Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included..... **$3 20**
One copy, six months, postage included **1 60**

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

☞ To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now **Fifty Thousand Copies** weekly. For 1880 the publishers anticipate a still larger circulation.

The Scientific American Supplement

Is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter. Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, MAY 15, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 228,

For the Week ending May 15, 1880.

Price 10 cents. For sale by all newsdealers.

THE USE OF STEEL FOR STRUCTURAL PURPOSES.

At the last meeting, in Pittsburg, of the Engineers' Society of Western Pennsylvania, the subject which most interested the iron and steel men of Pittsburg was the topic ably handled by Mr. A. F. Hill, C.E., of New York, in his paper entitled "Steel in Construction." The points presented embodied a series of interesting tests conducted by the gentleman named, with open hearth Pittsburg steel from the establishment now supplying the steel for the wire used in the East River Bridge cables. These experiments were conducted at the works of the Keystone Bridge Company, Pittsburg, at J. M. & J. B. Cornell's works, New York, and at the United States testing machine at Watertown, N. Y. Following are the salient points in Mr. Hill's paper:

"Within the past few years there has been developed in this country a tendency toward steel construction, which today is so pronounced as to command the most thoughtful consideration alike of constructors and manufacturers. The adaptability of steel to purposes of construction is probably no longer questioned, yet there is still a certain distrust of the material in minds of many thoughtful men, who believe steel to be endowed, more than any other material, with that exasperating quality which might fitly be called the 'innate cussedness' of inanimate objects. This arises undoubtedly from some of the remarkable and seemingly inexplicable failures which have occurred in finished parts of steel, some of them breaking under loads utterly inadequate to produce rupture, others breaking in some instances without any apparent cause at all. I use the expression 'seemingly inexplicable' advisedly, for I believe that every such extraordinary failure is susceptible of rational explanation, and can almost invariably be traced, not to the inherent defect in the material itself, but to the wrong treatment of the steel during the process of manufacture into parts of the structure. I propose to lay before you the results of some steel tests made under such conditions as would naturally arise when the material is to be used in a structure."

The samples tested ranged from 0·30 per cent to 0·50 per cent carbon, and were in the form of eye bars, plates, and girders. In the first named, the eye bars were from the Kloman machine, which rolls the bar complete from end to end; the Keystone "upset" bar, and bars made by welding and die forging. The tests showed that the first two classes gave best results, and the last named second best, and the process of welding and die forging "could not be recommended for general practice." The tensile strength of these bars ranged from 93,000 lb. per square inch in the 0·30 per cent and 102,000 lb. in the 0·50 per cent steel.

The tests made on plate steel were crucial. A ¾ steel plate was tested in the direction of rolling, and across the same; also as to the relative strength of sheared and punched plates, and the effects of annealing and tempering. To ascertain just what such a plate, would stand, Mr. Hill punched out the edges of such a plate and then reduced its gauge by cold hammering to $\frac{1}{8}$ of an inch. The sample was then heated to a bright cherry, and annealed forty-eight hours in lime. A test showed an elastic limit of 55,000 lb., and an ultimate strength of 100,400 lb. In tempering sheared and punched plates from a low heat in oil, the effect was contrary to what might be expected; instead of rendering the material hard and brittle, it restored its ductility and increased its ultimate strength. The last test was with a steel girder of $\frac{5}{16}$ web plate, 12 inches high, with $\frac{5}{16}$ top and bottom plate, and $\frac{5}{16}$ 2½ x 2½ steel angle. For such a girder (6 feet long) in iron the test load would have been not quite 22 tons distributed load. The steel girder was tested up to 65 tons distributed safe load; and under a continued application of 103 tons distributed load, acquired only a permanent set of half an inch.

Mr. Hill concluded his paper as follows: "The foregoing tests are a fair indication of the wide range of application steel is capable of in construction, and they also show very conclusively that our present methods of dimensioning will have to undergo modification; that our present safety factors, based as they are entirely upon an assumed ultimate strength, become almost meaningless when we have to proportion in steel; and last but not least, that our mechanics must learn to test steel as steel, and not as iron. Steel construction is undoubtedly *the* construction of the near future. The conservative element in our profession which to-day opposes it will still oppose it twenty years hence, just as it took them twenty years to learn that iron was better than wood. This conservative element is not without its use by any means; nor are the sand bags to the aerial navigator; they help to steady the flight of his air ship at the lower levels. To make the comparison complete, let me add, that to reach a higher altitude, they must both be thrown overboard."

TWO TONS OF SILVER PER WEEK.

There are five establishments in the United States where the smelting and refining of silver-bearing lead ores is carried on. One of the most extensive, if not the most extensive, of these works is that of the Pennsylvania Lead Company, of Pittsburg, Pa. Here the "base bullion" of Leadville and of Utah is brought to meet the cheap coke and coal of Pennsylvania, and though the freight per car averages $300, the business has grown to great proportions. President Schwartz, of the above company, gives figures showing that 60 per cent of the "base bullion" output of Leadville is shipped to the Pittsburg refining works, besides 75 per cent of the output of Utah lead mines. "Base bullion" is the product of the ore smelters of the mining regions, and bears about the same relation to refined silver as pig metal to refined steel. At the Pittsburg refining establishment this base bullion is converted into lead, silver, and gold. The precious metals find their way to New York, while the lead is consumed by the makers of white lead. The Utah ores are the richest in gold, sometimes reaching 40 ounces per ton. Of silver, the Pennsylvania Lead Company ships 50,000 ounces per week, or two tons, representing in value, at $1.14 per ounce, $57,000. This metal leaves the works in pretty bars of 2,000 ounces each.

THE TELEGRAPH SET SCREW.

The decision of Judge Blatchford sustaining the Page Electrical Patent was noted in our issue of March 6.

April 4 Judge Blatchford heard motions by the American Union Telegraph Company, the Wabash, St. Louis and Pacific Railway Company, and the Union Pacific Railway Company, praying to have the decision referred to so modified as to exempt them from the payment of royalty to the Western Union Telegraph Company, on the grounds that they have always used the machine and devices invented and patented by Prof. Morse, and that it could be proved that the original Morse instrument on exhibition in the office of the Western Union Telegraph Company was made by Prof. Morse as early as 1835, and contained all the essential parts of the apparatus and devices set forth in the eleventh, twelfth, and thirteenth claims of the Page patent.

The petitioners allege further that the defense in the previous suit could have proved (though they did not) that the testimony of Page in the suit of French against Rogers related to these essential parts of the Morse apparatus and devices; they could have proved by Thomas Hall of Boston that in 1847 he manufactured a machine under the Morse patent, which contained a device and combination adjusting or regulating the length of the vibration at the armature of an electro-magnet by means of a set screw as described in the 13th claim of the Page patent; they could have produced an affidavit of Mr. Page himself, taken in 1848, in the suit of Morse against O'Reilly; also, the defendants could have proved by the Rev. S. Irenæus Prime that Mr. Page wrote to the Hon. Amos Kendall in 1848 that he had never claimed the invention of the receiving magnet used in the Morse telegraph; and the defendants could have made use of the depositions of Professor Morse, taken in 1850, in the suit of French against Rogers, and of Leonard D. Gale in the suit of Morse against O'Reilly.

The petitioners further asserted that they were ready to produce before the court one of the machines now and for many years past used by them in telegraphing, and the machines used by Mr. Hall, and if aided by the process of the court they will cause to be produced by the Western Union Company the machine used by Prof. Morse and presented to the company after his death; upon a comparison of which it would be seen that the machines now used by the petitioners and that made by Mr. Hall and that used by Prof. Morse are alike in their essential parts, and that all of them have the designs and appliances mentioned in the eleventh, twelfth, and thirteenth claims of the Page reissued patent.

Two weeks were allowed by Judge Blatchford for the plaintiffs to make answer. When the case was called the counsel for the Western Union Telegraph Company denied that due diligence had not been used in obtaining evidence in the previous trial, and produced the original model of the Morse telegraph instrument, to show that the disputed set screw governing the play of the armature was not there and never had been. It was held by the opposite side that the original screw had been removed and another substituted, whereat an excited colloquy ensued between the opposing counsel; but no evidence would appear to have been brought to show the real function of the screw which the model now carries.

The arguments of the counsel being unfinished for lack of time, the case was carried over to Monday April 26, and again to April 30.

STEAM INJECTORS.

Among the most reliable and effective devices in this class the Rue's Little Giant Injector occupies a prominent place. It is made by the Rue Manufacturing Company, Philadelphia, Pa. The lawsuit for infringement, recently mentioned in our paper, has, we learn, been fully settled, and the company is now increasing its facilities and extending its sales. The Rue Company's advertisement will be found in another column.

THE REGISTRATION OF TRADE MARKS.

A bill to provide for the registration and protection of trade marks was passed by the House of Representatives, April 27. It included the first thirteen sections of Bill No. 5088, submitted by the Committee of the Judiciary as a substitute for H. R. 2573, and H. Res. 125.

The committee sought to re-enact substantially the trade mark legislation of 1870 (Rev. Stat., sections 4937–4947 inclusive) with the act of 1876, save that the operations of the proposed law were confined to trade marks used in commerce with the Indian tribes and foreign nations.

Before its passage the House struck out all the penal and search-warrant clauses (sections 14 to 21 inclusive); so that the proposed law re-enacts only so much of the old trade mark laws as are embraced in sections 4937–4942 of the Revised Statutes.

The bill as passed also provides that applicants for regis-

tration under it shall be credited for any fee, or part of a fee, heretofore paid by them into the Treasury of the United States with the intent to procure protection for the same trade mark, and that citizens wishing to register trade marks in foreign countries, where prior registration here is a condition precedent to registration there, may register here for such purpose.

RECENT TELEPHONE EXPERIMENTS.

At the suggestion of one of the proprietors of this journal —Mr. A. E. Beach—a series of interesting experiments relating to the electrical transmission of sound has lately been commenced in this vicinity, which seems likely to lead to a variety of useful results. In the introductory experiment the SCIENTIFIC AMERICAN office and Mr. Beach's dwelling, in the upper part of this city, were connected by wire with the auditorium of Plymouth Church—Rev. Henry Ward Beecher's—in Brooklyn, N. Y., and these points were also telegraphically joined by the wires of the Bell Telephone Company and those of the Gold and Stock Company, the electrical circuit being thus enlarged and ramified in all directions, communicating with offices and dwellings in New York, Brooklyn, Jersey City, Newark, Orange, Elizabeth, Yonkers, and other adjacent places. One object of the experiment was to determine approximately through how many united circuits and lines the voice of a public speaker might be simultaneously transmitted.

At Plymouth Church, in Brooklyn, the wire passed under the floor to the platform or pulpit, where it connected with two of the well known Blake transmitters, arranged upon a shelf under the speaker's desk. The general arrangements for the experiments were under the charge of Mr. Frederick C. Beach, Ph.B., of the SCIENTIFIC AMERICAN office.

When it became known at the Bell telephone office in Brooklyn that experiments were to be tried, the interesting news soon spread to all of the other telephone offices, and the various operators not only called into their offices parties of their friends to enjoy the treat, but gave notice to numbers of private persons having communicating wires, who in turn invited friends to their dwellings. Thus at many points on the great ramification of connecting wires were groups of persons waiting, with telephones at their ears, to hear the words of the distinguished speaker. At one of the stations fifteen telephones were in this way connected, the instruments being joined by wires, just as a circle of people join hands in sharing an electrical shock.

The first experiment was made on Sunday, April 18, and was on the whole perhaps more successful than could have been expected. The telephone listeners stationed in Brooklyn, and nearest the church, were enabled to hear the service with much satisfaction; but those in New York, Yonkers, and Orange, N. J., only heard the music and portions of Mr. Beecher's sermon. It was concluded on the whole that there were too many telephones in circuit; and it was subsequently ascertained that the wire leading to the church had been surreptitiously tapped where it passed over a dwelling, a ground made on the tin roof, and a considerable number of telephones smuggled in.

On the following Sunday, April 25, another trial was had, precautions having been taken not to allow so many tapping lines or instruments in circuit. Special care was also taken by Mr. Adee, the adjuster of the Bell Telephone Company, to give the most delicate adjustment to the transmitting instruments at the church. The result was most successful and marvelous.

From the opening note of the organ prelude to the last word of the preacher's voice, at the close of the service, everything was delivered to the ears of the listening telephoners in the most perfect manner, the tones that came over the wires being so full, round, clear, and distinct, it almost seemed to the hearers in New York, Yonkers, and Elizabeth as if they were stationed within the church itself directly in front of the speaker.

The delivery of the music was equally perfect, every note of the organ and of the individuals of the choir being fully brought out. The majority of the participators in this experiment were persons accustomed to the use of the telephone, and their unanimous verdict was that the results obtained far surpassed anything of the kind within their previous experience.

In consequence of the successful progress of these experiments, several new improvements have been suggested for trial, and there seems to be every probability that in a short time some new and very effective instruments will be in use, by which all who desire may carry the sounds of church services into their dwellings, and may also enjoy the best lectures, musical and other entertainments with the utmost satisfaction in their homes. Heretofore, in listening to the telephone, it has required effort and strain of the ear on the part of the listener. But this experiment shows that all sounds may be delivered in full and easy tones, readily heard, with all the natural characteristics, modulations, and inflexions of the human voice.

We shall keep our readers informed of the further results accruing from this series of experiments. With the continued co-operation of the various electricians and managers of the lines it is believed that something of value to science may be adduced.

The progress and success of the experiments up to the present time have been greatly promoted by the active interest taken and assistance rendered by the gentlemen connected with the several telephone companies, to all of whom we return our sincere thanks. We are under especial obligations to Mr. C. F. Wiley, Superintendent of the Gold and Stock Company; to Mr. H. R. Butler, Secretary of the company; to Mr. T. G. Ellsworth, Electrical Manager of the company, through whom the experimental circuits were in the first instance arranged; to Mr. Henry W. Pope, Superintendent of the Bell Telephone Company; to Mr. E. T. Greenfield, Assistant Superintendent; to Mr. C. N. Chinnock, Electrician of the company; to Mr. D. M. Adee, Adjuster of the company; to Mr. Robert Brown, Superintendent of Construction; Mr. Grinsted, of the Orange office; Mr. William Hanford, manager of the Brooklyn office; Mr. Charles Walton, manager of the Nassau-street office, N. Y. Mr. R. W. Macgowan; also to Col. Wm. H. Paine, C. E., and to C. C. Martin, C. E., Assistant Engineer of the great Suspension Bridge between New York and Brooklyn, for permission to lay a temporary experimental wire across the foot bridge.

THE COFFEE PRODUCT.

From an exhaustive review of the coffee trade of all countries by the managers of the Java Bank (Batavia), it appears the total crop of the world for 1855 was 330,165,000 kilos; for 1865, 421,950,000 kilos, and that the average of the three years 1876-7-8 was 490,840,000 kilos. The figures represent an increased consumption of 27 per cent over fifteen years ago, and of 47½ per cent over 1855. In the Dutch Indies the increase since 1855 has been below the average rate in other countries. In the British Indies and Ceylon the crop has nearly doubled. The total for Asiatic countries is in about the average ratio for the whole world. Brazil falls somewhat below the average ratio of progress; and the same is true of the West Indies; while the most notable increase is in the case of Central America, where the crop has risen from 3,500,000 kilos in 1855 to 32,500,000 in 1876-8. In the South American countries other than Brazil the production has risen from 22,300,000 kilos to 35,900,000, which also is above the average ratio.

It may not be generally known that Guatemala produces some of the best coffee that is grown in any country; but such is the fact. From the plantation of Mr. José Guardiola, of Chocola, there has been sent to New York, the past year, a grade of coffee surpassing in quality either Java or the celebrated Mocha. The kernel of the Guatemala coffee is small and plump, resembling the best quality of wheat and but little larger.

Mr. Guardiola has introduced drying machines of his own invention, which enables him to cure his coffee in wet as well as sunny weather, and he has also patented in this and other countries a hulling and polishing machine, which he uses with great success on his extensive plantation. To the introduction of these machines is no doubt attributable the preservation of the delicious flavor and aroma of Guatemala coffee. Coffee growers in other countries will do well to introduce Mr. Guardiola's machines on their plantations.

IMPROVED TELEPHONE CENTRAL OFFICE SWITCH BOARD.

On page 15 of the current volume of this journal we illustrated and described one of the largest telephone central offices in this city, and alluded briefly to an improved switch board invented by Mr. T. G. Ellsworth, manager of the office. This switch board has been in use for a number of months, saving a great deal of labor and greatly facilitating the business of the office. A patent has just been issued to Mr. Ellsworth for this improvement. The invention consists in a board provided with a number of longitudinal bars used to connect the wires of the different subscribers. When these bars are in use they are turned to indicate that they are occupied, so that the switchman may know at a glance which rods are unoccupied.

This switch board has proved its utility by long use, and is especially adapted to small exchanges, and may be easily and cheaply applied.

Wind Pressure.

At a recent meeting of the Scottish Meteorological Society, Mr. St. John Vincent Day, C.E., spoke upon the great importance to engineers and bridge builders of having accurate records of the velocity of the wind. Having seen remarks in the newspapers that the Forth Bridge had been passed by the railway authorities and the Board of Trade, he had made inquiries respecting the calculations on which it had been based, and he had found, on the authority of the Astronomer Royal, that only 10 lb. per square foot had been allowed for wind pressure. Engineers had considered the matter, and he believed they had reported that with regard to wind pressures they had found nothing upon which they could place any dependence, except the old tables of Smeaton, which put down the pressure of the wind at from 7 lb to 12 lb. and 13 lb. to the square foot. Numerous wind pressures, Mr. Day showed, had been recorded since then by Professor Rankine, Professor Piazzi Smith, and Dr. Robinson, Armagh, the last mentioned of whom had stated that the gusts of one particular storm, which was half a mile in breadth, blew at the rate of 125 miles an hour for six minutes continuously. What would become of the Forth Bridge in such a gale as that? But of course the bridge as at present devised was not going on. He had that from the Board of Trade. The report of the engineers had been set aside, and the strains as yet were still unsettled. As to the pressure on the Tay Bridge on the night when it fell, the wind would, of course, blow with much greater force down the conical valley of the Tay than it would in the open; and, according to Dr. Robinson, nearly one-third would have to be added to its velocity near the bridge, owing to the contraction there of the Firth. Dr. Robinson had also said he had no doubt that the vertical effect of the wind resisted by the water below and by the pressure of the head above would tend to lift up the whole bridge off the piers. On February 20, 1877, a storm was recorded at Holyhead, the gusts of which blew at the rate of 200 miles per hour; and on November 16, of the same year, there was a storm which blew at 180 miles an hour.—*The Architect.*

The First American Iron Works.

In 1652 James and Henry Leonard established the first bloomery in America, at Taunton, Massachusetts. A correspondent of the *Evening Post* says that the Leonard establishment was about two and a half miles from Taunton Center, now Raynham. Henry Leonard, a brother of James, leaving the latter and his son to carry on the business in Taunton, went to New Jersey, and established a bloomery there. He removed to that State because the ore was much more profitable in its yield, and purer.

When the British Parliament prohibited the manufacture of iron in the colony, in 1750, there were three bloomeries at Taunton, carried on by the Leonards, Deans, Kings, and Halls, all akin by intermarriages. They dug their ore in the neighborhood, all along the streams which empty into Taunton River, mostly, however, along "Canoe River," now "Mill River," and also in the bogs of "Two Mile River." It is proper to add that the Parliamentary prohibition did not stop the work.

The first furnace for making pig iron, according to a recent letter to the Philadelphia *Press* from Principio Furnace, Maryland, was set up at that place in 1715, and its account books are preserved dating as far back as 1725. In 1727 the record shows the price of iron to have been £10 a ton. The writer says that it is probable that the first pig-iron ever exported from America to England—a small lot of three and one-half tons in the year 1718—was made at Principio. Prior to the Revolution Maryland and Virginia made and exported more iron than any other of the colonies. In the custom house returns in England the two colonies are always coupled together, because the Maryland iron was first sent to Virginia in small boats to be reshipped to England, and it is therefore impossible to allot to each colony its proper share of iron exported under the fostering care of the proprietary government. The production of iron increased in Maryland until 1751; it, with Virginia, exported to England 2,950 tons of pig-iron against 199 tons from Pensylvania, 33 tons from New York, 9 tons from New England, and 17 tons from Carolina.

In 1761 the eight furnaces and ten forges in Maryland made 2,500 tons of pigs and 600 tons of bar iron, while the annual production of England herself at that period was only 17,000 tons of pig-iron. Some of the ore banks worked by the Principio Company were on the Patapsco River, below the site of the future Baltimore, and were first discovered by that wonderful man, Captain John Smith, in 1606. Augustine and Lawrence, the father and brother of George Washington, were among those who had an interest in the Principio Company, which was retained by the Washington family until after the close of the Revolution.

The Use of Atropine in Cataract.

At a recent meeting of the Société de Biologie in Paris (*L'Union Medicale*, January 17, 1880), M. Javal said that atropine might be useful at the outset of cataract before the necessity for operation was indicated. If it were employed, note must be taken of two conditions. If the opacities be central and well limited, the dilatation of the pupil allowing the entrance of a large amount of light into the eye will produce a marked improvement of vision. As regards the state of the refractive power of the media, atropine, besides dilating the pupil, brings on paralysis of accommodation. The patient will not benefit by the first of these effects, unless the inconveniences of the latter be compensated by the help of correcting glasses, which should be most carefully chosen. By combining the use of these two expedients—atropine and spectacles—a large proportion of the visual difficulties depending on cataract may be diminished.

Artesian Well in Boston.

At present an artesian well is being bored in Boston under the direction of Mr. J. A. Whipple, in order to determine whether or not there is under the city an adequate, available supply of pure water. The experience of the men engaged has been as follows: They first bored through six feet of hard filling; then met with a stratum of some soft black substance in a semi-fluid state, about forty to forty-five feet in thickness. Below this they found from ninety-three to ninety-seven feet of stiff blue clay, overlying a stratum of coarse gravel, in which they found a small stream of excellent pure water. After this they again encountered a twenty foot vein of the stiff blue clay mentioned before, having passed through which they struck a solid bed of hard slate rock or shale, which necessitated the use of the rock drill, which they are using up to the present time. At the depth of three hundred feet they struck a second small stream of good water in the slate rock. They have now reached a depth of about three hundred and seventy-five feet. The tubing they put down measures eight and one-half inches, outside diameter, and is one-fourth of an inch thick. The weight now operating on the rock is about 3,000 pounds, the drill itself weighing about 1,600 pounds.