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Contents:

(Illustrated articles are marked with an asterisk.)

TO CITY SUBSCRIBERS.

The SCIENTIFIC AMERICAN will hereafter be served to our city subscribers either at their residences or places of business, at $3.50 a year.

Theodore Tasch, a very energetic and reliable young man, and for many years employed in this office, is authorized to deliver the paper, and to collect subscriptions and receive orders for advertisements.

WE propose during the coming year to devote more attention to the illustration and description of leading branches of manufacturing. We are prepared to send our artists, and competent writers to points within reasonable limits to take the necessary sketches, and prepare the descriptions. The advantage of such illustrated articles in a journal so widely circulated as the SCIENTIFIC AMERICAN, must be apparent to every enterprising manufacturer.

ONE of our associate editors has recently visited Pittsburgh, and we are now preparing illustrations of the largest iron works in that city, to be published soon, with an account of the operations and processes carried on at the works.

THE present number closes the volume. We are aiming at a subscription list of at least fifty thousand. This can only be accomplished by the co-operation of our present patrons, who have always generously responded to our appeals. We urge them now to speak a good word for the SCIENTIFIC AMERICAN. By so doing they can induce some of their neighbors to join in making up a club. If ten or more names are sent, the subscription is $2.50 a year. Any one who will send us twenty names and $50, can add his own name to the list.

AGENTS who receive their weekly supply of the SCIENTIFIC AMERICAN through news companies, are urged to canvass their localities. By a little effort among intelligent mechanics and manufacturers, they can add largely to their lists. We will send specimen numbers, when desired, for that purpose.

WHAT more valuable present can be made to young mechanics than a year's subscription to the SCIENTIFIC AMERICAN? Employers will be doing their employés a great service by acting on this hint, and we feel sure that at the end of the year they will consider the investment a good one.

SUBSCRIBERS who wish to have their volumes bound, can send them to this office. The charge for binding is $1.50 per volume. The amount should be remitted in advance, and the volumes will be sent as soon as they are bound.

THE Index, the Patent Claims, and Advertisements occupy so much of the present issue, that we are obliged to defer the publication of several interesting letters and contributions until our next number.

SUBSCRIBERS who forward their subscriptions, may consider the receipt of the paper as evidence of payment, as we cannot undertake to acknowledge such payments by mail.

PERMANENT WAYS versus LIGHT TRAINS.

When houses are properly built the foundation is the first and most important consideration. If the "hard pan" is not reached piles are driven to give a proper foundation. So with all structures built by men and growing out of the earth, the foundation is the first and main object of concern. To secure this foundation, in any particular locality, is possible even under very adverse circumstances; but, although it is intended mainly to support a constant weight, not subject to frequent or extensive variations in amount, it is, not seldom, very costly. Where the imposed weight is liable to sudden and frequent change, either of increase or diminution, it has been found that a rigid structure is not so lasting as one possessing more or less elasticity. Such are bridges, especially those of a large span, and we always hear of the amount of deflection caused by a stationary or a passing load when a bridge is described.

Unyielding sub-structure for the rails of a road, would be very costly. To prevent displacement by atmospheric agencies—frost, heat, snow and rain—the bed or foundation would have to be settled and located below the reach of these disturbances. That this would be hardly possible, at whatever expense, is evident when the nature of the beds of our railroads are considered. They are cut through hills and dense forests, carried through swamps, and over causeways, the material being rock, loose stones, gravel, loam, soil, sand, and even decaying vegetation. Such materials, under such circumstances, cannot make a *permanent* way. A foundation of gravel, stone, mortar, and cement would be altogether too costly, and make railroads an impossible luxury. Substituting stone for wooden sleepers has been tried and failed. A portion, at least, of the Boston and Lowell railroad was laid with granite sleepers. Each sleeper became an anvil and the jar of the successive blows of the wheels was immensely injurious to the rolling stock, while the stone sleepers were broken by the frost or the percussion of the trains. "Shims" or cushions of wood were introduced between the rails and the stone sleepers and thus the difficulty was partially remedied. If a permanent or rigid way is to be attempted it is evident that either the support of the rails must be continuous, or the rails must be made much heavier, or higher, giving a longer vertical section than those at present used.

As at present constructed and used, railroads are costly enough; they are anything but permanent ways, and as making them so would seem to be financially difficult if not physically impossible, we must look to the reduction of the weight the rails are compelled to bear. Between the supports (sleepers) the rail is a stringer like that of a bridge, and subject, like that, to deflection, as anyone may see who notices the movement of a train, a locomotive, or a heavily loaded car. Why not reduce the weight of the locomotive and of trains, running trains oftener and nearer together? Is there any insuperable obstacles to this, and would it not be cheaper than to make a long road, passing over and through all sorts of soils and all descriptions of country, a permanent way? It seems to us that altogether too much attention has been devoted to the introduction if steel rails, steel tires, and improvements in the permanent way, and too little to the proper utilization of our roads as they now exist, or as they may be cheaply made to be. Let the road be properly ballasted, placing the sleepers two instead of three feet apart, and then replace the enormous thirty, forty, and fifty tun locomotives by those better adapted to the road, of course reducing the weight of the trains (and if necessary, of the cars), and we should hear less about accidents from broken and worn out rails, broken axles, and defective sleepers.

CONDITION OF THE PATENT OFFICE.

The Secretary of the Interior, in his annual report to Congress, states that during the year ending September 30, 1868, there were 20,112 applications for patents; 14,153 patents (including reissues and designs) were issued; 1,692 applications allowed on which patents did not issue owing to the non-payment of the final fee; 3,789 caveats filed; 180 applications for the extension of patents received, of which 133 were granted. The receipts were $696,786, being $171 less than the expenditures. The Secretary also renews his former suggestion in favor of repealing so much of the law as allows an appeal from the decisions of the Commissioner on applications for letters patent and in interference cases, and respectfully refers to the views on the subject presented in his former reports.

The Commissioner of Patents reports to the President of the Senate as follows:

By an act of Congress passed July 20, 1868, all the receipts of the Patent Office were directed to be paid into the Treasury, and the sum of $250,000 was appropriated to pay its expenses.

In pursuance of said act, I transmit herewith to Congress a detailed account of the receipts and expenditures of the Patent Office during the period from the passage of said act up to the commencement of the present month.

The payments of salaries and wages at the Patent Office are usually made at the end of each month. Those, therefore, that were paid after the 20th of July were for the services of the whole of that month.

The accounts of expenditures include about $35,000 paid for debts that had accrued before the commencement of the term. Other portions of such past indebtedness, amounting to about $27,000, still remain due and unpaid.

The Agricultural Department, during the past summer, has been removed from the Patent Office building. The fitting up of the rooms thus vacated, and furnishing them for the uses of the Patent Office have involved considerable expenditures beyond the ordinary expenses of the office.

Of the $250,000 appropriated by the act of July 20th, $43,490 remain unexpended. This sum, it is estimated, will about meet the expenditures of the present month.

The receipts of the Patent Office, since the 1st of July last, that have been collected and paid into the Treasury, exceed all its expenditures during the same period, ordinary and extraordinary, by the sum of $29,494 85.

THE VELOCIPEDE MANIA.

The excitement on the subject of velocipedes is on the increase, and improvements are being made every day. But inventors are not confining their genius to velocipedes to be used on land; a number of plans and models have been submitted to us for aquatic use, some of which possess much novelty.

A riding school for giving instruction in the art of riding and driving the two-wheeled velocipede has been opened in the large hall, 932 Broadway, where large numbers of gentlemen congregate every evening to receive instructions.

The sport of velocipede riding is very fascinating, and is becoming quite fashionable. It is likely to take the place of skating to a great extent. Persons may be seen practicing on our streets and avenues every afternoon. One gentleman in the country who does business in the city is said to have sold his horse and wagon and substituted the velocipede, on which he rides back and forth from the railroad station to his house every day. He claims that he goes quicker and without fatigue. He enjoys the exhilarating ride, and is delighted with the change. His oats are for sale and stable to rent. No more harnessing, shoeing, or horse feed required by this gentleman. Other incidents of interest on the new mania are deferred for lack of space this week.

HORSE AND FOOT.

From the above heading it might be inferred that we intend to write a military essay, but such is not the case. Our desire is simply to call attention to a nuisance, and to suggest a remedy. The nuisance to which we refer is this: In all our overcrowded cities, New York, for instance, all streets are free to vehicles of whatever character, and are also pedestrian thoroughfares. It is true the sidewalks are the exclusive prerogative of the pedestrians, but, as they are forced to cross other streets to get from block to block, the nuisance remains, to the peril of life and the utter despoilment of broadcloth and patent leather.

Nine tenths of all the accidents from collisions occur at crossings. This city employs a large number of policemen to assist ladies in fording rivers of filth and preventing them from being run down by reckless drivers. It is no uncommon sight, in the midst of sludge which winter always brings us, to see some shipwrecked daughter of Eve stranded upon some island of frozen filth in the middle of the street holding frantically to her soiled crinoline, her pretty gaiters filled with an ice-cold solution of high fertilizing value, and looking appealingly around to find somebody whose bravery and boots are sufficient for an attempt to rescue her. Meanwhile along come the omnibuses and express wagons, carts and trucks, whose drivers seem to take a malicious pleasure in bespattering her velvet cloak and her snow-white feathers, regardless of the feelings which wring her heart-strings, or the damage which wrings her husband's purse strings.

Now there is but one remedy for this uncivilized state of affairs. The horse must be separated from the foot. In order to effect such a separation we advocate first, the erection of a screen along the edge of the sidewalk next the street, the screen to consist of an iron frame, with a curtain of canvas that can be raised or lowered, to suit circumstances. In fair weather it would of course be unnecessary to keep it up, but in sloppy weather it would add greatly to the comfort of all who are compelled to pass through our principal thoroughfares. Second, the crossings should be tunneled. The experiment of the Fulton Street Bridge has proved that bridges are not the thing wanted. They require to be too high to accommodate the loaded vehicles and omnibuses, and for various other reasons are not tolerated. Tunnels at crossings, on the contrary, need not to be deep, and the steps leading into them can be made of easy grade. They can be lighted day and night with gas, for one-fourth the expense of keeping policemen to guard the principal crossings, and on the score of cleanliness are preferable to bridges. Their expense need not be much greater than bridges, but if it were five times as much we should still advocate them as the only feasible method of correcting the nuisance we have described.

CLEANLINESS IN SHOPS.

In our visits to different manufacturing establishments we are often shocked at the confusion and want of order which seems to prevail. Cleanliness, the virtue which has been said to rank next to godliness, seems to be entirely disregarded in many otherwise well conducted establishments. Now we regard order in the arrangement of tools, the avoidance of confusion attendant upon misplacement, and the frequent and thorough removal of the litter upon floors, as more important in an economical point of view, than with reference to the comfort and health of workmen, although the latter consideration is important enough.

The want of attention to this point is costing many a shop in this country more than is imagined. In one shop we visited lately we saw a workman search for a mislaid tool longer than it took him to use it after he found it. The incident did not seem an unusual one but one of ordinary occurrence, as we inferred from some remarks of the foreman, who saw the whole matter and even suggested some places where the missing tool might probably be found.

The floor of this shop was covered with a mass of useless lumber. The removal of any bulky object from one end of the shop to the other, would have necessitated a previous removal of rubbish to clear a way that would have consumed a considerable time. Such a slovenly state of things must inevitably breed carelessness on the part of employés, and greatly facilitate accidental misplacement of tools, nuts, and other small objects liable to be dropped. The reflexive effect upon hands, of strictly enforced order in the replacing of tools and cleanliness in a shop, is always in the highest degree beneficial and should never be overlooked by an intelligent foreman.

Nothing is more refreshing than to pass from one of these ill-regulated slovenly shops into one where order and cleanliness prevail. Even the workmen seem be more cleanly in their person and tidy in their attire, and to feel the elevating tendency of the discipline which prevails. Everything moves on quietly, rapidly, and surely to its accomplishment. No time or material is wasted. Everything is in its place when wanted and ready for use. A comparison of two such shops is a demonstration that there is no such thing as perfect manu-

facturing economy when order and cleanliness are overlooked.

THE JONVAL VS. THE FOURNEYRON WATER-WHEEL.

It has long been a mooted question with both engineers and manufacturers whether the Jonval or the Fourneyron water wheel utilized the greater amount of power from a given quantity of water and fall. This problem seems to have been at last solved in a very satisfactory manner in favor of the Jonval turbine, as the accompanying letter from a disinterested party, prepared agreeable to contract, will show.

The wheels in question are from 125-to 150-horse power, and were expressly constructed to test the respective merits of the principle of which each is a type. The builders of the different wheels are well known to be eminent in the construction of the wheels they produce; and the builders of the beaten wheel—the Fourneyron—it is reasonable to suppose, used all their skill in the construction of the wheel upon which so much depended, hence the result must be attributed not to a faulty adaptation of, but to the principle itself.

We deem this a very important result; and as it is evidently no accidental or forced result, but a matter of deliberate contract and agreement between all the parties interested, the builders, as well as the users of the wheels, we take pleasure in calling the attention of engineers and manufacturers to it.

WILLIMANTIC, CONN., Oct. 31, 1868.

MUNN & Co: Gents—When our new thread mill was being constructed, we made a contract with Mr. J. P. Collins, of the Troy Turbine and Machine Works, to build one of his improved Jonval Turbine Water Wheels, to be tested with a Fourneyron or "Boyden" Turbine, as built by Messrs. Kilburn, Lincoln & Co., of Fall River, Mass.

The test was to be a comparative one, *i. e.*, each wheel to drive the same machinery, and the relative amount of water measured which each should require to do it.

About one year since, the builders of both wheels met here and, assisted by ourselves, conducted the test. Messrs. Kilburn, Lincoln & Co. were much dissatisfied with the result, and claimed that their wheel was badly injured by some sticks or stones getting into it. Upon this ground they claimed the privilege of putting in a new wheel, preparatory to another test. This request was granted them, and the final test was made on the 15th inst., both builders again being present.

The Fall River wheel drove 12 1-2 per cent more machinery than the Collins wheel, but in doing so required 38 99-100 per cent more water, thus leaving a result of over 23 per cent in favor of the Collins wheel (being about the same comparative difference as in former test). In the last test the water used by each wheel was measured over the same weir, the same depth being retained by contracting the ends. The gates were fully open in each test, and the Collins wheel was not changed after the first test.

Our contract with Mr. Collins was that we should give a certificate of the result, no matter which wheel should prove the best, for publication in your useful journal, and we now hereby comply with the same.

Yours, very truly,
WILLIMANTIC LINEN CO.
A. B. BURLESON, Agent.

THE TELESCOPE.---A LECTURE DELIVERED BEFORE THE AMERICAN INSTITUTE BY PROF. ALEXANDER.

Reported for the Scientific American.

The second lecture of the regular course of scientific lectures before the American Institute, was delivered on the evening of the 4th December, by Prof. Alexander of Princeton College.

The lecture was opened by an allusion to the figure in Bunyan's Pilgrim's Progress, in which the senses are considered as gates to the soul. The speaker dwelt in the most eloquent manner upon the beauty of the mechanism of the "eye gate," and the mysterious agent by which impressions of remote objects are conveyed to the mind.

He next proceeded to explain the mechanism of the telescope, that "artificial eye" bestowed upon man by optical science, illustrating this part of the subject with numerous diagrams. It is quite impossible to reproduce in a report of this kind this part of the lecture. One part, however, can be made clear to our readers. People often imagine the magnifying power of a telescope depends upon the size of its object glass. This is a mistake. An instrument with a small object glass may magnify as much as a larger one, the magnifying power depending upon the eye-pieces. The limit of the power of the eye-pieces which telescopes can carry, and give a distinct image, depends upon the object glass which determines the illuminating power. In other words, we behold objects clearly only when their size and illumination are together sufficient to produce a distinct impression upon the retina. The larger the object glass of a telescope is, the more light it will collect from objects towards which it is directed, and hence the advantage of large lenses.

The lecturer next dwelt briefly upon the early history of the telescope. Roger Bacon, in the thirteenth century, made use of such language with reference to what "may be performed by refracted vision," as to render it somewhat probable that he was at least acquainted with the theory of a refracting telescope, though there is no sufficient proof that he constructed one; and Baptista Porta is said by Wolfius to have made a telescope, but the description of the instrument given by the inventor is very defective, and the instrument, whatever it was, does not seem to have been used in any celestial observation. Indeed, we have no distinct evidence that such an instrument was used before the beginning of the seventeenth century. Descartes ascribes the invention of the telescope to James Metius (Jacob Adriansy) of Alkmaer in Holland; but Huygens, as well as Borellus, to John Lippensheim, or Lippersy (Hans Zans, or Jansen), a maker of spectacles, of Middleburgh. Prof. Moll, after an examination of official papers preserved in the archives of the Hague, comes to the conclusion that on the 17th of October, 1608, Jacob Adriansy was in possession of the art of making telescopes, but from some unexplained cause concealed it; and that on the 21st of the same month, Hans Zans, or Jansen, was actually in possession of the invention; but there is little reason to believe that it was devised by either him or his son Zacharias, though one of them invented a compound microscope about the year 1590.

One of the earliest of the telescopes made by the Jansens was presented to Prince Maurice, to be used in his wars. It was in April or May, 1609, that Galileo first heard of this, and the instrument was then described to him as one which had the property of making distant objects appear as though they were near. Galileo thereupon devised how that might be effected, and the next day, according to Delambre, was in possession of a telescope magnifying three times. Galileo's second telescope magnified about 18, and his third about 33 times.

The remainder of the lecture was an elegant and graphic description of some of the wonders of the heavens revealed to us by the telescope, and it was closed by a strong argument in favor of natural and revealed religion based upon the evidences of an intelligent Creator to be found in the study of the material universe.

THE MANUFACTURE OF IRON.---A NEW PROCESS.

A new process for manufacturing iron, which seems to give considerable promise, is now on its trial at one of the iron mills of Pittsburgh. The process obviates the necessity of puddling. The pigs of crude iron are melted, and, while in a fused state, a quantity of crushed ore is intermixed. The oxygen of the ore combines with the carbon of the crude iron. The mixed mass is called a pig bloom. Upon re-heating these pigs and squeezing them in the usual manner, and rolling, iron of a very good quality is obtained. More rolling is required than in the ordinary process, but notwithstanding this fact, the iron is produced, so it is claimed, at a saving of six dollars per tun over the old method.

Some specimens which we have seen tried, indicate that the iron is slightly red-short, but not so much so as to seriously impair its quality. When cold it is remarkably tough, enduring very severe tests of bending, twisting, and so forth. We have not obtained analyses of the ores used in the process and cannot therefore give any further details. We shall, however, watch the progress of this method, and hope at a future time to give a minute description of it.

The Siemens Furnace.

During a recent visit to Pittsburgh, our attention was called to the operation of one of the Siemens regenerative gas furnace, and we are satisfied that among the many modern advances in the manufacture of iron and steel, this deserves to rank among the most valuable. The furnace alluded to was applied to the melting of steel in pots, and we were told that the saving in fuel effected by it was enormous. It would be difficult to conceive how a more intense heat on so large a scale could be reached, than in one of these furnaces. The *American Railway Times* contains the following interesting facts in regard to this furnace, and its applications:

One of these furnaces used in Bolton, England, since November, 1867, in puddling iron, shows some remarkable results in competition with the ordinary puddling furnace, which may be summed up briefly as follows: an increase of from thirty-five to fifty per cent. in the amount of work done; greatly improved quality of the iron produced; great saving in the waste metal; and a saving of from twenty-four to fifty per cent in the amount of fuel used. When to these facts is added that the Siemens furnace will last much longer than the ordinary furnace, and that it occupies much less room, it makes out a pretty strong case in favor of its general adoption for puddling iron. The Siemens Furnace is now being rapidly introduced into the United States, for melting steel in pots, being used for this purpose at Nathan Washburn's works at Worcester, Mass., and at the works of Messrs. Anderson & Wood's, and Singer, Nimick & Co., of Pittsburgh, Pa., while several other furnaces are being built at other places for like purposes. In melting steel in pots it is found that one half tun of slack coal of poor quality, will melt one tun of steel in three hours, while the pots will last two melts more than by the old process. In Great Britain the manufacturers are now successfully using clay pots at the cost of about fifty cents each, while the lead crucibles commonly used, cost about three dollars each. These pots are now being introduced into Nathan Washburn's works, and in other steel works, and this item of economy is of no mean importance in favor of the Siemens furnace. It is found at the Lenox Plate Glass Works, at Lenox, Mass., that this furnace will melt the same mixture in nine hours, that in the old furnace it takes thirteen hours to melt. For heating iron and steel, the Siemens furnace is now used at the Nausha Iron Works, and the Renssalier Iron Works; and it is found that four hundred pounds of poor coal are found sufficient to heat one tun of iron. These furnaces are likewise now being erected for heating, melting, and puddling purposes, by the Washburn & Moen Manufacturing Company, by Messrs. Burden & Sons, by the Trenton Iron Works, by Messrs. James Wood & Sons, of Pittsburgh, the American Silver Steel Company, and by several other parties in different sections of the country.

Chemical Action of Light.

The interesting researches of Professor Tyndall as to the action of light on certain vapors and liquids may have no immediate effect upon the practice of photography, but it is impossible to say at what point in his discoveries a practical application may become obvious. Let us illustrate by a speculation upon the possibilities attending his recent discoveries. In his paper before the Royal Society he states that actinic light decomposes the vapor of nitrite and nitrate of amyl. Amyl is a radical analogous to ethyl and methyl, the hydrated oxide of amyl being known as fusel oil, as the hydrated oxide of ethyl is known as ethylic, or common alcohol, and the hydrated oxide of methyl is known as methylic alcohol. Fusel oil is known to be a common impurity in ordinary alcohol, and its presence in collodion has long been regarded as injurious, and conducive to fog, without any knowledge of the reason why it should produce mischief. Professor Tyndall's experiments suggest a series of possibilities. When fusel oil is in collodion, and comes in contact with nitric acid, either free in the bath or liberated by action of free iodine in the collodion, a trace of nitrate of amyl may be formed, and this body, being present in the film when exposed to the action of light, and possibly decomposed, would, under some circumstances, yield, as a product of decomposition, valerianic acid, a substance answering to acetic acid, as the product of the oxidation of common alcohol, or formic acid in methylic alcohol. Or, possibly, in the decomposition, intermediate bodies, analogous to acetone or aldehyde, might be formed, with a well-known tendency to produce fog when present in a collodion film. Such a series of possibilities exist, and might furnish a clue to the fogging action of fusel oil when present in collodion, which, arguing from ordinary analogies, ought not to be more inimical to success than the ordinary alcohol employed in the manufacture of collodion.—*Photographic News.*