spoken above of the excellent roads in the Central Park of New York, as macadamized. I should, perhaps, have styled them *Telfordized*, for it was Thomas Telford, a famous English engineer, cotemporary with Macadam, who invented the particular plan upon which those roads are built. Macadam laid his broken stones upon the naked soil; but it was Thomas Telford who improved upon Macadam's idea by laying large, rough, flat stones upon the soil, placing upon them the broken stones of Macadam, and covering the surface with fragments of the size of a boy's marble.—*New York Ledger*.

The Fort Montgomery Explosion.

The New York *Sun* states that the recent terrible explosion in a mine near Fort Montgomery, on the Hudson river, was occasioned by nitro-glycerin in its new form of "dynamite." Some of it had been sent to the mine for trial. Having a three-inch hole, four feet deep, to fire, the foreman pounded the compound under a hammer to the consistency of fine powder, while the boss of the gang scraped it from the plank on which it was pulverized, and put about seven pounds in his can which had a thimble stopper, when the gang of three men left for the shaft. While on their way, the can was opened by the man who had it in charge to exhibit the powder to others, and as there were lighted pipes in the company, a spark came in contact, when the explosion took place. It is quite evident that this terrible substance has been somewhat tamed, but not yet sufficiently so as to justify the neglect of ordinary precaution in handling it.

Manufacture of Silk in California.

Since writing the article entitled "Why not Grow our own Silk?" we find the following additional particulars in a California exchange, relative to the silk culture in that State: "Mulberry trees are here in great abundance, the 'Natural Wealth of California' giving 4,000,000 of trees for 1867, and we may say at least 5,000,000 for next year's use. The production of eggs has kept pace with the means to supply food for the worms, for it has been stimulated by a full demand from abroad. We raise two crops of cocoons in a season, as the rule, but three crops are not unfrequent, though the third crop draws too severely on the vitality of the tree, by overplucking of the leaves, and it should be discouraged. We can expect but one crop of eggs in a season. The second is left to us for home use. The cocoon, which the miller cuts his way through, suffers a loss of value by the continuity of the thread being broken. But it makes good silk for goods not requiring long staple. Of this spun silk, we are accumulating stock. Mr. Englander, who made so creditable a display of silk fringes at the Fair, says it can be worked up here by our present facilities. Beside this stock, the sound cocoons left for silk, this year, may be rated at one million, and so rapid is the reproduction, that this would make ten millions for 1869. To reel, weave, and complete the fabric would give steady employment to one thousand hands, beside the great number that would find work gathering leaves, attending and feeding the worms. When we consider, that in 1870 the rapid increase of silkworms, all healthy, will give us five to ten times more cocoons than 1869, we are sensible there is no time to be lost in going into the making of silks. In one season the simple unwinding of cocoons may be taught very expertly to any number of girls. Making silk sewing thread is as simple as making other thread. Dyeing silk, though it has some peculiarities, can be done by workmen skilled in other fine coloring, and, at least, the artesian waters of our San Bruno range have the requisite freedom from impurity. Can we weave silk? will not be questioned by any one who has seen the silk cloth actually and continuously made during four weeks at the Fair, by Messrs. Joseph and Isidor Neumann, whose perseverance is worthy of the highest reward; and we trust they will soon realize it in substantial success and in public acknowledgment. Mr. Neumann has a number of new looms of the best construction ready for use, and he has invented a reel, which was in use at the Fair, and which is all that can be desired. Though silk eggs bring a price that tempts us to export them just now, the establishment of manufactories would show that it would pay us better to lose the surplus eggs and save the cocoons for thread and cloth. Notwithstanding the price of labor, we can make our own silk for 25 per cent less than the importer can put the foreign fabric on his shelves. Our land is cheaper, our trees are more prolific of leaves, our worms are not infected with disease that kills half of them and injures the silk-making perfection of the rest; our trees are new, and the quality of the leaves for food is untainted by the effects of long-continued plucking. Our climate alone gives advantages in the superior weight of our cocoons, and in the perfection of the silk they yield, to counterbalance the greater wages of labor, if we had not the other advantages enumerated; and no branch of industry affords so great a proportion of light and pleasant work for the employment of women and children."

Carbonic Acid in the Atmosphere.

The German chemist Pettenkofer, several years ago, introduced a new and more accurate method for the quantitative determination of the amount of carbonic acid in the atmosphere. By means of this method, Thorpe has obtained the following result: On the land the amount of carbonic acid in the atmosphere varies from 2½ to 8 volumes for 10,000 volumes of air; the mean for Europe is 4 volumes in 10,000 of air; in New Granada, South America, Levy had previously found 3·8 volumes during the rainy season, and 4·6 during the dry season. On the sea the variations are much less, and the amount of carbonic acid is also less; the mean of all determinations of sea air being only 3, while land air gave 4 volumes in 10,000 of air.

To show the difference between the free atmospheric air and the air in our school rooms and other crowded places, we collect the following from results, most of which were obtained by means of Pettenkofer's method; all the figures given as the amount of carbonic acid express the number of volumes of carbonic acid in 10,000 volumes of the air analyzed:

Free atmospheric air, 4. Pettenkofer's study, 3,000 cubic feet capacity—after having been there for four hours, 5 2-3; after his assistant had been with him for a little while, 9. Liebig's laboratory—capacity 46,000 cubic feet—air taken at various intervals during a lecture (about 3,000 persons present), in March, 6 P. M., 11; same lecture, 6 1-2 P. M., 23; same lecture, 7 P. M., 32 this last time the air was somewhat oppressive. A school room—10,400 cubic feet capacity—70 girls between nine and ten years old; temperature of room, 66 deg. Fah., at the close of the instruction, 72—or about eighteen times as much as in the free air! Sleeping rooms, for soldiers in Munich—one room, 10,147 cubic feet capacity, 19 soldiers—in the morning, 46; another room—capacity 10,255 cubic feet, 10 soldiers—in the morning, 34. A theater, very crowded, Roscoe found, 4 feet above the stage, 23; 34 feet above the stage, 32. A court room, in London, 44; Underground Railways, London, from 4 to 12. Air, fresh, inhaled, 4. Air, exhaled, on average, 400—or 100 times as much as the air inhaled.

From all determinations yet made, it may be concluded that 10 volumes of carbonic acid for 10,000 of air, are quite comfortable; when this quantity is not exceeded, the ventilation is good, no unpleasant odors are observed; but that rooms containing much more than 10 of carbonic acid in 10,000 of air (or one in a thousand) are not fit for a prolonged sojourn of people.—*Prof. Gustavus Hinrichs*.

OPINIONS OF THE PRESS.

We are indebted to our cotemporaries for many very flattering notices, only a few of which we can copy. The Chicago *Railway Review* says:

Our readers are well aware of the value which we attach to the SCIENTIFIC AMERICAN, from the frequency with which we quote its articles and refer to its conclusions. The excellence thus indorsed by us, in common with the entire newspaper press, lies not only in its scope and versatility, but in the simplicity and intelligibleness of its style. It covers the whole field of practical science, but without pretension, technicality, and dreary pedantry. It is emphatically a journal of to-day—an "abstract and brief chronicle"—brief but comprehensive and exhaustive of all branches of applied science which find a field in modern invention and industry. The last number of the XIXth volume comes to hand with a finely engraved representative title page, an earnest of the realization of the liberal promises of the prospectus of volume XX. Glancing at the index of subjects discussed and illustrated in the volume just closing, it is hard to see where improvements can be made; but we take the word of the liberal and enlightened publishers, that noticeable improvements will be made, and wait curiously, but not skeptically, to see what they will be.

The *Ambassador*, published in this city, says:

The SCIENTIFIC AMERICAN has a place, all to itself, in the world of scientific readers and writers—having neither peer nor second. It is a just compliment to American thought and enterprise, that America can lead the world in the publication of such a journal. Its specialties are practical information, art, science, mechanics, chemistry, and manufactures. Every patent invention is recorded; many of them described; many illustrated by large and handsome engravings. Every created thing, from a steam engine to a top, has a biography in the SCIENTIFIC AMERICAN. For reading matter it has carefully prepared papers on all sorts of subjects within the limits of science and art.

The Iowa *Instructor*, the educational organ *par excellence* of Iowa, thus speaks of the value of the information obtainable from the perusal of our columns to the proper qualification of teachers for their arduous and responsible labors:

The SCIENTIFIC AMERICAN is unquestionably *the* journal for all those who delight in following the inventive genius of the people of this country in that direction which at present is most prominently developed. If we were at all phrenologically inclined, we should, in giving a description of Uncle Sam's cranium, pronounce his bump of mechanical contrivances most wonderfully large—especially after a close inspection of a few numbers of the SCIENTIFIC AMERICAN. Yet it is astonishing to notice that few persons outside of the mechanical arts take an interest in these matters. Surely it is as important to understand the peculiar appliances and ingenious processes, which, as by magic, transfor the natural products into such articles which civilized society demand, as it is to be able to know what peculiar twists the ancients were fond of attaching to nouns and verbs, to indicate their mutual relations. At any rate *we think it neither improper nor ungenteel not to be ignorant* of some of the processes of the mechanical arts; and, indeed, we know that in other countries such knowledge is considered essential to education. If, therefore, any teacher has a predilection for such matters, we trust he will cultivate this faculty of his mind and give the result of his readings, study, and work to the pupils under his care—in order to make the children honor labor and love those who have benefited mankind by their mechanical genius.

More About the Suez Canal.

A captain of an English merchant vessel who has recently been making a trip through the Suez Canal, writes as follows to the *London Times*:

The canal, as designed, is about a hundred miles long. Of this length about half is sufficiently advanced for the sea water to reach fifty miles—that is, into the middle of the Isthmus. It is finished to its full breadth, which is a hundred yards, or the width of a considerable river, but not to the intended depth of twenty-six feet. The remaining fifty miles not yet penetrated by the sea water, are in various states of progress: parts are excavated, parts are under water, parts will have to be laid under water, which is to be supplied from a great lake not yet filled, while a good many miles have to wait for large blasting operations. To English ears it must sound promising that a good deal of clay has to be cut through; for nothing can be dealt with so successfully in this country as that material. The completion of the southern half of the canal would look like a very long work but for the fact of the immense subsidiary works being completed and a vast mass of appliances being on the spot. The service canal from the Nile to the mid point of the salt water canal, and branching thence to either extremity, is an immense work, not less than a hundred and fifty miles long, and in full use for the supply of fresh water for navigation and for otherwise assisting the work to be done. The port at the Mediterranean end is an immense work, already available. The sea channel at the Suez end has difficulties, but only such as engineers are familiar with. Forty enormous and costly dredging machines are at work on different parts of the canal—chiefly, we conclude, the northern half—discharging mountains of mud, sand and clay over the banks or into barges. The rate of expenditure is put at £200,000 per month, or two and a half millions a year. Our informant calculates that a driving wind, after blowing a month together, will send into the canal, when finished, five hundred tuns of sand a day, or fifteen thousand tuns a month. This, however, is no more than a single dredging machine would be able to keep down at a certain moderate cost in coal. The difficulty of keeping up the banks of the canal, exposed as they will be to the wash of steamers, and to a surface often agitated by the wind, is a more serious matter, but one which does not enter into the present question. Upon the whole, it does seem a moral certainty that, at least in two or three years—for one year seems out of the question—this great undertaking, worthy of a heroic age, will be brought to what we may fairly call an actual completion. In the course of the year 1871, we may probably see the sea water of one ocean flowing into the other.

Improved Automatic Horse Hay Rake.

That the department of agriculture is highly estimated by inventors, at least as affording a field for the exercise of their tal- ents, is sufficiently proved by the frequently offered improvements in implements of husbandry, especially those designed to save labor and time. Among these none have received more frequent attention than those relating to the cutting and gathering of the hay crop, and none have been of greater utility. To be sure, objections to their use and difficulties in their management have been found in a number of horse rakes, but improvements following improvements are rapidly bringing this implement to perfection. The engraving presents a perspective view of a horse hay rake which offers some points believed to be improvements not found on other machines.

The wheels, two in number, are rigidly secured to their respective axles, the outer bearings of which are in a box secured to the under side of the main frame of the machine and the inner portion supported by similar boxes secured to cross bars of the frame. The inner ends of the two axles support a gear or pinion turning freely, the outer faces, or sides of which are formed into ratchets with which sliding ratchets on the respective axles engage, these latter allowed to slide on the axles, but held to the ratchet sides of the pinion by means of spiral springs, and connected to the axles by pins traversing slots in the axle, or by forming the axle ends and the holes in the clutches square. This gives independent action to each wheel in backing and unites the two wheels, when the vehicle moves forward, so that the two axles act as one. A toothed rack bar, connecting at one end with a lever having a handle at the top, and at the other end with a foot lever in front of the driver's seat, serves to raise by means of the pinion on the main shaft or combined axle, the teeth of the rake, which pass through slots in a hinged bar at the rear of the machine. The separate teeth are attached to thimbles that turn freely and independently on the rake head shaft, so as to enable them to reach depressions in the surface of the field. When driven on the road the rake teeth are held from the ground by the lever at the right hand of the driver's seat. To discharge a rake-full of hay the driver presses upon the foot lever, bringing the rack in contact with the pinion that raises the rake, and allows it to fall soon as the rack section has passed the circumference of the pinion. The operation of the machine and its advantages may be comprehended by an examination of the engraving in connection with this description. It will be seen that the operation of the rake is at all times under the control of the driver, and that except when he wishes to instantly elevate the rake teeth by means of the hand lever, both hands will be free to guide the horse.

Patented June 16, 1868, through the Scientific American Patent Agency, by Jonathan Hunsberger, who may be addressed for the sale of the entire right, or for state and county rights, at Skippackville, Montgomery Co., Pa.

Improved Engine and Signal Oils for Railroads.

Throughout the country, says Pease's Oil Circular, there is a better demand for first-class oils. In many cases what is gained in price of cheap oils is lost ten times over in the repair account. There is an enormous loss of power in our railroads by the use of cheap oils, and we include in this those oils easily affected by heat. The experiments of Metz and Morin in 1831, and others up to the present date establish the fact that the amount of friction is found to be dependent rather upon the nature of the unguents than upon the surface of contact, and the nature of the oils must be measured by the pressure or weight tending to force the surfaces together.

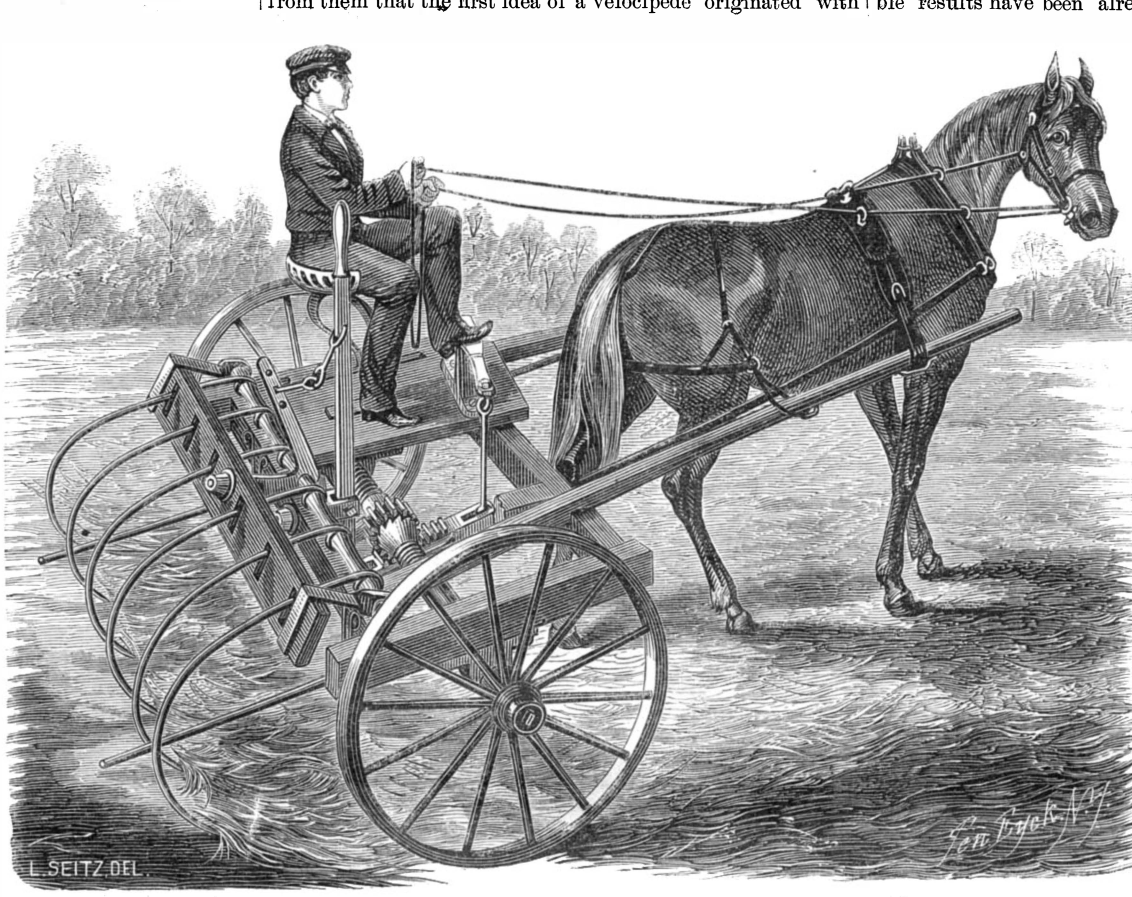
There is no question but that there is a loss of 30 to 56 per cent of power on most of the roads in this country by not looking into and understanding the laws of friction, and the effects of heat and pressure upon the oils used. They must be based upon scientific principles, and adapted to the uses intended, otherwise they fail to accomplish any satisfactory results, and a great loss of power and destruction of machinery is the result.

Friction, immediate or long continued has the same effect upon oils; in one case it is immediate, as in a steam cylinder, in the other it is slow and long continued, as on the slides and smaller bearings. Oils must be made to form a perfect separation, otherwise the friction is increased and is dependent upon its greater or less viscosity, whose effect is proportional to the extent of the surface between which it interposed.

Those roads that have looked into this important matter, ranking the third or fourth in expenses, are now saving tens of thousands of dollars every year.

There is no occas on for a hot journal on any road under ordinary circumstances and using proper oils. There is no occasion for cutting of journals and destruction of valve seats, if a little thought would only be given to the subject of pressure and friction. The wonderful chemical effect of some of the poor cheap oils upon the iron surfaces and journals of some of the roads is entirely overlooked. Has it ever occurred to railroad men that the use of oils of strong acid reaction has a tendency to weaken the strength of the boiler itself, as they have the power to cut and destroy the bolts of the steam chest and cylinder?

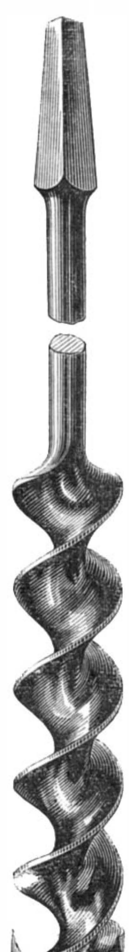
THE INVENTOR OF THE VELOCIPEDE.—The last number of the *Moniteur de la Photographie* of Paris, (1st Nov., 1868) has an interesting series of letters upon the invention of the velocipede, which, it appears, would be due to Niepce, for whom is claimed also the invention of photography. The letters in question are written from Claude Niepce to his brother Nicephore Niepce, and are dated from Hammersmith, near London, Nov. and Dec., 1818, and August, 1819. We do not glean from them that the first idea of a velocipede originated with Nicephore Niepce, but simply that he was occupied with some experiments concerning the improvement of this kind of locomotive. If no mention can be found of a velocipede prior to the year 1818 doubtless Niepce has good claim to its invention.



HUNSBERGER'S PATENT SELF-DISCHARGING HORSE RAKE.

KASSON'S CONCAVO-CONVEX AUGER AND BIT.

The front or working faces of this auger bit are concave and the rear faces are convex giving great strength to the twist and removing the chips without undue friction against the edges of the hole, thus preventing clogging and gumming. The cutting lip is merely a continuation of the twist, so that if the auger should be broken at any portion of its length another screw and other cutting edges can be formed by cutting the twist at a plane nearly at right angles with the axis of the auger. The convexity of the cross section of the twist, increasing toward the center, is, in effect, a strengthening rib, making a very stiff tool. This auger, or bit, is adapted to all kinds of wood, hard or soft, and is specially adapted for boring hubs, pumps, etc., and to all descriptions of wood boring machinery. Having less friction than the ordinary style of auger it is less liable to become heated, and it relieves itself perfectly of the chips, without clogging, and does not require to be withdrawn for clearance.



Patented through the Scientific American Patent Agency, January 15, 1867 (reissue dated April 9, 1867), by A. C. Kasson of Milwaukee, Wis., assignor to himself and N C. Gridley of St. Louis, Mo. Manufactured and for sale by the Humphreysville Manufacturing Company; J. M. Watkins, agent, who may be addressed at No. 5 Gold street, New York.

A CURIOUS fact in connection with the practical working of the Atlantic Cable Telegraph is that messages sent from London to-day arrive in New York yesterday.

A Newly-Discovered Property of Gun-cotton.

It has been found that the explosive force of gun-cotton may, like that of nitro-glycerin, be developed by the exposure of the substance to the sudden concussion produced by a detonation; and that if exploded by that agency, the suddenness and consequent violence of its action greatly exceed that of its explosion by means of a highly heated body or flame. This is a most important discovery, and one which invests gun-cotton with totally new and valuable characteristics; for it follows, as recent experiments have fully demonstrated, that gun-cotton, even when freely exposed to air, may be made to explode with destructive violence, apparently not inferior to that of nitro-glycerin, simply by employing for its explosion a fuse to which is attached a small detonating charge. Some remarkable results have been already obtained with this new mode of exploding gun-cotton. Large blocks of granite and other very hard rock, and iron plates of some thickness, have been shattered by exploding small charges of gun-cotton, which simply rested upon their upper surfaces—an effect which will be sufficiently surprising to those who have hitherto believed, as every one has believed, that unconfined gun-cotton was scarcely to be considered as explosive at all, that it puffed harmlessly away into the air, not exerting sufficient force upon the body on which it might be resting to depress a nicely balanced pair of scales, supposing the charge to be fired upon one plate of the scale. Further, long charges or trains of gun-cotton, simply placed upon the ground against stockades of great strength, and wholly unconfined, have been exploded by means of detonating fuzes placed in the centre or at one end of the train, and produced uniformly destructive effects throughout their entire length, the results corresponding to those produced by eight or ten times the amount of gunpowder when applied under the most favorable conditions. Mining and quarrying operations with gun-cotton applied in the new manner have furnished results quite equal to those obtained with nitro-glycerin, and have proved conclusively, that if gun-cotton is exploded by detonation, it is unnecessary to confine the charge in the blast hole by the process of hard tamping, as the explosion of the entire charge takes place too suddenly for its effects to be appreciably diminished by the line of escape presented by the blast hole.

Thus the most dangerous of all operations connected with mining may be dispensed with when gun-cotton fired by the new system is employed. It will readily be observed that this discovery, which we believe is due to Mr. Brown, of the English War Office Chemical Establishment, is likely to be attended with the most important results. Not merely is the strength of gun-cotton exploded in this way much greater than that of the same substance fired by simple ignition, but it now operates under conditions which were sufficient under the old system practically to deprive gun-cotton of its power. It has been said, and said justly, that if you want gun-cotton to exert itself you must coax it into the belief that it has a great deal to do. You must give it bonds to break and physical obstacles to overcome, with no outlet or possibility of escape. But now gun-cotton will exert itself, and put forth more than what was believed to be its full strength, whether to see any work to do or not. It will behave as less coy explosives have behaved before it—always with this difference, that it is half a dozen times as powerful as any of its rivals, with the exception of nitro-glycerin, to which in mere power even it is not inferior. This discovery, therefore, can hardly fail to give a considerable impetus to gun-cotton, and to lead to its universal adoption for mining purposes, as soon as its new properties become generally known. In connection with possible military applications the discovery is invaluable. There can no longer be any doubt what agent should be employed for the breaching of stockades and the like; and the absence of all necessity for the use of strong confining envelopes will have an important bearing on the employment of gun-cotton for torpedoes and all submarine explosive operations, beside greatly simplifying mining and breaching operations in the field. We have, in fact, discovered several new advantages to add to those which already had sufficed to recommend gun-cotton as an explosive agent in preference to all others. The conditions that are fulfilled by a detonating fuse in determining the violent explosion of gun-cotton, under circumstances which hitherto have been altogether unfavorable to such a result, have been made the subject of investigation by Mr. Abel, and we hope at some future time to notice the conclusions at which he has arrived, as they appear to have a very important general bearing upon the conditions which regulate the development of explosive force, not merely from gun-cotton and nitro-glycerin, but from explosive compounds and mixtures generally.

A MICROSCOPIC club has been organized in Chicago. Two well-known citizens express a willingness to give liberally toward purchasing instruments and scientific works upon the subject of microscopic instruments.

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VOL. XX., No. 3....[NEW SERIES.]....*Twenty-fourth Year.*

NEW YORK, SATURDAY, JANUARY 16, 1869.

Contents:

(Illustrated articles are marked with an asterisk.)

WE are now printing 35,000 copies of the SCIENTIFIC AMERICAN, and subscriptions are rapidly flowing in, from Maine to California—from the Lakes to the Gulf. Our columns offer one of the very best mediums in the country for advertisers who value a large circulation. A word to the wise is sufficient.

HONOR OF WORKMEN—THE VALUE OF A GOOD NAME.

That "honesty is the best policy" requires no argument addressed to the intellect, nor moral appeal to the conscience to prove. He who has studied history, used his opportunities for observation, or allowed his own experience to become his teacher, needs no further evidence that it "pays" to be honest. We do not use the verb in only its lower and ultimate sense, but in its true signification; for no condition is so abject as that in which a man cannot respect himself. Injustice or neglect may be borne philosophically, but a consciousness of meanness and a knowledge of deliberate wrong-doing are worse than the brand of Cain, and destroy the manly pride that is the glory of every honest man. He who gives his neighbor the fair return for his money leaves no obligation unredeemed, no promise unfulfilled to return like a "curse come home to roost." The laborer who faithfully works his allotted hours, honestly fulfilling his part of the contract; the mechanic who earnestly uses his best endeavors to understand the job in hand; and the employé who works for his employer as earnestly and honestly as he would for himself, or as he would require others to work for him, know that honesty *is* the best policy. The false economy which induces the "middle man," or merchant, to take advantage of the producer and consumer by belittling the value of the article he buys, and adding improperly to the price of the article when sold, and which encourages the belief among workmen that they gain by the loss of the employer through their negligence or overreaching, is entirely unworthy the character of an honest man, and is also unprofitable. Such cases we believe to be rare among mechanics. No department of our business life is more honorably conducted than that in which the mechanic and employer, the manufacturer and his customer are concerned.

Generally, we believe, our mechanics take such pride in their work that they prefer to suffer a personal pecuniary loss rather than impair their good name. We have known manufacturers to condemn a large number of finished or partly finished articles, and bear the loss of the labor, time, and material expended, rather than risk impairing the good name their perfect work had gained for them. To prevent any injury to his reputation, we know of instances where a manufacturer has so utterly destroyed imperfect work that it could not be used except in its elements, as the crude material, when the loss was counted by the thousands of dollars.

And this sense of honor is no less strong among workmen who depend wholly on their daily work for a livelihood. How often the workman refuses to permit himself to eat his lunch or rest during the hour of recess, preferring rather to rectify an error or to perfect an unfinished piece of work. He will even deprive himself of sleep or neglect domestic duties in order to keep up his self-imposed standard of excellence as a mechanic. Yet in many such cases the workman was paid by the day, with no special consideration of the amount of work performed. But his innate sense of justice, or, rather, his pride in his handiwork, has been the impelling power, even the approval of his "boss" or employer being frequently unexpected and perhaps withheld. The fascination of the exercise of mechanical skill may account for part of this earnestness and self-denial; for scarcely any other employment can equal, in absorbing interest, that of the mechanic who sees, day by day and week by week, the crude materials assume form, and beauty, and at last acquire the quality of usefulness. Yet something must be attributed to the *esprit de corps*, the generous honor of excellence that undoubtedly prevails among mechanics, and preserves the trades from becoming only a resort for miserable mercenaries.

The good name attained by the exercise of this honor among manufacturers and mechanics is really valuable, apart from the comfort of a "conscience void of offense." The prosperity of some of the most extensive manufacturers has been assured, and is maintained simply by the exercise of this honor. We could name a number, both in this country and Europe, which has not depended specially on the monopoly of patents, nor upon any secrets in their business, but on the excellence of workmanship and absolute value of their productions for their fame, which is world-wide. And we could mention mechanics by name who never aspired to the position of proprietors or employers, yet whose loss would be felt far beyond the limits of the establishment in which they are employed or its immediate connections. These are mechanics *par excellence*, whose opinions are decrees, whose honor is unimpeachable, and whose monuments, apart from the admiration of their fellows, are their works.

INUTILITY OF FORTS OF MASONRY.

The recent destruction of Fort Lafayette at one of the entrances of New York harbor, by fire, leaving only the blackened walls remaining, affords an opportunity of judging of the value of such structures for coast defense. Here was no battering of the structure by hostile shot, no shattering by hostile shell; but a simple accident, such as might occur in any dwelling or storehouse, left the defense, so-called, in a few hours a perfect wreck. Indeed, but a few minutes sufficed to render it untenable, the flames driving the last sentinel from his post. If a spark from the chimney of a casemate could so easily and quickly kindle a fire that stopped its ravages only when there was nothing left for the flames to feed upon, and which left the entire structure only a mass of useless ruins, what would be the value of such a defense against the exploding shells of a hostile ship? The fort would prove only a funeral pyre for its garrison.

Masses of masonry, either of brick or stone, are useless against the artillery and projectiles now in use. This was sufficiently proved in the Crimean war, and received many exemplifications during our late civil war. Fort Sumter, after being knocked into a dust heap, was more formidable than when under Anderson it frowned upon the rebel batteries of Charleston. Heaps of rubbish and mounds of earth and sand proved during the war to be more effectual defenses than the best specimens of engineering skill when built of granite, bricks, and mortar. The day of stone forts has passed. If forts are to be built they must be either of sand or earth, affording merely protection to men and guns from the direct fire of the enemy, or of iron, containing their garrisons in a shell, proof against the heaviest shot. But even these are limited in their usefulness for purposes of offense. If located at the entrance of a harbor the train of their guns is limited, and every advantage is in the hands of the enemy with ships at his command. A fort presents a fixed and usually a large target at which the guns of the enemy's ships may practice at will, while those of the fort can reply only when the enemy chooses to offer an opportunity, and then the target is a comparatively small one which is continually shifting its position and offering no satisfactory mark for the gunner.

If stationary forts are to be constructed at all, they should be places entirely inclosed so that dropping shot or shells could no more reach the interior than direct shot. They should also be bomb and shot proof, of material impenetrable to any projectile yet known. That this can be measurably accomplished is susceptible of theoretical proof and even practical demonstration. A system similar to that illustrated in No. 26 Vol. XIX SCIENTIFIC AMERICAN would seem to be greatly preferable to that on which millions are wasted every year.

But we believe that a system of floating, movable batteries would cost less in the first instance, be kept in repair for less, and be vastly more effective as harbor and coast defenses than the most elaborate system of fixed forts and batteries at present in use. Some such system, we are confident, will yet supersede the present inefficient and cumbersome method of national defense.

ABUSE OF THE FRANKING PRIVILEGE AGAIN.

We have frequently called attention to the abuse growing out of the franking privilege. The people now heavily taxed have a right to complain, and it is the duty of the press to expose the rascality which helps to carry up the cost of our mail service several millions beyond its actual receipts. If members of Congress knowingly allow others to use their franked envelopes to promote private schemes, then we say that they are *particeps criminis* in cheating Uncle Sam out of his just dues.

It is evident, that so long as a stamped frank is recognized as valid by the Post Office authorities, there can be no difficulty in reproducing the frank of any member of either House of Congress, the only expense being the cost of cutting the *fac-simile* of his signature

The only safe and proper method of guarding against frauds and abuses of this sort is to abolish franking altogether.

We have before us several envelopes covering the pamphlet of a Patent Agency at Washington bearing the stamped frank of Hon. John A. Logan, M. C. We have a letter from a gentleman in Germany in which he orders the SCIENTIFIC AMERICAN. It reaches us under the frank of Hon. J. M. Broomall, M. C. The *Sun* says the frank of Hon. John Lynch is used to pass bags full of New York papers through the mail. It is said that Hon. Demas Barnes franks circulars advertising his plantation bitters. And so it goes on. The people ought to grumble against such abuses until they are stopped; and we hope Senator Ramsay and others who can assist to do so will secure the passage of some bill to put a stop to this iniquity at once.

AERIAL INHABITANTS.

Most people have little idea of what the air we breathe contains. This ocean of mixed oxygen and nitrogen at the bottom of which we mortals flounder about, contains more than is dreamed of in their philosophy. The old spelling book exercises, "Birds live in the air," "Fish live in the sea," would be the substance of their replies, if questioned as to the living things which inhabit air and ocean. But the air is the home of immense numbers of living things which the unaided eye connot perceive, as well as the feathered and insect races. This vital fluid, without which we cannot ordinarily live five minutes, is literally crowded with life; life in an embryotic state it is true, but none the less life on that account.

An egg is a living thing; if you touch your tongue to the ends of a newly laid egg, you will find that one end is quite warm, while the other may be quite cold. So long as that heat remains the egg is alive—an organized being—capable under favorable circumstances of development into a bird of the species which deposited it. When that vital spark of heat is gone the egg is dead and will immediately decay. The seeds of plants are analogous to the eggs of birds, although after they are dead and incapable of germination, they will not decay so rapidly.

There is another class of germs of a still lower order than vegetable seeds. These are minute granules, parts of flowerless plants, which perform the functions of seeds, called spores. A good example of spores is to be found upon the under sides of the fronds of ferns, at the proper season. Spores are not so highly organized as the seeds of flowering plants, but they contain a vitality which, although of a lower type, is longer retained. In fact it is not improbable that some of them retain their power of germination for ages, only waiting for favorable circumstances to become developed into complete growth.

The air has been ascertained to be full of such germs, which, blown about by winds, lodged in crevices of stones in high buildings and tall cliffs, taken into the stomachs of animals with their food or inhaled with their breath, beaten to the earth with rains to rise again in the form of impalpable dust, at length find a proper nidus in which they speedily develope into maturity.

Some of these when breathed or otherwise taken into the system pass into the blood and produce disease. A large class of diseases are now attributed to this cause. Among them is the "Fever and Ague," the pestilence of new and low lands. This disease has lately been attributed by good authority to the presence of microscopic algea in the blood.

So plentiful are these germs existing in innumerable forms and variety in the atmosphere, that Dr's. Smith and Dancer, of Manchester, England, found that there was a quarter of a million spores in a single drop of distilled water which had been agitated in contact with the common air of that locality in a bottle. What myriads upon myriads of these tiny beings must be precipitated upon the earth during a storm of rain.

The microscope, that "wonderful eye which science has bestowed upon mankind" reveals to us these curious facts; and what its ultimate effect upon the sciences at large and medicine in particular, is to be, it is impossible to predict. The telescope is penetrating deeper and deeper into the celestial vault, and constantly telling us new wonders of the starry universe. The microscope on the contrary is dragging to light minute existences that have lain hidden for ages, and is tracing their influences upon the health of mankind. The army of workers with this most fascinating and instructive instrument is daily increasing, and a flood of light is beginning to pour upon many things hitherto most mysterious.

NAVIGATION OF THE MISSISSIPPI—PROPOSALS FOR ITS IMPROVEMENT.

The Mississippi and its tributaries constitute the great natural thoroughfare for the central portions of North America. The importance of improving its navigation and developing the facilities it affords, has been often the subject of thought and discussion since the general settlement by the whites of the one million two hundred thousand square miles which it drains. No other system of rivers can compare with it in extent or in the natural advantages afforded for extended and profitable traffic. It is not a matter of surprise then that in this age of stupendous enterprises, the improvement of these rivers should have attracted renewed attention from the engineering talent of the country. Such being the case, it may not be amiss, before discussing the plans proposed for this purpose, to say something of the peculiarities of the river itself.

The Mississippi is, in round numbers, three thousand miles in length from its source to its mouth, and is navigable at present from its mouth to the Falls of St. Anthony, about two thousand two hundred miles. Above these falls it is again navigable. The Arkansas and Red rivers emptying into it are each navigable for more than one thousand miles. The Missouri, its principal western tributary, is navigable to a point nearly four thousand miles by water from the Gulf of Mexico. Its large eastern tributaries, the Ohio, Tennessee, and Cumberland rivers give two thousand miles or so additional scope for steamers; while the total number of branches, large and small, towards its mouth, which are to a greater or less extent navigable, has been estimated at not less than fifteen hundred.

The lower plain through which the Mississippi flows, extending from the mouth of the Ohio to the Gulf, is about five hundred miles in length and of varying breadth, say from thirty to one hundred and fifty miles, including the great delta at its mouth. The delta is in all its parts nearly on a level with the water in the river when at its lowest point, and in consequence a system of dykes has been found requisite to prevent inundation. In the low water of summer the current towards the mouth of the river is extremely sluggish, an average fall of about eight inches per mile being all that is estimated for the lower plain through which it flows. It could hardly be otherwise under these circumstances that the course of the river over this plain should be very crooked, and its channels should be very changeable. Add to this the fact that the entire system embraces many tracts of sandy country and timber land and it will be easily understood how bars are constantly forming and shifting and "snags" are constantly drifting down the current to obstruct navigation.

How to relieve navigation from these embarrassments and at the same time to protect the low lands from the dangers of inundation, constitutes an intricate problem and one which will probably never be solved except by repeated experiment. The clearing up and removal of timber along the banks of the principle stream and its affluents, will gradually lessen the trouble arising from "snags," but the sediment poured into the river by the Missouri and other rivers and the periodical freshets remain. Some of the convolutions in the course of this river are so great that a distance of twenty-five to thirty miles by water only makes an air-line headway of a mile or two.

Some cuttings have been attempted to straighten the channel in such cases as the above but we believe the result has generally been that the succeeding freshets have wholly or partially filled up the channels thus formed, and the obstinate waters have either selected an entirely new bed or have returned to the old one. True these works were very imperfect in their nature and could hardly be expected to be durable; but there are doubtless difficulties to be surmounted in making permanent improvements in the Mississippi channel arising from the general instability of its banks, that are hardly appreciated by engineers who have not given special attention to the subject.

A plan has been recently laid before the Louisville Board of Trade, recommended by the New Orleans Academy of Sciences, which it is claimed meets the exigencies of the case; embracing, first, the proper direction to be given to walls or jetties for controlling the action of flowing water; and, second, a material for the construction of these walls or jetties, which can be conveniently handled, and which water cannot move or undermine. The first part of this plan depending upon the principle of reflection for the direction of currents, it is claimed can be readily applied by the exercise of proper judgment in constructing the jetties at the necessary angles to the currents intended to be controlled. In regard to the second part of the plan it was represented to the board that Manico's caisson is the best material for the construction of these jetties. These caissons are the invention of Lieut. Manico, of the Royal Marines of Great Britain, the engineer in charge of the construction of the breakwaters and other sea works of England, and are now used exclusively for such works on its coasts. Their construction and the method of placing them in position were described to the board as follows: "They are usually constructed of a latticed frame of wood or iron filled with loose stones of any kind; and for the convenience of being carried in barges, and handled with the crane, they are only one yard square. They are made sufficiently strong to bear the weight of from 1,200 to 2,000 pounds of stone, and to be craned or dumped down to form walls or obstructions upon the lines marked by the engineers for breakwaters, jetties, the foundations of lighthouses and forts, or any subaqueous works in seas or rivers. They are used exclusively in England for such purposes, and they are especially useful in all water currents, and indispensably necessary in bottoms of sand and mud, like those of our harbors and great rivers where piling and plank ing will not answer. Their great excellence consists not only in the convenience of their form for transportation, and handling for engineering purposes, and their cheapness, but in their stability to resist the undermining power of water. Their latticed form gives them the property of the snow shoe formed by the savage of plaited splits, and which prevents his foot from slipping or sinking in the snow; or like the knotted and webbed foot of the duck, which the Creator has formed for standing or walking on the mud and sand. They will not sink upon a sand bar and no power can drive them into it.

"The work done by the aid of these caissons is very simply and quickly performed. The lines for the jetties to protect a caving bank, or remove a bar, or shift or deepen a channel are 'staked off' by the engineer, and the barges of caissons are unloaded upon these lines and the work is done. The water completes the structure, and by its deposits makes a solid wall of the whole. No matter how they are thrown in a current, they can never be removed by the water. Every interstice between the loose stones is filled with sand and clay, Chemical action takes place in the compacted mass, and the whole becomes a conglomerate which will endure to the end of time."

In opposition to the claims of this plan may be placed the statement of General Roberts, of the U. S. A., made at the last meeting of the Connecticut Academy of Sciences, in which he attempted to show that the system of confining the flood-waters of the Mississippi river in one narrow channel by dyking, is obstructing the creative laws of delta bottoms and basins, and working the most serious evil by emptying into the Gulf of Mexico the delta-forming material that would, if the waters were left free, spread themselves over the low marshes and swamps, and in time raise them up to higher levels, by the cumulative process of delta deposit, and create cotton lands.

His plan is to introduce a system of waste weirs that should create artificial rivers and carry all the flood waters into the swamps, morasses, bayous, etc., of the Mississippi basin. He also proposes a system of engineering for the waters of the lakes, using them as reservoirs for the regulation of minimum low water navigation.

Without pretending to decide finally upon the relative merits of these schemes, we repeat that experiment alone will determine the value of either. To attempt to carry out either of them without previous trial of their individual workings would be extreme folly. It would be well, we think, for the Government to employ some engineers of established reputation to devote their time and efforts to experimental solution of this problem, and to feel the way as it were to a practical method. We do not believe the man lives who can devise in his study a system that will fulfill all the conditions of the problem, but we do not by any means on that account hold that a solution is impossible. If ever obtained, however, it will be by practical attempts upon the fickle banks themselves and not upon drawing paper.

WHAT IS FUSEL OIL?

The new York dailies, since the report of analytical chemists of the Board of Excise has been made, are asking the question, What is fusel oil? Some have also made a feeble attempt to answer the question which is thus propounded. The query has arisen from the fact that the report above alluded to states that out of thirty-two samples of Bourbon and brandy obtained from the liquor dealers of this city all but four contained fusel oil. One daily gives vent to its feelings in the following:

"Is it after all such a frightful thing? Dunglison describes it as an acrid, volatile oil, formed in the manufacture of potato brandy, and which is not easily separable from it; and another authority says it accompanies ordinary alcohol in its production from potatoes and grain. Dunglison also says that its chemical constitution is analogous to that of alcohol, and that, in small doses, it is highly stimulating—acting like narcotics in general; while, in large doses, it destroys the mucous membrane of the stomach. The same authority also designates it as 'potato oil,' 'grain oil,' 'corn spirit oil,' 'amylic alcohol,' and 'hydrated oxide of amyle.' Some medical men have considered that in the use of whisky by consumptives, fusel oil was the effective element—having the tendency to retard the processes of decay in the tissues of the lungs. But there is no question of the ruinous effects of the fusel oil liquor sold in New York."

In regard to the effects of fusel oil upon the human system we can do no better than to quote the "United States Dispensatory," which says: "Amylic alcohol (fusel oil), as shown by experiments on inferior animals, is an active irritant poison." If that is not sufficiently definite to satisfy anxious and thirsty inquirers we shall not attempt to make it more so. Of course it may be taken like other poisons diluted with water and common alcohol, as it is found in the compounds doled out by honest and conscientious rumsellers without danger of immediate death or anything more serious than "redness of eyes," temporary madness of brain, and now and then a touch of *delirium tremens*, until the coats of the stomach and the nervous system succumb to continued and prolonged attacks, and another wreck is cast upon the shores of life. But it is, nevertheless, a poison, *an active irritant poison*, upon good authority. How it gets into the liquor is of little consequence. The report says it *is* there, and we say let it alone and it won't poison you.

THE NEW FRENCH GASLIGHT.

Messrs. Ball, Black & Co. have illuminated the show windows of their splendid store in Broadway with the Bourbouze light. Its peculiar brilliance and beauty nightly attract a crowd of admiring spectators. So brilliant and pure is this light that the ordinary gaslights look like spots of sickly and ghastly yellow when placed between the eye and the pure white illumination of the Bourbouze burners. The light is as steady as the sun. The closest examination cannot detect the least tremor. We tried it with a sheet of white paper corrugated, and inclined so that portions should be thrown into shadow, thus magnifying any motion that might be imperceptible to the unaided eye, but could not detect any motion whatever. Equal parts of oxygen and common street gas are driven simultaneously upon a pencil of magnesia; this is all there is of mechanism of this wonderful light, which literally throws all other lights at all adapted to general use into the shade. In point of cost, when lights of equal intensities are used, the new light is so much cheaper that we should fear to be suspected of exaggeration should we make a statement of it. We are told that Messrs. Ball & Black's establishment is the first that has adopted the Bourbouze light on this continent. A full description of it will be found on pages 185, and 200 Vol. XVIII. of the SCIENTIFIC AMERICAN.

WE were recently shown a chain of brass, with hook and solid links, said to have been cast in a sand mold.

REMINISCENCES OF TRAVEL IN SPAIN.

NO. V.

An anonymous correspondent, who signs himself "A Spaniard" complains of some of our strictures upon Spanish manners. We can only say that whatever we have written upon this subject is not only true, but our statements are borne out by other travelers and writers who have visited Spain. The habits and customs of a people are free to be observed and commented upon by all travelers, and in the preparation of our reminiscences of Spanish travel we have had neither motive nor purpose to do the slightest injustice to the people of that afflicted country; and if some of our statements have seemed singular even to a native Spaniard, we can only account for it by the fact of his long residence in this country, where life, untrammeled by usages of hoary antiquity, appears more new, fresh, and vigorous.

There is one other phase of Spanish character which we propose to present, and in thus closing our sketches of European travel, it is with the hope that Spain, which has so grand a history, with so much undeveloped wealth, may, even though it be through revolution, once more arise to greatness and substantial prosperity.

THE GREAT NATIONAL SPORTS—A BULL FIGHT.

The national sports of a people are true indexes of their character and civilization, and it is therefore difficult to believe that Spain is the only Christianized nation in the world which tolerates the cruel and inhuman practices of bull fights and cock fights.

It is commonly said that you must not quit Spain without seeing a bull fight, the great national sport. We had read about this heroic spectacle, and being naturally averse to cruelty in every form, we entered upon the business with considerable trepidation. But after all there is nothing like seeing of what stuff the people are made in order to properly appreciate their character. We wanted to see the whole thing or nothing, and to make the affair as respectable as possible in our own eyes, we joined a party of Americans and proceeded to visit the Plaza de Toros (Place of Bulls) the evening previous to the fight, for the purpose of inspecting the pens where the animals were kept. These pens, within the inclosure, are about fifteen feet square, and are provided with galleries, where the tormentors practice the *humane* sport of spearing the bulls, in order to get them into a towering rage before they are let through the dark narrow passage way communicating with the arena. Within the building there is also a hospital, provided with apparatus and medicines, in case any of the tormentors should chance to be injured, and in order to impart to the spectacle a serio-dramatic interest and solemnity, there is also an altar, where they kneel and kiss the crucifix before engaging in their work; the effect being heightened by the presence of a priest* to administer the consolations of religion in the event of any of them being mortally wounded. A most touching and beautiful adjunct to be sure.

The next morning, being the occasion of a popular religious festival, the whole city was astir, and in the afternoon the crowd began to wend its way towards the Plaza de Toros. The building resembles an ancient coliseum, built of stone, and furnished with several tiers of stone seats, above which are inclosed boxes for the higher classes. There is also an inclosed box emblazoned with the royal arms, and appropriated to the use of the royal family. We should judge that 15,000 spectators might be accommodated with seats. The arena is surrounded by a heavy plank barrier, about six feet high, to protect the spectators, and over which the tormentors leap when hotly pursued by the infuriated beast.

The performance was announced to begin at three o'clock in the afternoon, and an armed guard of handsomely mounted men were stationed about the Plaza to preserve order. The crowd inside, consisting of men, women, and children, must have numbered ten thousand, and aside from slight manifestations of impatience, behaved very orderly. The band performed an overture and the performers entered. There were several men in costume called *picadors*, mounted upon miserable old horses, of the same class used to draw fish wagons about our streets. The *picadors* have their legs incased to ward off the thrusts of the bull; and following them was a team of three mules in fancy harness, dragging a whiffletree and chains, accompanied by *bandarillos*, who flaunt the red cloaks, also several men leading bloodhounds. We were satisfied at this point that we were not going to like the thing at all, but the ring being speedily cleared, a blast of the trumpet signalized that the beast was coming; and sure enough, in he plunged—a noble animal he was, too. After rushing wildly around, as if anxious to escape, he plunged headlong at one of the mounted *picadors*, who could offer no resistance, and in a moment he was thrown from his poor old horse, and the animal was soon beyond the need of a veterinary surgeon. After three horses had been killed, and the signal given, the red cloak flaunters had the bull to themselves. He pursued them with considerable fury for a while, but soon began to show signs of fatigue. In the meantime, by a most adroit movement, barbed arrows were thrown into his neck, two being lodged at the same moment, followed by others, until six or eight of these ugly weapons were firmly planted; the effect of which was to arouse the animal to a final desperate struggle. The next professional tormentor who enters the arena to share the honors of the occasion is the *matador*, dressed like a horseman in the circus, and whose duty it is to kill the bull —which is most skillfully done by thrusting a rapier into his neck, back of the horns, which, if well done, causes almost instant death. After this manner four bulls were tormented to death, and eleven horses were killed; each of the dead animals being dragged outside by the mules upon a keen jump,

* This information was given to me by a trustworthy local guide, who had no motive to misrepresent the facts.

there to be gazed at by an admiring crowd of dirty urchins, who could not raise money enough to get inside.

It is considered very heroic when a horse has been disemboweled if the *picador* can rally him for a ride about the arena, with his entrails protruding from the wound. This latter spectacle always excites great applause from the spectators who occupy the lower range of seats. One of the bulls, a fine orange color, from Andalusia, leaped the barrier seven times, and turned upon his pursuers with astonishing vigor. This same animal killed six horses before he fell under the sharp prick of the rapier. The last bull of the four showed no fight—he refused to attack the horses, and seemed to look imploringly around upon the people as if to say, "can it be possible that in this city of Madrid, the capital of Spain, which professes to be Christian, such awful cruelty is permitted," but he was not to be let off; the programme called for the slaughter of four bulls, therefore he must die; and four large bloodhounds were let loose upon him, when the fight became somewhat spirited, until they had fastened their fangs into his flesh, and held him fast when the *matador* terminated his life with the rapier.

The performance wound up with the introduction of four young bulls let in, in succession, with balls on their horns, to be worried by the crowd. There would have been some amusement in this but for the shocking sights which had preceded it. There is nothing whatever in this spectacle that deserves to be called a fight. It is simply a cruel method of torturing to death a few bulls—and old worn-out horses.

The whole exhibition lasted two hours and a half, and seemed to afford infinite satisfaction to the crowd of natives who were present. It was bad enough, we found, to once witness such a scene, but what shall be said of the people who cherish it as the great national sport.

It is, however, no more than just to say that the higher orders of society are beginning to look with disfavor upon bull-fighting. Such brutalizing spectacles are now encouraged chiefly by the lower classes, with the few strangers who witness them from motives of pure curiosity. Having witnessed this, the chief sport of Spain, which appears to have kept pace with the progress of the nation, we concluded to give the minor sport of cock-fighting the cold shoulder; and were glad to get out of Madrid as early as possible the next morning.

Some English writer has said that when he visited a Spanish bull fight, he felt as though the clock of time had been turned back eighteen hundred years.

OBITUARY.

Ichabod Washburn, "Deacon Washburn" as he was known, of the firm of Washburn & Moen, Worcester, Mass., died on the 30th of December last, having been identified with the manufacture of machinery in this country for nearly half a century. He was of old Puritan stock, and the writer was one of his first apprentices, when it was the style to make the youngest apprentice a member of the "master's" family. The honesty, integrity, and business capacity of Mr. Washburn are not more vividly brought to mind than his kindness to, and carefulness of all who came under his roof or were confided to his protection.

He became first established in business as one of the firm of Washburn & Goddard, successors of Capt. John Earle in Worcester, Mass., the first builder of wool carding machinery in that State.

"Deacon" Washburn is held in remembrance by many mechanics who received their first mechanical education under him, and apart from these living monuments of his fidelity to duty and his conscientiousness as an employer and the head of a family, he will be held in grateful remembrance by those who are destined to enjoy and improve by his gift to the Worcester County Institute of Industrial Science, to which he donated a brick machine shop, completely equipped, and $50,000 as working capital, and a fund of $200,000, the proceeds of which are to be used for the purposes of the institution.

In all the relations of life, employer, father, husband, friend, and citizen, he was an example worthy of imitation. His loss will be felt far beyond the limits of the city he honored by his generosity.

The Deepest Coalpit in England.

A correspondent of the London *Telegraph* has been down the great coalpit at Wigan, and writes a long account of what he saw and heard, from which we extract the following interesting details: "It is very difficult to realize the enormous value of Wigan underground. Looking at the plans of the mines which we mean to inspect to-day, we see that between the surface and the deepest point to which the sinkers have reached, there have been no fewer than twelve workable seams of coal. These include the great seam of cannel. The seams are classed in five different series. First there is the Ince series, consisting of four seams—the 'yard' seam, at a depth of eighty-four yards; the 'four feet' seam, one hundred and thirty-four yards below the surface; the 'seven-feet' seam, twenty-six yards lower; and the 'furnace' seam, at a distance of one hundred and eighty-six yards from the surface. With the exception of that which was named last, all these seams are exhausted. Below them come the Pemberton series, with a five-feet seam, at a depth of two hundred and seventy yards, and a four feet seam twenty-five yards beneath. Then there is the Wigan series, with its five feet, four feet, and nine feet seams; the first of which is four hundred and forty-five, the second four hundred and sixty-six, and the third four hundred and ninety-five yards below the surface. Lower still, at a depth of six hundred yards, is the famous cannel seam, and now the men are going even below that; they have indeed sunk the shaft to the yard seam of the Orrell series, which is six hundred and seventy-three yards below the surface; and are now, night after night, pushing their way to the fiery and dangerous Arley seam, which is here more than eight hundred yards below ground, although at Hindley they have reached the same coal at a depth of three hundred and twenty yards. There are about six hundred and fifty men employed at these mines—the Rosebridge Collieries. Just now the times are rather bad for colliers. They have not been known to be worse at any time during the last thirty years.

"After chatting awhile with the manager and his son, we made ready for a descent. We do this by doffing the clothing we ordinarily wear, and donning in its stead a very rough miner's dress. Then we (the manager's son and the writer) walk out, and, calling at the lamp room, provide ourselves with lamps, which are somewhat better that the ordinary 'Davy.'

"It is necessary to prepare the nerves for a shock. We are going down to the Cannel Mine, a depth of six hundred yards, and the big engine will throw us that distance in less than a minute. At a signal there is, as it were, a sudden withdrawal of the bottom of the cage beneath our feet, and a rapid falling through dark space; then there is as sudden a check, and we feel, not only as if we had regained our footing, but as if we were being thrust back again as rapidly as we had been before falling. Before time is allowed to analyse the sensations we have experienced, the cage touches the bottom, and we stumble out half dizzy into the eye of the pit.

"Before we leave the pit eye we have our lamps lit, and then turn to take a stroll into the workings. We are not long in reaching a little cabin, into which we step, and while sitting there we are told some particulars respecting life in the pit. When the men come to work they obtain their lamps, already lit, but unlocked, at the pit bank. Then they descend, and at the pit eye the lamps are examined and locked. They are again examined as the men enter the particular district of the mine in which they may be employed. Every day the fireman examines the clothes of each miner, to prevent the introduction of pipes and matches. The law is observed very strictly. If a man is found to have the means of striking a light he is sent before a magistrate, and either fined or imprisoned. But such a discovery is rarely made at Rosebridge. The authority of the manager is regarded, and he himself is personally respected by the men; and throughout a large colliery district these mines are noted for the admirable system of working adopted, and for the skill and wisdom engaged in their management.

"From talk about matters in general, we, still sitting in this cabin, six hundred yards below the surface of the earth, turn to what is more personal, and I learn that my guide has had his dangers and his narrow escapes, as all men must have who have to do with the getting of coal. Once he was in at an explosion, and of course ran for his life. The subtle choke damp, that palpable white mist, was swifter than himself, and floating all about him, so numbed his senses that he sat down, and felt as if lulled to a gentle, delicious sleep. Consciousness was fast passing from him, when his brother, stronger than himself, dragged him rapidly to the pit eye, and saved his life. My friend thinks that choke-damp is the easiest and nicest possible way of dying. There is no pain—there is simply a going to sleep, which you have neither the wish nor the power to prevent."

Exchange of Skill for Labor---China and the United States.

The Shanghai *News-Letter* suggests the outline of a plan by which China and America may enter upon a system of exchanges on a grand scale for their common benefit. The outline is given by a respected missionary in the north of China, where there is a plethora of labor and a dearth of skill; and where experience has convinced him that an exchange would be advantageous for both countries. America needs labor; China needs skill. China can furnish the first; America the second; and both would be benefited by the furnishing. He would pour into each of the Western and Southern States a million of laborers, men who by virtue of patient, industrious, and imitative habits are prepared to obey, to follow, and to execute; and would accept in return the larger brain, superior education, and stronger will which qualify Americans to originate, plan, and command. "Let them come to China," he says, "and fill the land with railroads, steamboats, and telegraphs. Let them develop her vast mines of coal, iron, gold, silver, copper, and lead. Let them light her cities with gas and supply them with water. Let them become physicians, teachers, and preachers. Let them create for her an army and navy, and command them for the good of the Chinese nation," etc., etc. By a proper distribution of brain and muscle, and a good understanding, the missionary anticipates the time when the empire and the republic will hold the destinies of the world.

Editorial Summary.

THE SOUTH AFRICAN GOLD FIELDS.—The Philadelphia *Ledger* says, the South African gold fields are to be visited by an exploring party, composed of certain well known travelers in Africa, and of assistants skilled in mining gold in California. A photographer will be attached to the party. The expedition will be absent for over a year, and will visit regions where no travelers have as yet been. Mr. Baines, one of the company, has already visited the Transval region, and describes the operations of the native goldsmiths as follows: They use, he says, a broken earthern pot for a furnace, and a small goat skin for bellows. The crucibles are made from the nests of the mason wasps, and the metal is cast into ingots five or six inches long by half an inch square. The ingots are made into bars be the use of a hammer on a small anvil, weighing three or four pounds. The natives use blowpipes made out of the section of a gun barrel.

THE NEW STATE DAM AT COHOES.—This work is rapidly progressing. It is to be fifteen feet higher than the old structure, and stands twelve feet further down the river. It is supposed the increased hight will prevent the hitherto frequent drifting over and wreck of boats during the freshets to which the Mohawk is liable. Four hundred feet of the dam are already completed and one pier. The total length will be sixteen hundred and forty feet. Its width at the bottom is eighteen feet, and at the top ten feet. Its hight varies from fourteen to twenty feet. The whole structure is of granite.

AN adaptation of the semaphore signal post to street traffic is now the subject of experiment in London, the object being to assist the police of that city in preventing the concentration of vehicles at crossings when stoppages occur. The use of the signal is to warn approaching vehicles against coming too near, and thus enabling the officers to make a diffused or general stoppage some distance from the crossing rather than the usual jam and confusion now common in such cases. Something of the kind is also greatly needed in New York.

THE *European Mail* says the little Prince Theodore has got out of the channel of gossip, and few know where he is and how he is being brought up. The young Abyssinian is at school at Bonchurch, in the Isle of Wight, and turns out with the boys—a very dark speck on their line of white faces. The expression of the lad's face is good, and his eyes are such as might serve for a chapter on "dark orbs" for anyone in writing a novel. He is under the charge of Captain Speedy, who is bringing him up kindly and carefully.

THE largest kitchen in the world is that of Liebig's Extract of Meat Company's establishment at Fray Bentos, on the river Uruguay, South America. The building covers an area of 20,000 square feet. In one hall there are four meat cutters, which can dispose of 200 bullocks each per hour. There are 12 digesters in which the meat is boiled by steam. They can hold altogether 144,000 pounds of beef. About 80 oxen per hour are actually slaughtered for this immense establishment.

PARADE OF THE NEW YORK LETTER CARRIERS.—On the morning of the 30th December, the letter carriers of New York city, arrayed in the new uniform of the department, paraded through the streets to the number of about two hundred. Our rural friends may form some idea of the extent of the postoffice business here when it is known that it takes the entire time of over two hundred men to deliver the mails, exclusive of the large amount of matter taken from the boxes.

DISASTROUS FIRE IN LYNN.—The thriving and busy city of Lynn, Mass., has received a severe blow in the disastrous fire on Christmas night. It was the most serious conflagration ever experienced by that town, and although it will not seriously affect its chief industry, the manufacture of boots and shoes, it throws 600 hands out of employment in the dead of winter, and inflicts severe loss upon many prominent business men.

THE steam roller for leveling and smoothing newly made or recently repaired roads just introduced in Liverpool, seemed at first to be a great success. It seems, however, that its use has resulted in serious injury to the network of gas and water pipes underlying the streets, and its weight will have to be reduced or its use discontinued.

A GERMAN savant has put forth a singular and novel theory to account for the decay of the trees in the gardens and promenades of Berlin as well as in other large European cities. He attributes this decay to the tremulous motion of the ground, which prevents the perfect adherence of the soil to the roots necessary to the absorption of nourishing juices.

THE whole of the capital required for the laying of the new French Atlantic cable has been subscribed and the first instalments paid in. Four hundred and sixty miles of cable are completed and the work is progressing rapidly. The Great Eastern is fitted out and was to commence receiving the cable in the earlier part of January.

PROF. MARSH, of Yale College, is said to have discovered in the tertiary deposits of Nebraska the minutest fossil horse yet obtained. It is only two two feet high, although full grown, as the character of the bones fully indicates. This makes the seventeenth species of fossil horse discovered on this continent.

THE improvement made in the art of watchmaking and the present approach to perfection are shown by the fact that in 1862 the average deviation of the Neufchatel chronometer was 1·61 seconds per day; but one was recently finished and tested which gave only ·164 of a second variation in twenty-four hours.

THE longest artillery range on record, namely, 10,300 yards, was lately attained at Shoeburyness by Mr. Whitworth's 9-inch muzzle loader gun of 14 tuns firing a shot of 250 lbs. with a charge of 50 lbs. This range is 225 yards over that of the 7-inch Lynall Thomas gun, which in 1861 ranged 10,075 yards.]

The American sewing machine has crossed the Alps, and has made its appearance in the chief cities of Italy. It is reported that there is a lively competition going on among the dealers in Florence. No other people in Europe more need the introduction of labor-saving machinery than the Italians.

IT is stated that the Mont Cenis Tunnel lacks but little more than two miles of completion.

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

Propulsion of Vessels.

MESSRS. EDITORS:—Although it is admitted by all engineers that there is yet room for improvement in our present system of paddle and screw, yet very few are aware of the really immense disparity between the amount of steam consumed in the engine and that actually utilized in propulsion. The fact being, that if it were possible to utilize all the steam that passes into the engine in actually propelling a vessel, it can be shown that a saving of fully two thirds or three fourths would be effected—this statement is based on the following facts, viz.: Two horses can propel a loaded canal boat of two hundred tuns, at a rate of two miles per hour. Two-horse power of steam is equal to the power of two actual horses. Hence, if two-horse power of steam were fully utilized, this, and an allowance of ten per cent additional for friction, would be sufficient to propel same boat the same speed as two horses would.

The resistance of water in a canal is one third greater than that of deep rivers or more open waters; and the resistance of a canal boat, having no lines favorable to speed, is greater than the resistance of a well built schooner of same tunnage; therefore, it cannot be disputed, that if two-horse power of steam, plus ten per cent, can propel a loaded canal boat of two hundred tuns, at the rate of two miles per hour, the same power applied to a two hundred tun schooner, having good lines, and being in open water, should give a speed of two and a half miles per hour. Resistance increasing as the square of the velocity, it is easy to calculate power required to propel a two hundred tun boat, at any required speed. For example, to go ten miles per hour, or four times the velocity, evidently requires sixteen times the power. Therefore, $2\frac{1}{10}\times16=33\frac{6}{10}$ horse power, to drive two hundred tuns ten miles. Although the resistance does not increase in exact proportion to increased tunnage, it will be safe to calculate the amount required to drive any larger vessel, by taking the two hundred tun boat as a basis, and multiply the horse power for any required speed, by exact increase in tunnage. By this method it will be found easy to calculate power required to drive any given boat at any given speed. For instance, if all steam were utilized, it would be possible to drive boats of the following tunnage at following rates, with horse power of high pressure or low pressure, respectively, as follows:

200	tun	boat,	10	miles,	$33\frac{6}{10}$	high	press.,	$22\frac{4}{10}$	low press.
1000	"	"	10	"	168	"	"	112	" "
1000	"	"	20	"	672	"	"	448	" "
3000	"	"	20	"	2016	"	"	1332	" "

By comparing these figures with amount of *actual* horse power consumed in vessels at present, there will be great disparity. To invent a system capable of utilizing all steam consumed, it is simply necessary to know the primary laws or conditions of propulsion.

From a series of actual experiments made on a one hundred tun boat, the writer is enabled to construct the following hypothesis, viz.: That propulsion is produced by repulsion, that the one cannot exist without the other; hence they are coexistent, and the perfection of propulsion logically and practically depends upon perfection of repulsion; that, therefore, "slip" is but another name for imperfect repulsion; that propulsion is simply a question of power and comparative resistances—a greater and a less; and that perfect propulsion can only be produced by so applying the power to the body to be moved as to overcome the resistance in line of propulsion, without overcoming resistance, in opposite direction, or that of repulsion.

The foregoing hypothesis applies alike to the propulsion of all animate and inanimate nature, and will stand the most rigid logical or practical test as applied to a boat. It will be admitted that the area of immersed cross section, represents the resistance of propulsion, and the area of two buckets of a paddle represents resistance of repulsion. Hence it follows, that to produce perfect propulsion, it is necessary so to apply the power as to overcome a greater resistance, without overcoming a less. To do this, and adapt the means of doing so to any boat, in the simplest and best manner possible, is to construct a propelling apparatus capable of utilizing all the steam, and hence effect the immense saving of sixty to seventy-five per cent. With this end in view, the writer has invented a propelling apparatus, that he trusts will accomplish the desired result, as follows:

A horizontal engine is attached, by proper links, to a crank motion, at a point as near as possible to the center of an axis; a pair of piston propellers are attached by proper links to the points of a pair of vertical dynamic levers, most distant from same axis, the axis is swung athwart the boat, and works in proper journals. The engine being set in motion, puts the piston propellers in motion the cylinders in which the piston propellers work being open at one end, two proper holes or parts in the boat admitting the water to propelling face of pistons. These pistons impinge on the water on one side only, and are so arranged as to work in a vacuum on the other; so that they make propelling stroke by pressure of steam on the engine, and are brought back to original position by means of pressure of water alone. The resistance of the small area of water at the propellers being, by means of proper use of dynamic lever, made virtually greater than that of the larger area of immersed cross-section, it is evident (from the fixed law, that power applied to overcome to unequal resistances of necessity overcomes the least) that the water forming resistance of boat's motion can give way without displacing water at propellers, and, consequently, that the boat can be propelled by this means without "slip;" and it is also evident there can be no lift water, hence the economy. So that every pound of steam is actually utilized in propelling vessels, minus the friction, which will be less than ten per cent.

It will be found, the shorter the crank at which power is applied, and the longer the arms of the lever, to which propellers are attached, the greater the economy—for this dynamic leverage is the vital principle of my invention, the form of propellers used being that simply best mechanically adapted for impinging on the water, on one side only, and are, as is well known, worthless as economical propellers, of themselves, otherwise applied. The philosophy of this use of the dynamic lever is, simply, that by its means, power is applied as near as possible to the axis, because the axis represents the actual point of impact, or the true point of resistance of motion in a boat, and as far away as possible from point of resistance of propellers, which is the actual fulcrum; and by this means the water at propellers is much more difficult to displace than the resistance of boats' motion, which was to be done.

In addition to its great economy in fuel, and cost and weight of machinery required, this system presents many other advantages over paddle and screw—namely, great simplicity of machinery—hence less wear and tear, and much better protection from the action of rough seas, or the obstruction of ice, weeds, logs, etc., common to inland navigation, and its special adaptability for shallow rivers and gunboats.

I hope, at an early date, to lay before your readers drawings and more explicit details of my invention. F. K. P.

New York city.

Quadrature of the Circle.

MESSRS. EDITORS:—I am surprised that the *London Building News*, from which you republished an article under the above heading (page 375 of your last volume), is not better posted in regard to English investigations and London publications. The article states, that later researches brought the number expressing the ratio of the diameter of the circumference to 127 decimals. Now this is exceedingly old news, as later researches went much further. M. de Lagny, in France, found this in 1682, and published the 127 decimals in the "Memoires de l'Academie," in the year 1719; after that, we find in the library of Radcliff, Oxford, 155 decimals; and we find, further, that Dr. Rutherford, of Woolwich, presented a calculation of 200 figures to the Royal Society, London. However, it was, unfortunately, found out, that all his decimals, added to the 155 of Oxford, were wrong. Perhaps he was confident that nobody would take the pains to persuade him of error; this was, however, done by Dr. Clausen, of Dorpat, who found 250 decimals, and Mr. Shanks, of Durham, 315. This stirred Dr. Rutherford up, and he, in his turn, tried to find errors, but he found the figures all correct; and he extended them to 350 decimals. Mr. Shanks appears to have become jealous, and carried them to 527 decimals. Mr. Rutherford, wishing again to ascertain if they were correct, found them so to 411 decimals, and then gave it up. Mr. Shanks did not give it up, but went again to calculating, till he had obtained 607 decimals, and he published the result of his calculations in the "Contributions to Mathematics," London, 1653.

There we find the curious, famous, and, at the same time, useless decimal fraction of 607 decimal places, representing the relation of the diameter and circumference of a circle so near to the truth, that the difference, with the absolute ratio, is smaller than the strongest imagination possibly can conceive. We call it also useless, as, for the most delicate calculations, 10 or 12 decimal figures are amply sufficient.

Never has any continuous fraction been carried so far. For instance, no body ever had, till the present day, the patience to calculate $\sqrt{2}$ or $\sqrt{3}$, even to 100 decimal figures; we must, therefore, conclude that the relation between the diameter and circumference of a circle is numerically better known, at present, than many other quantities which are daily used.

We give here the beginning of this fraction for curiosity's sake: Diameter $=1$; circumference is

3·14159 26535 89793 23846 26433 83279 50288 41971 69399 37510 + . . . , etc., 507 more decimal figures. This decimal fraction is not and cannot be repeating or periodical, but changes the order of its figures infinitely.

P. H. VANDER WEYDE, M.D.

New York, city.

Air Bubbles in Ice.

MESSRS. EDITORS:—In the SCIENTIFIC AMERICAN of Nov. 25th, I see the theory of C. D. Sutton, on the specific gravity of ice, which is lessened, as he says, by the retention of air bubbles in its substance. For at least twenty years I maintained the same theory with considerable energy and then from force of experiments, gave it up and sought other reasons for the phenomenon. It is now a good season of the year for him or others to try that kind of experiments. Let him grind ice to an impalpable powder and put it in water at 32° Fah. and then stir the mixture well, and if it or any part of it sink, it will strengthen his theory, and if it all should float he must look for other reasons. My experience has been that it all swims, and I gave up attributing the low specific gravity of ice to the air contained in it.

The Creator so in best wisdom ordered that the arrangements of the particles of water under congelation, should so stand apart as to cause ice invariably to float, so that rivers might continue, during long freezes, to vent their waters, and not gorge up, overflow, and destroy all the property along their banks, which would inevitably be the case if ice sank to the bottom as formed. Ice in a muddy running stream, will in a few days of warm weather, sink to the bottom by reason of the earth attached to it. I have ridden scores of miles on Lake Erie, when the ice was eighteen inches thick. At the distance of five or six miles apart, I found cracks in the ice running from the shore square off into the lake. These cracks, if I remember right, were about the width of one foot of shrinkage, for each mile of unbroken distance! I know that I had to course along these cracks until I came to a bend, or crook that threw the crack up and down the lake, where I could get across! This was proof to me that ice, like other solids, contracts after congelation is finished. JOHN S. WILLIAMS.

Cincinnati, Ohio.

Steam on Canals.

MESSRS. EDITORS:—What can you tell us about steam on canals, about boats constructed for cheap unloading of which you have one running in New York harbor, etc.? How do the English canals afford to pay dividends with 50-tun boats towed by steam, etc.? Can the expense of a skilled engineer be saved by adopting Loper's or other caloric engines for canal barges? In short, won't you wake upon the subject of modernizing canals and their motive power, by towage either by tug or locomotive, but not by submerged wires, which don't answer? NAVIGATION.

Philadelphia, Pa.

[We have published a number of articles on this subject, which may be found in previous numbers of the SCIENTIFIC AMERICAN. We have no confidence in the use of hot air engines for towing purposes. The conditions of canal navigation in England and in this country are so different that no conclusion based on the facts of either would be applicable to the other.—EDS.

Chrome Iron for Lapidaries' Wheels.

MESSRS EDITORS:—I see the new alloy of iron and chromium mentioned in your admirable paper, and I would ask of some of your valued correspondents, who I hope will favor me with a speedy reply, whether a lapidary's slitting wheel for jaspers, agates, and the like, could not be made from it? It cuts glass as well as the diamond, and I think might possibly take the place of the soft iron wheel fed with diamond dust, which is so extravagantly dear and so often shamefully adulterated. I think a wheel of this kind would answer for all the softer stones and pebbles, and prove a great boon especially to amateurs. Can any one tell me what genuine diamond powder can be bought for in America? MEDICUS.

Ensworth, Hants, England.

The Effect of Glaciers on the American Continent.

Proffessor Agassiz said some interesting things concerning his pet glacial theory at the Amherst agricultural meeting, recently. He declared that all the materials on which agricultural processes depend are decomposed rocks, not so much rocks that underlie the soil, but those on the surface and brought from considerable distances and ground to powder by the rasp of the glacier. Ice, all over the continent, is the agent that has ground out more soil than all other agencies together. The penetration of water into rocks, frost, running water, and baking suns have done something, but the glacier more. In a former age the whole United States was covered with ice several thousand feet thick, and this ice, moving from north to south by the attraction of tropical warmth, or pressing weight of ice and snow behind, ground the rocks over which it passed into the paste we call the soil. These masses of ice can be tracked as surely as game is tracked by the hunter. He had made a study of them in this country as far South as Alabama, but had observed the same phenomenon particularly in Italy, where, among the Alps, glaciers are now in progress. The stones and rocks ground and polished by the glaciers can easily be distinguished from those scratched by running water. The angular boulders found in meadows and the terraces on our rivers not now reached by water, can be accounted for only in this way. He urged a new survey of the surface geology of the State, as a help to understanding its constituent elements, and paid a high tribute to the memory of the late President Hitchcock.

Adulterated Liquors.

The New York *World* has been doing the country a service by some investigations into the quality of liquors sold at the different bars in this city. A large number of samples of brandy sold at from thirty to fifty cents a glass, and of whisky sold at from twenty to thirty cents per glass, were examined and found to be genuine in only two instances. If such be the case with liquors sold at the best places, what must be the character of the fluids retailed at the low grog shops where whisky can be obtained for from five to ten cents a glass. In this connection it may be remarked that some specimens of brandy pronounced by experts under oath in a recent revenue case to be genuine and worth twelve dollars a gallon in gold, were afterward found to have been manufactured in Brooklyn, and to contain not one particle of genuine liquor. How shall the sale of these poisons be stopped? By each and all refusing to touch, taste, or handle the filthy compounds.

The practice of using ardent spirits is exerting a very malign influence upon all classes in this country, and although we do not believe that mechanics as a class are more addicted to the practice than others, still a word of warning will not be out of place to them at this time. The waste of money, time, and worst of all, the ruin of mental and moral power which follows a career of dissipation, is sad enough and has been repeatedly and forcibly placed before every person in the civilized world. Nothing can restore what is lost in this way and we once again appeal to the noble army of mechanics in America to join in the suppression of the practice. Mechanics will you do it? Any one of you can commence the work in the establishment to which you belong, and we shall be most happy to announce in our columns the success you meet with in the good work if communicated to us.

Recent American and Foreign Patents.

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

SCYTHES.—Charles E. Griffin, Roseville, Ill.—This invention consists in the application of a weight to the outer end of a scythe swath, to serve as a counterpoise for the same and thereby greatly facilitate and lessen the labor of mowing.

ANTI-FRICTION BOX.—Jeremiah McIlvain, Churchville, Md.—This invention relates to a new and improved box for the shafting of machinery, and it has for its object the reduction of friction.

COTTON SEED PLANTERS.—A. J. Going, Clinton, La.—This invention relates to a new, simple, and useful device for agitating cotton seed in the hoppers of cotton seed planters, so as to insure the separation of the seed onefrom the other, and thereby prevent the clogging or chocking up of the hopper and effect a proper distribution of the seed from the same.

SCREW PEG FOR BOOTS AND SHOES.—J. M. Estabrook, Milford, Mass.—The object of this invention is to facilitate the attachment of soles to the uppers of boots and shoes, and consists in the use of screw or notched pegs, which can by means of hammers be forced through the leather instead of being turned into the same as heretofore made.

ELASTIC LANYARD.—J. E. Jones, Wiretown, N. J.—This invention has for its object the construction of an elastic lanyard by which the stays of a ship's rigging can be most conveniently connected with the dead eyes or some other fixed part of the vessel, the lanyard being elastic so that the rigging will be in some degree yielding. The straining of the mast, as well as that of the rigging, will thus be most advantageously avoided.

POTATO WASHER.—L. B. Sherwin, Hyde Park, Vt.—This invention relates to a new and improved method of washing potatoes, and other articles, and it consists in agitating the potatoes in the vessel in which they are placed by revolving a horizontal bar or agitator with inclined sides or blades on the bottom of the vessel.

DUMPING CART.—Joseph H. C. Applegate, Bridgeton, N. J.—This invention relates to an improvement in the method of dumping cart bodies, and it consists in attaching to the front of a cart a catch of novel construction which is operated from the rear end of the cart.

MEDICAL COMPOUND.—J. M. Hughes, Menomonee, Wis.—This invention consists in a compound of matter, which as an external application is advantageous in treating many complaints in cattle.

WINDOW FRAMES.—Samuel Myers, Hogestown, Pa.—This invention has for its object to improve the construction of window frames so that the sashes may be easily and conveniently removed without its being necessary to remove the parting bead, which is usually a troublesome operation, frequently breaking the bead, injuring the paint, and defacing the frame.

WATER REGULATOR FOR PAPER PULP MACHINES.—David Hunter, North Bennington, Vt.—The object of this invention is to produce an automatic attachment to paper pulp machines for regulating the flow of the water which enters the machine so as to prevent the overflow of the water and the consequent loss of pulp. It also consists in the use of a float by which the valves controlling the water supply are held open or closed according to the hight of water in the tub.

SLATE-RULING MACHINE.—John H. French, Albany, N. Y.—This invention relates to a new machine for ruling slates, of that class in which the lines are formed by scratching the surface of the slate with a pointed or sharp instrument. It consists chiefly in arranging a series of sharpened or pointed tools in one head, and in drawing them at once in the required direction across the slate, or in moving the slate over them, so that by one motion of the slate or tool a whole series of parallel lines can at once be produced.

RAILROAD TICKETS.—H. E. Alexander, New York city.—This invention relates to improvements in tickets for use upon railroads, steamboats, and conveyances, for passengers, but is particularly adapted for street cars or other vehicles where a fixed rate of fare is to be collected, the object of which is to prevent fraud or embezzlement on the part of those who collect the fare.

ROOFING.—Philip A. Brown, Indianapolis, Ind.—This invention consists in forming roofing from clay of any suitable kind, in molds of peculiar form, into blocks, so shaped in sections as to be readily joined together by lapped joints, and form a waterproof roof composed mainly of one thickness of material.

TOOL HOLDER.—Charles H. Reid, Danbury, Conn.—The object of this invention is to provide a simple, convenient, and effective stock or tool holder for machinists' use, and which is available both as a tool holder for lathes and planing machines, and also for holding a boring tool for such shallow work as is capable of being bored out in the chuck of a lathe.

CAR COUPLING.—H. W. Boifeuillet, Savannah, Ga.—This invention has for its object to furnish an improved car coupling which shall be so constructed and arranged as to be self-coupling, and so as to be adjustable to support the link at any desired elevation to enter the bumper of the adjacent car when the cars are run together.

MOWING MACHINE.—F. A. Geisler, Bristol, R. I.—This invention consists, first, in certain improvements in the arrangement of the main shoe and the cutter bar; second, in the arrangement of means for raising the shoe and bar off the ground; third, in a method of readily gearing and ungearing the cutter operating mechanism; fourth, an improved arrangement of the finger bar and the guard fingers; and fifth, in the arrangement of a mold board at the outer end of the finger bar, for throwing the fallen grass away from the uncut grass.

WASH BOILERS.—H. P. Bemiss, Milan, Ohio.—This invention relates to improvements in that class of wash boilers wherein currents of water are caused to flow from bottom to top and *vice versa*. It also consists in an arrangement of the same designed to be more effectual in producing the said flow.

CULTIVATORS.—J. W. Jessop, Harveysburgh, Ohio.—This invention has for its object to furnish an improved cultivator, which shall be so constructed and arranged that it may be easily adjusted for use, to cultivate corn or cover wheat, as may be desired, and which shall at the same time be simple in construction and effective in operation.

MACHINE FOR MAKING PAPER BOXES.—William Gates and David J. Lloyd Frankfort, N. Y., and Samuel Miller, South Hammond, N. Y.—This invention relates to a new and improved machine for making paper boxes, such as are of square or rectangular form in their transverse sections. The invention is an improvement on a machine for the same purpose patented by R. L. Hawes, April 24, 1855, and the object of the present invention is to obviate several difficulties attending the operation of the original machine, a practical use of which for a number of years having suggested a number of improvements.

FAUCET CLAMP FOR PLUMBER'S USE.—James Elliott, New York city.—This invention relates to a new and improved clamp designed to facilitate the securing or soldering of faucets in lead pipes, and also forming the connections of branch pipes to a main pipe.

DOOR FASTENER.—J. H. McElroy and J. H. Holley, Warwick, N. Y.—The object of this invention is to provide a means of fastening doors from the inside and is intended as a fastening for sleeping rooms so that burglars may not enter without forcing the door and alarming the occupant of the room.

PROPELLER.—Henry F. Roberts, Pittsburgh Pa.—The object of this invention is to provide a substantial and easily operating apparatus for propelling vessels, so constructed that its action can be readily reversed without reversing the action of the engine or motive power.

HORSE HAY FORK.—John S. Yinger, Manchester, Pa.—The object of this invention is to provide for public use a horse having the pivoted jaws so constructed and operating that they can readily be opened and closed to receive or discharge the hay.

SEPARATOR FOR THRESHERS.—Tobias Crumling, Cross Roads, Pa.—This invention is intended for an attachment to a threshing machine and has for its object to separate straw from grain after both have passed through a thresher. It consists of the common form of straw cutters that are composed of alternate vibrating, reciprocating beam, operated by crank shafts, in combination with a reciprocating winnowing board, and a series of suspended fingers, between said beams, for the purpose of preventing the escape of straw in the wrong direction.

PILL MAKING MACHINE.—Thomas Bushby. Manchester, England.—This invention consists in constructing a pill making machine, to which the mass or substance from which the pills are formed is supplied in a layer or sheet and fed in beneath a reciprocating knife, which cuts the strip into sheets or bars. These bars or strips then fall down between a segmental grooved stationary plate and a grooved roller, by which they are formed into pills.

WEATHER STRIP.—Charles Bean, Ionia, Mich.—In this invention a rubber strip is attached along the middle of the edge of a door or window, by means of a clamping rod which presses one edge of the rubber strip into a groove in the door or window prepared for the purpose. The clamping rod is fastened in place by screws, and its outer edge is sunk below the surface of the edge of the door, leaving a recess into which the projecting edge of the rubber folds back, when the door is closed.

MOTIVE POWER.—H. Crumlisk, Keokuk, Iowa.—This invention relates to a new method of making the power obtained from steam, available, and consists broadly in the employment of a Giffard injector in connection with a wheel, the arrangement being such, that the latter is caused to revolve by the action of the former.

HOSE.—Edward L. Perry, New York city.—This invention consists in constructing the ends of rubber hose of the proper size and form internally to be stretched over the ends of metallic coupling joints on the nozzles of fire plugs, and providing the said ends externally with rings or other suitable fastenings which may be forced over the said ends after they have been so stretched on the said parts, and thereby press the yielding material of the hose into the said threads or grooves of the said parts making water tight joints; the said ends of the hose being tapered to cause the said rings or fastenings to more effectually produce tight joints. It also consists in constructing the nozzle for the hose in one piece and of the same material of which the hose is composed.

SLEIGH ATTACHMENT TO WHEELED VEHICLES.—Joseph Stonebanks, College Point, N. Y.—The object of this invention is to produce a simple device, whereby carriages, wagons, and all other kinks of wheeled vehicles, even street cars, can be readily converted into sleighs or sleds, so that such vehicles can be used on snow as well as on the ground, as may be required. The invention consists in fastening flanged runners to the wheels, said runners having grooved spring holders, by means of which they are secured to the fellies and prevented from turning.

MACHINE FOR MAKING NUTS.—Ferdinand Rheydt, Chicago, Ill.—The object of this invention is to construct a machine on which screw-nut blanks can be shaped on and cut from prismatic bars, which have already the requisite hexagonal, octagonal, or other desired cross-section of the nuts to be made. The tedious and laborious process of forming the nuts between dies is hereby dispensed with and neater work produced.

CHAIR SEAT.—George Buckel, Detroit, Mich.—This invention relates to a new chair seat, which is so arranged as to be of the most convenient form and easily made. The invention consists in producing a semi-cylindrical seat of tape lines, that are crossed and interwoven so as to form a substantial fabric.

HOT AIR OVEN.—Mathias Schlegel, St. Jacob, Ill.—The object of this invention is to produce a hot air oven in which the largest possible amount of cold air is heated by the products of combustion, so that proportionately more heat than usual is produced by an equal amount of fuel. The invention consists in such an arrangement of smoke and air channels and conduits that the desired object is obtained by a very simple apparatus.

FURNACE FOR SMELTING AND REFINING STEEL.—Alois Thoma, New York city.—This invention relates to a new furnace for smelting steel and iron and for producing all kinds of cast-steel and other metal. The invention consists in the construction ef a new apparatus for feeding the material to be smelted into the furnace, also in a new manner of arranging and operating the receptacle for the steel or iron. This recepticle is one solid open pan, which forms the bottom of the smelting oven, and which is, by means of vertical screws, supported and up and down adjustable.

PORTABLE FENCES.—C. S. Coolidge and J. A. Rollins, Jersey Mills, Pa.—This invention relates to portable fences and consists chiefly in a new manner of joining the pannels to the uprights or posts.

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.

Official List of Patents.

Issued by the United States Patent Office.

FOR THE WEEK ENDING DECEMBER 29, 1868.

Reported Officially for the Scientific American.

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85,264.—LIFTING JACK.—W. F. Arnold, New Britain, Conn.
85,265.—DEVICE FOR SHARPENING RAILS.—James Ayres, Branchville, N. J.
85,266.—PITMAN.—Earle C. Bacon, New York city.
85,267.—HYDRANT.—Harry J. Bailey, Pittsburg, Pa.
85,268.—BREECH-LOADING FIREARM.—Salmon Belden and John Franklin Crabtree, Visalia, Cal.
85,269.—EXPANSION WAGON WHEEL.—Salmon Belden, Visalia, and Johnson P. Ford, Santa Clara, Cal. Antedated Dec 24, 1868.
85,270.—PUMP.—Samuel Benson, Allegheny city, Pa.
85,271.—FLOOD FENCE.—David P. Bird, Richwood, Ohio.
85,272.—CHURN.—C. W. Brewer, Racine, Wis.
85,273.—METHOD OF ROLLING BARS OF METAL.—William Bunton, Pittsburg, and John Davis, Birmingham, Pa.
85,274.—HARVESTER.—George E. Burt, Harvard, Mass.
85,275.—HORSE RAKE.—George E. Burt, Harvard, Mass.
85,276.—WRENCH.—John Burt (assignor to himself and Wilet M. Slocum), Fall River, Mass.
85,277.—PILL-MAKING MACHINE.—Thomas Bushby, Manchester, England. Antedated December 17, 1868.
85,278.—STEAM PORT OF STEAM ENGINE.—Hampton R. Camfield (assignor to himself, John H. Fitz Simmons, and George Boyd), Susquehanna Depot, Pa.
85,279.—DERRICK.—Angus Campbell, Downieville, Cal.
85,280.—MARBLE-SAWING MACHINE.—Duncan McDougald Campbell and John Stevens, Oswego, N. Y.
85,281.—GAME, CALLED VINCO.—J. Carlin, New York city.
85,282.—REVOLVING HARROW AND CULTIVATOR COMBINED.—S. D. Carpenter, Madison, Wis.
85,283.—BLACKSMITHS' FORGE.—Thos. S. Clark, Lena, Ill.
85,284.—SEED AND FERTILIZER SOWER.—Elisha H. Cook, Clarendon, Mich.
85,285.—PORTABLE FENCE.—Charles S. Coolidge and Joseph A. Rollins, Jersey Mills, Pa.
85,286.—DISTILLING APPARATUS.—William Corfield, Philadelphia, Pa.
85,287.—DISTILLING APPARATUS.—William Corfield, Philadelphia, Pa.
85,288.—STOP VALVE FOR STEAM AND OTHER ENGINERY.—Joseph H. Davis, Allegheny, Pa.
85,289.—STEAM ENGINE EXHAUST VALVE.—Thomas S. Davis, Jersey City, N. J. Antedated December 23, 1868.
85,290.—SHUTTER FASTENER.—Le Grand Dodge, Syracuse, N. Y.
85,291.—CONCRETE BLOCK MACHINE.—Lewis Dodge and Lewis J. Magnusson, Chicago, Ill.
85,292.—CULTIVATOR.—William A. Dryden (assignor to himself and John M. Turnbull), Monmouth, Ill.
85,293.—MACHINE FOR DRILLING AND BORING FLANGES OF PIPES AND CYLINDERS.—Henry S. Fairbanks, Central Falls, R. I.
86,294.—HANGING SAWS.—Amos Fellker, Bay City, Mich.
85,295.—CURTAIN FIXTURE.—Henry Fininley, New York city.
85,296.—KNIFE.—R. H. Fisher (assignor to Beaver Falls Cutlery Company), Beaver Falls, Pa.
85,297.—DISINFECTANT OR OZONE GENERATOR.—William Hutson Ford and Samuel Logan (assignors to Wheelock, Finlay, and Company), New Orleans, La.
85,298.—SUSPENDING CLAMP.—D. P. Foster, Waltham, assignor to himself and N. M. Lowe, Boston, Mass.
85,299.—METHOD OF TEACHING THE RUDIMENTS OF CHEMISTRY.—Samuel M. Gaines, Glasgow, Ky.
85,300.—VOLTAIC PILE FOR MEDICAL PURPOSES.—Alfred C. Garratt, Boston, Mass.
85,301.—MACHINE FOR MAKING PAPER BOXES.—William Gates and David G. Lloyd, Frankfort, and Samuel Miller, South Hammond, N. Y., assignors to William Gates.
85,302.—RAILWAY CAR BRAKE.—Joseph T. Guthrie, Pittsburg, Pa.
85,303.—MODE OF TREATING DISEASES BY VACUUM.—John G. Hadfield, M. D., Cincinnati, Ohio. Antedated December 15, 1868.
85,304.—FOUNDATION FOR RAILROAD TRACKS.—James E. Halsey, New York, assignor to himself, Morris H. Smith, and Samuel F. Noyes, Brooklyn, N. Y.
85,305.—TRUSS.—E. B. Harding, Northampton, Mass.
85,306.—GATE.—Uriah W. Hardy, Abingdon, Ill.
85,307.—BREAKING THE SURGE ON HARNESS OR VEHICLES.—Francis P. Hart (assignor to himself and Samuel Keneagy), Strasburg, Pa.
85,308.—PAINT COMPOSITION.—Russel P. Hinds, Chicago, Ill.
85,309.—COCK FOR WATER PIPES.—William Johnson, Philadelphia, Pa.
85,310.—BUT HINGE.—John W. Jordan, Lexington, Va.
85,311.—FOUNTAIN COMB.—William Kerr, Jr., and Joseph A. Robbins, Boston, Mass.
85,312.—MOLDING, CORNICE, AND THE LIKE, FROM PAPER.—L. W. Kimball, Pittsburg, Vt.

85,313.—FOOD FOR ANIMALS.—Joseph S. Kirk, Pittsburg, Pa.
85,314.—STAGING.—J. E. Lang, Norway, Maine.
85,315.—WASHING MACHINE.—John Leib, Akron, Ohio.
85,316.—SHINGLE.—John Lewis, New York city.
85,317.—STONE-QUARRYING MACHINE.—Curtis O. Luce and Cyrel W. Green, Brandon, assignors to themselves and Cyrenius M. Willard, Castleton, Vt.
85,318.—BREAST PUMP.—Morris Mattson, New York city.
85,319.—STREET SWEEPER.—Robert Y. McConnell and George Pringle, Rochester, N. Y.
85,320.—SHIELD FOR PUDDLING FURNACES.—Hugh McDonald, Pittsburg, Pa.
85,321.—DOOR FASTENER.—J. H. McElroy and J. H. Holly, Warwick, N. Y.
85,322.—HYDRAULIC PRESSURE REGULATOR.— Theodore J. McGowan, Cincinnati, Ohio.
85,323.—CARRIAGE SPRING.—John M. Miller, Cincinnati, Ohio.
85,324.—CORN AND COTTON PLOW.—James W. Milroy, Galveston, Ind., assignor to himself and S. B. Shaner, Xenia, Ohio.
85,325.—GRAIN CLEANER.—Joseph Montgomery, Baltimore, Md. Antedated December 22, 1868.
85,326.—CAR BRAKE.—Joseph H. Moore and Joseph E. Gary, Chicago, Ill.
85,327.—TANNING HIDES AND SKINS.—Cesare Osmani, Tolentino, Italy. Patented in England, January 23, 1868.
85,328.—COMPOSITION FOR PRESERVING EGGS.—Nancy Patton, Kansas, Ill.
85,329.—TOOL HOLDER.—Charles H. Reid, Danbury, Conn.
85,330.—MILK COOLER.—Charles G. Riggs, Turin, and Homer C. Markham, West Turin, N. Y.
85,331.—STEAM STREET CAR.—Thomas C. Robinson and Geo. P. Clark, Boston, Mass.
85,332.—BRIDGE.—Robert W. Rogers, Pittsburg, Pa.
85,333.—LAND ROLLER.—Roger Sandiford, Joliet, Ill.
85,334.—EXPANDING DRILL.—J. L. Sayles, Gloucester, R. I.
85,335.—HOT-AIR FURNACE.—John Siddons, Rochester, N. Y. Antedated Dec. 15, 1868.
85,336.—MACHINE FOR MAKING RINGS.—John Siddons, Rochester, N. Y. Antedated Dec. 17, 1868.
85,337.—VELOCIPEDE.—Samuel M. Skidmore, Brooklyn, N. Y.
85,338.—MACHINE FOR MAKING CLOTHES PINS.— John B. Smith, Sunapee, N. H.
85,339.—COFFEE POT.—J. B. Smith, Milwaukee, Wis., assignor to himself and George R. Chittenden, Chicago, Ill.
85,340.—CLAY MOLD FOR CASTING METALS.—John Joseph Charles Smith, Philadelphia, Pa.
85,341.—CASTING BEARINGS FOR MACHINERY.—Henry F. Snyder, George S. Snyder, and William N. Jones, Williamsport, Pa.
85,342.—PLOW.—P. H. Starke, Richmond, Va.
85,343.—SEEDING MACHINE.—Adam Sternberg, Nettle Lake, Ohio.
85,344.—APPARATUS FOR PRESSING CIGARS.—George Studer, Richmond, Ind.
85,345.—SASH STOP AND LOCK.—W. H. Sullenberger (assignor to himself and J. C. Martin), Harrisburg, Pa.
85,346.—CORN PLANTER.—Emma Thrall (administratrix of the estate of George W. Thrall, deceased), and William L. Rayment, of Burlington, Mich.
85,347.—RAILWAY RAIL CHAIR.—William VanAnden, Poughkeepsie, N. Y.
85,348.—STOVE FOR RAILROAD CARS.—A. P. Winslow, Cleveland, Ohio.
85,349.—HARVESTER.—George W. N. Yost, Corry, Pa., assignor to Corry Machine Company.
85,350.—REVOLVING FIRE-ARM.—John Adams, the Strand, England. Patented in England, July 23, 1866.
85,351.—RAILROAD TICKET.—H. E. Alexander, New York city.
85,352.—DOOR BELL.—William Allport, New Britain, Conn.
85,353.—DUMPING CART.—J. H. C. Applegate, Bridgeton, N. J.
85,354.—QUARTZ CRUSHER.—Hosea Ball, New York city.
85,355.—WASHING AND WRINGING MACHINE.—Eli Bartholomew, Cleveland, Ohio.
85,356.—DEVICE FOR OPERATING WINDOW SASH.—Fred. Baumgartner, Brooklyn, N. Y. Antedated Dec. 17, 1868.
85,357.—RAILWAY CHAIR.—G. W. R. Bayley, Algiers, La.
85,358.—WASH BOILER.—H. P. Bemiss, Milan, Ohio.
85,359.—CAR COUPLING.—H. W. Boifeuillet, Savannah, Ga.
85,360.—FENCE POST.—Richard E. Bowen, Colden, N. Y.
85,361.—FURNITURE PROTECTOR.—George F. Boyden, Providence, R. I.
85,362.—MOLD FOR FORMING ROOFING TILES.—Philip A. Brown, Indianapolis, Ind.
85,363.—CHAIR SEAT.—George Buckel, Detroit, Mich.
85,364.—CLOTH GUIDE FOR SEWING MACHINES.—Wm. Carpenter, Fairbury, Ill.
85,365.—BALING PRESS.—M. D. Cheek, Memphis, Tenn.
85,366.—TOY.—Asa H. Church, Hubbardtown, Mass.
85,367.—BILL HOLDER.—J. A. M. Collins, Keokuk, Iowa.
85,368.— SEPARATOR FOR THRESHING MACHINES.— Tobias Crumling, Cross Roads, Pa.
85,369.—RAILWAY CAR BRAKE.—Charles D. Culver, Mauch Chunk, Pa.
85,370.—MANUFACTURE OF CHLORINE.—Henry Deacon, Appleton House, Appleton, England.
85,371.—QUICKSILVER FURNACE AND CONDENSER.—Thomas W. Dresser, San Francisco, Cal.
85,372.—PIPE AND FAUCET CLAMP.—James Elliott, New York city.
85,373.—SAFETY LAMP.—A. H. Emery, New York city.
85,374.—SCREW-PEG FOR BOOTS AND SHOES.—J. M. Estabrook, Milford, Mass.
85,375.—TREADLE.—Albert Fontayne, Cincinnati, Ohio.
85,376.—MACHINE FOR RULING SCHOOL SLATES.—John H. French, Albany, N. Y.
85,377.—STEAM-PIPE COUPLING FOR RAILROAD CAR HEATERS.—George A. Fullerton, Lynn, Mass.
85,378.—MOWING MACHINE.—Fred. A. Geisler, Bristol, R. I.
85,379.—COTTON SEED PLANTER.—A. J. Going, Clinton, La.
85,380.—SCYTHE.—Chas. E. Griffin, Roseville, Ill.
85,381.—LOCK NUTS.—Wm. Hamilton, Toronto, Canada.
85,382.—FASTENING AND STRENGTHENING FOR HORSE COLLARS.—Eli Harbaugh, Washington, Iowa.
85,383.—SEED SOWER.—James House, Turin, N. Y.
85,384.—HOE.—Chas. P. Howell, Covington, Ky.
85,385.—MEDICAL COMPOUND.—J. M. Hughes, Menomonee, Wis.
85,386.—WATER REGULATOR FOR PAPER-PULP MACHINES.—David Hunter, North Bennington, Vt.
85,387.—CULTIVATOR.—J. W. Jessop, Harveysburg, Ohio.
85,388.—ELASTIC LANYARD.—J. E. Jones, Wiretown, N. J.
85,389.—VALVE FOR STEAM AND OTHER ENGINERY.—Paul H. Kendricken, Boston, Mass.
85,390.—GATE ATTACHMENT.—H. M. Long, Williamsville, N. Y.
85391.—FOLDING LOUNGE.—William H. Lotz, Chicago, Ill.
85,392.—COLLAR FOR PIPES IN HOT BLAST FURNACES.—Henry McCullaugh, Marietta, Pa.
85,393.—ANTI-FRICTION BOX FOR SHAFTING.—Jeremiah McIlvain, Churchville, Md.
85,394.—WINDOW FRAME.—Samuel Myers, Hogestown, Pa.
85,395.—HOSE.—Edward L. Perry, New York city.
85,396.—MACHINE FOR CUTTING VITREOUS SUBSTANCES.—Ozi M. Pike, Leverett, Mass.
85,397.—FABRIC FOR THE MANUFACTURE OF PAPER COLLARS, Cuffs, etc.—James Restein, Philadelphia, Pa.
85,398.—COVER FOR POTS, KETTLES, ETC.—George Reuben, San Francisco, Cal.
85,399.—MAKING SCREW NUTS.—Ferd. Rheydt, Chicago, Ill.
85,400.—FORK BLANK.—J. C. Richardson, Ilion, N. Y.
85,401.—BEE-HIVE.—S. L. Richardson, Webster City, Iowa.
85,402.—SHACKLE AND SUPPORTER.—William Riley (assignor to H. Carpenter), Salem, Oregon.
85,403.—PROPELLER.—Henry F. Roberts, Pittsburg, Pa.
85,404.—HOT AIR STOVE.—Mathias Schlegel, St. Jacob, Ill.
85,405.—POTATO WASHER.—L. B. Sherwin, Hyde Park, Vt.
85,406.—OPERATING BRIDLE BLIND.—A. Simis, Brooklyn, E. D., N. Y.
85,407.—CAR STARTER.—Joseph Steger, New York city.
85,408.—ATTACHING WHEELS TO SLEIGHS.—Joseph Stonebanks, College Point, N. Y.
85,409.—RAILROAD TICKETS, AND PUNCH FOR CUTTING COUPONS THEREFROM.—Henry M. Stow, San Francisco, Cal.
85,410.—FURNACE FOR MELTING AND REFINING STEEL.—Alois Thoma, New York city.
85,411.—MACHINE FOR COATING THE SURFACE OF ELECTROTYPE MOLDS WITH PLUMBAGO.—Stephen D. Tucker, New York city.
85,412.—CULTIVATOR.—Flavius J. Underwood (assignor to B. D. Buford), Rock Island, Ill.
85,413.—DEVICE FOR CATCHING AND HOLDING DOMESTIC ANIMALS.—H. V. Van Etten, Auburn, N. Y.
85,414.—MACHINE FOR MAKING HORSE SHOES.—Edwin Wassell, Pittsburgh, Pa.
85,415.—HOISTING MACHINE.—William C. Williamson, Philadelphia, Pa.
85,416.—HORSE HAY FORK.—John S. Yinger, Manchester township, Pa.
85,417.—SAW.—Emanuel Andrews, Williamsport, Pa.
85,418.—POTATO DIGGER.—Levi Annis, Quincy, Mich.
85,419.—HOISTING APPARATUS FOR BUILDERS.—Leonard Atwood, New York city.
85,420.—ICE CREAM FREEZER.—Allen S. Ballard, Mount Pleasant, Iowa.
85,421.—WATER WHEEL.—David L. Bartlett, Rockford, Ill.
85,422.—WEATHER STRIPS.—Charles Bean, Ionia, Mich.
85,423.—HOLLOW AUGER.—J. H. Beauregard, Sandy Hill, N. Y.
85,424.—ROAD SCRAPER.—Robert S. Boyd, Smithland, Ky.
85,425.—POKER.—James F. Brewer, Plantsville, Conn.
85,426.—MACHINE FOR COLORING PAPER.—Charles K. Brown (assignor to himself, Charles A. Brown, and F. Field), Troy, N. Y.
85,427.—SCISSORS.—James Bull, Galesburg, Ill. Antedated December 19, 1868.
85,428.—DRIVE WHEEL.—William Burditt and George H. Burditt, Boston, Mass.
85,429.—KETTLE FOR CULINARY PURPOSES.—Jabez Burns, New York city.
85,430.—COMBINED BEAM COMPASS AND CALIPERS.—William Burrows, New York city.
85,431.—AUTOMATICALLY OPERATED PAN FOR WATER CLOSETS.—William A. Butler, New York city.
85,432.—LOOM.—George Crompton, Worcester, Mass.
85,433.—CURTAIN FIXTURE.—Alfred S. Dickinson, Washington, D. C.
85,434.—COMPOUND FOR EXTINGUISHING FIRES.—Thomas Drew, Newton, assignor to himself and James P. Bridge, Boston, Mass.
85,435.—WATER INDICATOR FOR BOILERS.—William V. Dubois (assignor to himself, William A. Sangster, and I. G. Sangster), Covington, Ind.
85,436.—SEWING MACHINE.—Geo. H. Eddleman, Atlanta, Ga.
85,437.—HORSE HAY FORK.—J. T. Elliott, Grand Rapids, Mich.
85,438.—FASTENING FOR SHEET METAL JOINTS.—Horace Everett, Philadelphia, Pa.
85,439.—DEVICE FOR CONTROLLING ENGINES.—Jean Joseph Leon Farcot, Saint Ouen (Seine), France.
85,440.—MOLDING PIPE.—George H. Garrett (assignor to Richard P. Garrett), St. Louis, Mo.
85,441.—COMBINED TANK AND CLOSET ATTACHMENT TO COOKING STOVES.—George W. Gillett, Chicago, Ill.
85,442.—BREECH LOADING FIRE ARMS.—Edwin F. Gunn, Charleston, S. C.
85,443.—COMBINED SEED SOWER AND HARROW.—Absalom Hallam, Monmouth, Ill.
85,444.—GRINDING MILL.—Edw. Harrison, New Haven, Conn.
85,445.—CHURN DASHER.—M. R. Heliker, Newark, Ohio.
85,446.—DEVICE FOR SUPPORTING WAGON TONGUES.—J. O. Houck, Iowa City, Iowa.
85,447.—WASHING MACHINE.—Eliza D. Hunt, New York city.
85,448.—MUSIC BOOK.—Isaiah Ickes, Massillon, Ohio.
85,449.—FILTER.—Charles H. Jackson, St. Louis, Mo. Antedated December 17, 1868.
85,450.—BINDING BOOKS.—A. H. Jocelyn, New York city.
85,451.—PLOW.—Moses Johnson, Three Rivers, Mich.
85,452.—CHURN.—William E. Kinert, Bluffton, Ind.
85,453.—METHOD OF LAYING AND SPREADING COMPOSITION ROOFING, PAVEMENTS, ETC.—J. Kivett and Geo. Kivett, Covington, Ky.
85,454.—PIANO STOOL SCREW.—Julius Krieg, New York city.
85,455.—SEED PLANTER.—Benjamin Kuhns, Dayton, Ohio.
85,456.—CALENDAR CLOCK.—Benjamin B. Lewis, Bristol, Conn.
85,457.—METAL SQUEEZER.—Lewis W. Lewis, Sharpsburg, Pa.
85,458.—MANUFACTURE OF ILLUMINATING GAS.—John S. Lipps, New York city.
85,459.—FRUIT DRYER.—Robert A. Lucas and Louis S. Lehman, Wooster, Ohio.
85,460.—EGG BEATER.—D. D. Mackay, Whitestone, N. Y.
85,461.—TEMPER SCREW FOR OIL WELLS.—Robert B. Magee, Venango City, Pa.
85,462.—WHIFFLE TREE ATTACHMENT.—Leonard Mancy, St. Morgan, Ill.
85,463.—COVER OR DOOR FOR GAS RETORTS, FURNACES, &C.—William Matthews and James Moore, Philadelphia, Pa.
85,464.—HAMES FASTENER.—J. H. McKinley, New York city.
85,465.—SHAFT COUPLING.—W. S. McKinney, Cincinnati, O.
85,466.—CORN AND SEED PLANTER.—Noah Mendenhall, Greensburg, Ind.
85,467.—CULTIVATOR.—Joseph Millard, Winslow, Ind.
85,568.—COOKING RANGE.—Elie Moneuse and Louis Duparquet, New York city.
85,469.—ADJUSTABLE SHOVEL PLOW.—G. W. Morter and Edward Berry, Hartville, Ohio.
85,470.—GRATE.—Peter Murray, Philadelphia, Pa.
85,471.—CULTIVATOR.—Ira A. Palmer, Monmouth, Ill.
85,472.—GRAIN DRILL.—C. E. Patric, Macedon, N. Y.
85,473.—POLE FOR HORSE CARS.—Timothy Pendergast, St. Louis, Mo.
85,474.—FARM GATE.—Albert J. Potter, Omaha, Nebraska.
85,475.—APPARATUS FOR FEEDING CLOTH TO PRINTING MACHINES.—Elisha O. Potter, Pawtucket, R. I.
85,476.—WATER ELEVATOR.—John T. Raferty, Eldara, Ill.
85,477.—BEER COOLER.—Thomas L. Rankin, New Richmond, Ohio, and Charles W. Grassmuck, Peru, Ill.
85,478.—NAIL-PLATE FEEDER.—Daniel Reed, Birmingham, Conn. Antedated December 24, 1868.
85,479.—GATE.—Nelson Rue, Harrodsburg, Ky.
85,480.—HOOP SKIRT CLASP.—M. Samuels, New York city.
85,481.—SPRING ROCKING CHAIR.—Charles C. Schmitt, New York city.
85,482.—EXPLOSIVE CARTRIDGE.—Wilhelm Schmitz, Philadelphia, Pa.
85,483.—WASH BOILER.—I. D. Seeley, Hudson, Wis.
85,484.—TUBE FOR OILERS.—Frederick J. Seymour (assignor to E. Miller and Company), Meriden, Conn.
85,485.—PROCESS FOR CURING AND PRESERVING MEAT.—Merrell B. Sherwood, Buffalo, N. Y.
85,486.—MACHINE FOR CHANNELING BOOT AND SHOE SOLES.—Michael Joseph Stein, New York city.
85,487.—DROPPER FOR HARVESTERS.—B. William Steschult, Glandorf, Ohio.
85,488.—CULTIVATOR.—William L. Stewart, Rushville, Ind.
85,489.—CAR COUPLING.—O. S. St. John, Willoughby, Ohio.
85,490.—CLAY PIPE MACHINE.—Christian Stotz and George Smith, Perth Amboy, N. J.
85,491.—CANNON.—John A. Terrell, Bloomfield, Ky.
85,492.—APPARATUS FOR MANUFACTURING SHOES.—Jules Constant Touzet, Paris, France.
85,493.—PRINTING PRESS.—S. D. Tucker, New York city.
85,494.—MAGAZINE FIREARM.—Frederick Vetterlin, Neuhausen, Switzerland.
85,495.—MANUFACTURE OF SPECTACLE BOWS.—Henry Want and John Lundgren, New Haven, Conn.
85,496.—GANG PLOW.—Timothy U. Webb, Springfield, Ill. Antedated December 22, 1868.
85,497.—REVERSIBLE LATCH.—Eli Whitney, New Haven, Conn.
85,498.—MACHINE FOR MAKING WIRE HOOKS.—R. S. Willard, Franklin, Vt.
85,499.—CLOTHES DRYER.—Daniel Witt, Hubbardston, Mass.
85,500.—HAND SHEARS.—Charles White, Brooklyn, N. Y.
85,501.—VELOCIPEDE.—Sylvester A. Wood, Manitowoc, Wis.
85,502.—RUFFLED TRIMMING.—Emma C. Wooster, New York city.

REISSUES.

67,483.—GANG PLOW.—Dated August 6, 1867; reissue 3,244. Robert Baxter, French Camp, Cal.
73,494.—BREECH-LOADING FIREARM.— Dated January 21, 1868; reissue 3,245.—Francis E. Boyd and P. Shelton Tyler, Boston, Mass.
32,236.—LOOM.—Dated April 30, 1861; reissue 3,246.—George Crompton, Worcester, Mass., assignee, by mesne assignments, of John Shinn.
73,328.—MACHINE FOR SEWING CARPET LININGS.—Dated February 11, 1868; reissue 3,247. Joel F. Fales, Walpole, Mass.
37,778.—COOKING STOVE.—Dated Fepruary 24, 1863; reissue 24, 1863; reissue 3,248. Augusta P. Stiles, Rochester, N. Y., assignee, by mesne assignments, of David L. Stiles.
52,121.—PROCESS FOR REFINING IRON AND STEEL.—Dated January 23, 1866; reissue 3,249. First National Refined Iron and Steel Manufacturing Company (assignees of John Absterdam), New York city.

DESIGNS.

3,298.—BADGE.—N. P. Chipman and William T. Collins, Washington, D. C.
3,299.—SHOW CASE.—John H. Fraser, New York city.
3,300.—HANDLE FOR A FORK OR SPOON.—Henry H. Hayden, New York city, assignor to Holmes, Booth, and Haydens, Waterbury, Conn.
3,301.—MACHINE FRAME OR HOUSING.—Francis D. Pastorius, Philadelphia, Pa.
3,302.—SPOON OR FORK HANDLE.—Henry G. Reed (assignor to Reed and Barton), Taunton, Mass.
3,303.—KEY TAG.—Arthur Stafford, Brooklyn, N. Y.

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THE UNION PACIFIC RAILROAD CO.

OFFER A LIMITED AMOUNT OF THEIR

FIRST MORTGAGE BONDS

AT PAR.

NINE HUNDRED AND SIXTY MILES

Of the line West from Omaha are now completed, and the work is going on through the winter. As the distance between the finished portion of the Union and Central Pacific Railroads is now less than 400 miles, and both Companies are pushing forward the work with great energy, employing over 30,000 men, there can be no doubt that the whole

GRAND LINE TO THE PACIFIC

Will be Open for Business in the Summer of 1869.

The regular Government Commissioners have pronounced the Union Pacific Railroad to be FIRST CLASS in every respect, and the Special Commission appointed by the President says:

"Taken as a whole, THE UNION PACIFIC RAILROAD HAS BEEN WELL CONSTRUCTED, AND THE GENERAL ROUTE FOR THE LINE EXCEEDINGLY WELL SELECTD. The energy and perseverance with which the work has been urged forward, and the rapidity with which it has been executed are without parallel in history, and in grandeur and magnitude of undertaking it has never been equaled." The Report states that any deficiencies that exist are only those incident to all new roads, and that could not have been avoided without materially retarding the progress of the great work. Such deficiencies are supplied by all railroad companies after the completion of the line, when and wherever experience shows them to be necessary. The report concludes by saying that "the country has reason to congratulate itself that this great work of national importance is so rapidly approaching completion under such favorable auspices." The Company now have in use 137 locomotives and nearly 2,000 cars of all descriptions. A large additional equipment is ordered to be ready in the Spring. The grading is nearly completed, and ties distributed for 120 miles in advance of the Western end of the track. Fully 120 miles of iron for new track are now delivered West of the Missouri River, and 90 miles more are *en route*. The total expenditure for construction purposes in advance of the completed portion of the road is not less than eight million dollars.

Besides a donation from the Government of 12,800 acres of land per mile, the Company is entitled to a subsidy in U. S. Bonds, on its line as completed and accepted, at the average rate of about $29,000 per mile, according to the difficulties encountered, for which the Government takes a second lien as security. The Company have already received $22,158,000 of this subsidy, of which $1,280,000 was paid Dec. 6th, and $640,000 Dec. 14th.

GOVERNMENT AID.

Security of the Bonds.

By its character, the Company is permitted to issue its own FIRST MORTGAGE BONDS to the same amount as the Government Bonds, *and no more*. These Bonds are a First Mortgage upon the whole road and all its equipments. Such a mortgage upon what, for a long time, will be the only railroad connecting the Atlantic and Pacific States, takes the highest rank as a safe security. The earnings from the way or local business for the year ending June 30, 1868, on an average of 472 miles, were over FOUR MILLION DOLLARS, which, after paying all expenses, were much more than sufficient to cover all interest liability upon that distance, and the earnings for the last five months have been $2,386,870. They would have been greater if the road had not been taxed to its utmost capacity to transport its own materials for construction. The income from the great passenger travel, the China freights, and the supplies for the new Rocky Mountain States and Territories must be ample for all interest and other liabilities. No political action can reduce the rate of interest. It must remain for thirty years *six per cent per annum in gold*, now equal to between to between eight and nine per cent in currency. *The principal is then payable in gold.* If a bond with such guarantees were issued by the Government, its market price would not be less than from 20 to 25 per cent premium. As these bonds are issued under Government authority and supervision, upon what is very largely a Government work, they must ultimately approach Government prices.

The price for the present is PAR, and accrued interest at 6 per cent from July 1, 1868, in currency.

Subscriptions will be received in New York

At the Company's Office, No. 20 Nassau st.,

AND BY

John J. Cisco & Son, Bankers, No. 59 Wall st.,

And by the Company's advertised Agents throughout th United States.

Bonds sent free, but parties subscribing through local Agents, will look to them for their safe delivery.

A NEW PAMPHLET AND MAP WAS ISSUED OCT. 1st, containing a report of the progress of the work to that date, and a more complete statement in relation to the value of the bonds than can be given in an advertisement, which will be sent free on application at the Company's offices, or to any of the advertised agents.

JOHN J. CISCO, Treasurer, New York.

December 15th, 1868.

FINE Iron CASTINGS, of all kinds, made to order promptly. Also, Patterns and models by LIVINGSTON & CO., Iron Founders, Pittsburgh, Pa.

Power Hammers.

IN HOTCHKISS' PAT. Air Spring Hammers; W. H. WALTER'S PAT. Drop Hammers. These SUPERIOR TOOLS made by CHARLES MERRILL & SONS, 3 tf 556 Grand st., New York.

SILICATE OF SODA AND POTASH, OR

Soluble Glass.

For Sale by the Sole Manufacturers, L. & J. W. FEUCHTWANGER, 3 3 55 Cedar st., New York.

Velocipede Wheels,

MANUFACTURED BY S. N. BROWN & CO., DAYTON, OHIO. They also make a prime article of Spokes and Hubs for light Carriage and Buggy Wheels. Send for price list. 3 13

UNITED STATES GREENBACKS Will be taken by Yeatman & Graham, in payment for Catawba Wine, by the Cask or Case, which they offer for sale, and will WARRANT the same to be Equal, if not Superior, to any Native Wine ever offered in this market. All our Bottled Wine is made from the first run of the Press; entirely pure, fined three years in Wood before Bottling, and of the same quality which gave us Premiums at the World's Fair in London, New York, Philadelphia, Wine Growers' Association at Cincinnati and St. Louis. YEATMAN & GRAHAM, 1* Office, 13 West 3d st., Cin.

SPOKE MACHINE WANTED— By J. R. HORNBAKER, Bristoe Station, O. & A. R. R., Va. All manufacturers of Spoke Machines please send Circulars to the above address. 3 4

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U. S. PATENT OFFICE, Washington, D. C., Dec. 19, 1868.
Emeline M. Woodruff, of Elizabeth, N. J., (formerly Emeline M. Stedman,) executrix of the will of George W. Stedman, deceased, having petitioned for the extension of a patent granted the said George W. Stedman on the 20th day of March, 1855, for an improvement in Sewing Machines, it is ordered that said petition be heard at this office on the 8th day of March next.
Any person may oppose this extension. Objections, depositions, and other papers, should be filed in this office twenty days before the day of hearing.
ELISHA FOOTE, Commissioner of Patents.

U. S. PATENT OFFICE, WASHINGTON, D. C., Dec. 26, 1868.
Thomas Crossley, of Bridgeport, Conn., having petitioned for the extension of a patent granted him on the 20th day of June, 1854, and antedated on the 5th day of April, 1854, for an improvement in Machines for Printing Woolen and other Goods, this application having been authorized by Act of Congress, approved June 25, 1868, it is ordered that said petition be heard at this office on the 8th day of March next.
Any person may oppose this extension. Objections, depositions, and other papers, should be filed in this office twenty days before the day of hearing.
ELISHA FOOTE, Commissioner of Patents.

U. S. PATENT OFFICE, Washington, D. C., Dec. 26, 1868.
William H. Guild and William F. Garrison, Brooklyn, N. Y., having petitioned for the extension of a patent granted them on the 27th day of March, 1855, and reissued the 27th day of July, 1858, for an improvement in Operating Valves in Direct-acting Steam Engines, it is ordered that said petition be heard at this office on the 15th day of March next.
Any person may oppose this extension. Objections, depositions, and other papers, should be filed in this office twenty days before the day of hearing.
ELISHA FOOTE, Commissioner of Patents.

U. S. PATENT OFFICE, Washington, D. C., Dec. 28, 1868.
Thomas J. Hall, of Bryan, Texas, having petitioned for the extension of a patent granted him on the 1st day of May, 1855, for an improvement in Gang Plows, it is ordered that said petition be heard at this office on the 22d day of March next.
Any person may oppose this extension. Objections, depositions, and other papers, should be filed in this office twenty days before the day of hearing.
ELISHA FOOTE, Commissioner of Patents.

U. S. PATENT OFFICE, Washington, D. C., Dec. 28, 1868.
Thomas J. Hall, of Bryan, Texas, having petitioned for the extension of a patent granted him on the 3d day of April, 1855, for an improvement in Plows, it is ordered that said petition be heard at this office on the 22d day of March next.
Any person may oppose this extension. Objections, depositions, and other papers, should be filed in this office twenty days before the day of hearing.
ELISHA FOOTE, Commissioner of Patents.

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THE MOST VALUABLE MACHINE for planing irregular and straight work, in all branches of wood working is the Combination Molding and Planing Machine Co.'s "Variety Molding and planing machine." Our improved guards make it safe to operate. Our combination collars save one hundred per cent; and for planing, molding, and cutting irregular forms, our machine is unsurpassed.

The Variety Machine sold by the Gear's is a direct infringement on the Grosvenor and other Patents owned solely by us, and the public will please notice the deeds given by Mr. Gear cover only the Gear Patent, being no protection to the purchaser against the rights of our Patents, infringements on which we are now prosecuting.

The Gear Patent, without our improvement, has for many years been discarded by mechanics as impracticable, in fact we have had on hand, ever since the introduction of our improvements, several of the old Gear Machines, which we cannot sell even at prices slightly above the value of old iron.

All our machines are sold and delivered in New York, but the right to use a machine goes with it, and we will protect all parties who may purchase machines from us, not only under the Grosvenor and Tice Patents, which constitute the practical value of the machine, but also under the Gear Patent.

Attention is called to cuts of our Variety Machine (in the issue of this journal of December 9th, 1868), of which we are the sole lawful makers, and other parties building or vending like machines, are doing so without the slightest legal authority, subjecting themselves and patrons to heavy damages, the collection of which we are determined to prosecute to the fullest extent of the law.

All communications for us should be addressed to COMBINATION MOLDING AND PLANING MACHINE CO., 424 East 23d st., or Box, 3,230, Post Office, New York city. tf

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IT IS THAT PERSONS INTERESTED, before purchasing, address A. S. & J. GEAR & CO., NEW HAVEN, CONN., for all particulars concerning the "GEAR PATENT," which is THE FOUNDATION, SOUL, and BODY of all VARIETY MOLDING and UPRIGHT SHAPING MACHINES of any account. We own and build all the latest and ONLY VALUABLE IMPROVEMENTS on the machine, and are OWNERS and LAWFUL MANUFACTURERS FOR ALL THE UNITED STATES (except the State of New York) of the BEST and ONLY COMPLETE AND PERFECT MACHINE invented for planing and molding irregular forms in wood. WE WARRANT OUR MACHINES, and give DEEDS of right TO USE EVERY PART OF THEM to protect the public from being swindled.

The Combination Molding and Planing Machine Co. own the GEAR PATENT for the State of N. Y., and a small interest in the State of Mass. ONLY. Notice particularly their STUDIED WORDS: "All our Machines are sold and delivered in New York." Nobody disputes their right to "sell" and "deliver" IN New York; but why do they refuse to give DEEDS, the ONLY guarantee, to use them out of the State of New York? If vested with a title, why refuse to give a title?

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Mr. Hamilton, the advertising man of the C. M. & P. M. Co., wrote us, under date of March 5, 1868, that he was satisfied our improvements were not infringements on theirs. He also wrote Mr. N. Gear, about the time Mr. Grosvenor got out his improvement, that they were not worth anything; and Stoughton (a patent lawyer), said that they were a perfect infringement on Mr. Gear's.

In the description of engravings of the C. M. & P. M. Co's Machine, two of the essential features of the "GEAR PATENT" are omitted. Query: Why?

EXAMINE YOUR BAIT BEFORE BITING.

If you want a machine *to use in New York State*, purchase of them. If you want one TO USE ELSEWHERE PURCHASE OF US.

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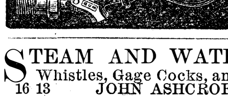

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BRASS AND COPPER WIRE,

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OFFICE No. 65 NORTH FRONT STREET, PHILADELPHIA, PA., Manufacture all kinds of Cotton and Woolen Machinery including their new *SELF-ACTING MULES AND LOOMS,* Of the most approved style. Plans drawn and estimates furnished for factories of any size. Shafting and mill gearing made to order. 1 tf

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