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.*