Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

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

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NEW YORK, SATURDAY, OCTOBER 13, 1894.

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(Illustrated articles are marked with an asterisk.)

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No. 980.

For the Week Ending October 13, 1894.

Price 10 cents. For sale by all newsdealers.

MARS.

At the first meeting of the Astronomical Department of the Brooklyn Institute, which occurred recently, Mr. Garrett P. Serviss, the well-known astronomer and astronomical lecturer, delivered a very interesting illustrated lecture on the planet Mars, in which he reviewed the works of numerous observers, but more especially that of Schiaparelli.

The special interest in Mars at this time is due to the fact that Mars is, or will be on the 20th of this month, in opposition, at which time it will be in a more favorable position for observation than it will be again in two years. The lecturer said the great question in regard to Mars is as to whether it is now inhabited, or whether its ability to support animal life had long since departed.

He said that while some of the observed phenomena required the existence of an atmosphere, Prof. Campbell, of the Lick Observatory, has, by means of spectroscopic observation, proved that Mars shows no more evidence of an atmosphere than the moon. Yet the existence of polar snows and of moisture seemed to indicate the presence of an atmosphere which, although possibly very rare, might be sufficient to support some form of animal life adapted to such an atmosphere.

Indeed, Prof. Campbell's observations were not inconsistent with the existence on Mars of an atmosphere one-quarter as dense as that of the earth. The lecturer referred to the strange markings discovered and mapped by Prof. Schiaparelli, and to the difficulty experienced in verifying the observations of Schiaparelli.

Mr. Serviss learned in an interview with Prof. Schiaparelli, at his observatory in Milan last summer, something of the secrets of the success of the famous Italian astronomer in his observation of Mars. Mars is a red planet, and the light reflected from it is red. Prof. Schiaparelli conceived the idea of a telescope corrected for the red rays, and had an instrument constructed to carry out his idea. The results are known throughout the world, and without a like instrument, no one can call in question the wonderful and glowing reports of Schiaparelli. It was through the munificence of a wealthy lady of Milan, who is interested in astronomical science, that Prof. Schiaparelli was enabled to obtain a larger and still finer telescope of the same kind as that with which his original discoveries were made.

The lecturer said that what, in more recent observations, appeared like a mountain projecting beyond the terminator of the planet might be a chain of mountains with the sun illuminating their peaks, or it might be clouds. He also said that some of the white spots seen on the surface of the planet were in all probability clouds which were shaped by the configuration of the planet's surface, as clouds in our own valleys were shaped by the adjacent mountains.

In conclusion, the lecturer said he hoped the day was not distant when Brooklyn might be provided with facilities as good as any in existence for the use of her astronomers in studies like this.

The St. Louis Union Station.

The boast of St. Louis, that in the new passenger station recently opened there it has the finest building of the kind in the world, is pardonable, if not literally true, for the main structure is spacious and architecturally imposing, and the equipments are on a most elaborate scale. The total cost, including land, buildings, power house, train shed and tracks, was $8,000,000. The passenger station itself is eighty by four hundred and fifty-six feet, and is three stories in height, surmounted by a clock which can be seen from all parts of the city. The material is gray stone. The ground floor is taken up by the carriage entrance, concourse, restaurant, post office, telegraph office, barber shop and wash rooms, emigrants' room and ticket office. The second story contains the general hall, ladies' and gentlemen's waiting rooms, the dining hall, kitchen, smoking room, news and cigar stands, and parcel and check rooms. The third story is occupied by the Terminal Railroad Association's offices. The waiting rooms are richly decorated and are elegant in their appointments. Especially is this so in the case of the ladies' waiting room, which has a tiled floor, walls of blue and white and gold, and heavy oak furniture. The train shed, which covers twelve acres, is built of iron and wood, with a concave glass roof. There is room in it for thirty tracks, besides approaches, platforms and mail and baggage sheds. Five million pounds of iron and four million feet of lumber were used in its construction. Beyond the train shed are three express houses and a milk platform, 350 feet long. The houses are 50 × 250 feet and provided with spurs of track on one side and a pavement for teams on the other. But of all the features of the new station, the arrangements for handling traffic are the most interesting. The thirty tracks are joined by a system of switches to the four main tracks within the passenger station. The power to work the switches and signals is furnished by compressed air delivered through pipes from the power house. The wires are set in motion electrically by means of small magnetic valves. When the operators in the tower desire a certain switch or signal thrown, they move a small lever three or four inches long, which closes the circuits in the tower, and by working the magnet valves at the switch or signal let in the compressed air, which completes the movement. The interlocking system is so constructed that it is impossible to make a mistake. Every switch in a given route must be set in its correct position before the signal can be given for the train to move. In like manner, after a signal is once given a train, it is impossible to move any of the switches on the route governed by the signal, or to give signals for any other routes. The interlocking machine is the largest in the United States. It has 66 switch levers and 65 signal levers, controlling 130 pairs of movable switch points and 103 signals. Some of the switches and signals are nearly 2,000 feet distant from the tower, a distance which would make it impossible to handle them mechanically. Over 127 miles of insulated wire were used to connect the various switches and signals with the tower.—N. Y. Evening Post.

The Steam Jacket.

Professor Thurston has gathered a large amount of data upon the subject of the value of the steam jacket, which contains many illustrations of modern practice, but does not settle the question itself as the results vary so materially. The gist of the arguments and the conclusions of Professsor Thurston are as follows:

1. The jacket should be provided with ample supply pipes and with effective traps or other drainage arrangements, and for removal of air as well as water. If the jacket can be made to drain back to the boiler, that plan should always be adopted. 2. They should be kept supplied with steam at a pressure equal to that in the boiler. 3. All surfaces exposed to full-pressure steam should be jacketed, if practicable. 4. The jacket itself should be very carefully and thoroughly lagged, and so made secure against serious external waste of heat. 5. Provision for safe expansions and contractions should be very carefully made. 6. It should be seen that the jacket steam has everywhere complete contact with the inner or working cylinder, and that all water precipitated therefrom may promptly and completely drain away. 7. The walls of the cylinder, or "liner," should be as thin as practicable, and yet safe; all core spaces should be free and clear; all core sand thoroughly removed; no pockets should exist in which water may gather, and all fits and joints should be made with extreme care. 8. It is probably wise to jacket all the cylinders of a multiple-cylinder engine, if maximum economy is sought. 9. The jacket, in cases in which steam passes through it on the way to the working cylinder, should be designed and proportioned to act as an effective separator. It may then give good results by the currents of steam sweeping the cylinder surface free from films of gathering water. A jacket through which the steam entering the cylinder should pass would have a great advantage in efficiency of heat transfer; but unless the entrained water and condensed steam could be completely removed, it would cause counterbalancing, and probably greater losses, as compared with the usual arrangement, by carrying that water into the engine to exaggerate waste. In all cases, and under all conditions, the use of a steam jacket is "a violation of the fundamental law of maximum efficiency of heat engines, which requires that they should receive all their heat at the maximum and give it out at the minimum temperature, and not, as in the case of an engine with a steam jacket, at temperatures between these, and at times when the heat imparted lessens efficiency, which it evidently must do at and near the end of the stroke." It is "a necessary evil, justified only by the conditions affecting the use and the construction of the engine. The advantage to be derived thus varies according to circumstances, and the jacket may not only sometimes be useless, but wasteful." That is where one difficulty comes. In actual practice the engine jackets do not get that care and drainage they do when tested, and they never will, and this fact will go a long way to keep steam jackets off engines.

The New Record of the Lucania.

The Cunard steamer Lucania arrived off Sandy Hook, September 28, having made the trip over a course of 2,782 miles in five days, seven hours and forty-eight minutes, breaking all records. The previous fastest trip, ending September 14, was made by the same vessel between Sandy Hook and Daunt's Rock, the time being five days, eight hours and thirty-eight minutes. By a singular coincidence this eastward trip was made in exactly the same time as the preceding (westward) trip which ended August 31. The eastward voyage was, however, the longest as regards distance. The performance of the Lucania in making two successive trips of nearly three thousand miles with the precision of a ferryboat is one of the most remarkable feats of ocean navigation. The Lucania also holds the record for the greatest day's run, 560 miles, and for the best hourly speed across the Atlantic, 21·89 miles.

A Locomotive Load.

A certain Eastern road has a large number of ten-wheeled locomotives, which at this season of the year have been rated both east and west bound at 40 loaded cars. When this rating was made the maximum car capacity was 40.000 pounds, and the average car load in both directions was supposed to be about 10 to 12 tons. The yardmasters, train dispatchers, and division superintendents have never had any means of knowing what tonnage cars contained, and have followed the rule to give the engines loads equal to 40 loaded cars. The advent of the 50,000 and 60,000 pounds capacity cars resulted in a slight reduction in the rating when the train was composed of a large number of large capacity cars. Recently the road in question has been making some interesting investigations to ascertain what tonnage was being hauled by locomotives. The following table, which we are permitted to print, shows the tonnage and characteristics of the freight on certain east bound trains for one day:

Number of loads.	Freight.	Total pounds.	Average lb. per loaded car.
36	Flour, beef, and mdse.	876,278	24,341
23	Cattle	510,920	22,214
38	Cattle and beef	806,800	21,232
34	Sheep, horses, and provisions	751,200	22,094
31	Grain and mixed freight	1,025,136	33,069
34	Beef and provisions	742,908	21,850
36	Cotton, malt, and provisions	992,343	27,565
37	Flour, provisions, and mdse	867,038	23,433
38	Flour, provisions, and grain	986,889	25,971
34	Cotton, flour, and provisions	910,105	26,768
29	Lumber and mixed freight	654,450	22,567
33	Sheep, cattle, and beef	733,510	22,228
403		9,857,577	24,460

It will be seen that the average car load varies from about 10½ tons to 16½ tons, according to the characteristics of the freight. Engines drawing 37 and 38 loaded cars, and erroneously supposed to have been loaded nearly up to their economical capacity, had in reality much lighter trains than another engine of the same class with only 31 loaded cars. An official of the transportation department of the road in question advises us that these engines will make fair time with trains of 40 cars of coal or grain averaging 50,000 pounds a car. This would appear to establish the maximum capacity of these engines at about 2,000,000 pounds, or 1,000 tons of paying freight on a road whose maximum grades do not exceed 35 feet per mile. His investigation has developed the astonishing fact that, as now rated, his engines in many cases are not hauling half that amount of tonnage. The demand for quick time with high class freight unquestionably has much to do with the light loading of locomotives, but the principal factor is the erroneous idea of rating locomotives upon the basis of the number of cars per train.

Another fact worthy of note is that the above tabulated statement only shows east bound trains, upon which the average car load is about 12 tons. Our informant states that his investigation proved that the tonnage west bound was found to average only a little over 6 tons per car. West bound freight consisted mostly of light and bulky merchandise and not much of it in a car, but no difference was made in the rating of the locomotives. In one instance he found 15 loaded cars in one west bound train which did not average more than 3,500 pounds per car, making the aggregate equal to only one good big car load.

This road is now considering a plan to increase the average tonnage of freight per car, and to change the basis of rating locomotives from the car basis to the tonnage basis.—Equipment Guide.

Modern Glass Making.

The maufacture of glass has progressed so rapidly in the last twelve years that it may now pertinently be asked what cannot be done with glass. M. J. Henrivaux, a prominent French manufacturer of this article, an original and enthusiastic inventor, has recently proved to us, by means of a veritable museum of curious samples, that everything is becoming possible to the modern glassmaker. Even conducting pipes of large diameter have been made of it, tiles, drains, tubs, curtains, furniture, chimneys, and even houses.

Glass is now blown mechanically. M. L. Appert, vice-president of the Society of Civil Engineers, some years ago substituted for the human breath an injection of compressed air. This was a great advance in the perfecting of glassmaking. The work of blowing was painful and injurious to the health of the workmen; to-day it is the machine which blows; the lungs rest. And as this machine has the breath of a giant, it has become very easy to manufacture objects of great size. This industry has been still further revolutionized by methodical moulding. This was formerly done by placing the glass, which had been made plastic by heat, between two metallic surfaces. But these surfaces cooled so quickly, and the glass with them, that it was impossible to obtain large pieces. M. Appert went resolutely to work to find some way of moulding while the glass was in a malleable condition, so that larger pieces could be made. At a short distance from the melting oven is fixed a post, to which a vertical mould is attached, which opens in two or three places on hinges. This mould is of very thick cast iron and retains the heat. A vertical core moved by a machine crosses the mould from side to side. The melted glass is poured into this mould in suitable quantities. The core is turned rapidly. The glass is driven against the walls of the mould and takes the impressions. Several moulds are grouped and form a battery. If pipes are to be moulded, a length of two meters is given to each one; the battery is comprised of eight moulds and cores; these easily perform fifteen operations an hour and produce thirty meters of pipe, which, with the waste, gives a production of five hundred meters a day. By this method glass pipes are produced which rival those of sandstone and even of cast iron, and which have the advantage of not being affected by the soil. The resistance of glass is very great. Glass slabs can very easily support carriages of great weight, and champagne bottles are veritable explosive machines, charged with a pressure of twenty-five atmospheres. For certain experiments in physics, gas with a pressure of one hundred atmospheres has been sometimes placed in glass tubes.

M. Henrivaux hopes to have a house made entirely of glass as one of the sights of the next exposition. The walls will be constructed of an iron skeleton, on which will be placed slabs of glass in such a manner as to form a double wall, in the interior of which hot air will be circulated in winter, and in summer compressed air, which will cool the walls. The roof will be of glass on a network of iron, and also the walls, the staircases, etc. As glass lends itself readily to all kinds of decorations, brick, marble, etc., can be imitated.

Flat surfaces are now being manufactured which are very pretty. On one of the surfaces are shown, in relief, various designs obtained at the moment of cooling by the action of a stamping roller. These can be gilded or silvered in various combinations. They are used in decorating walls, ceilings, etc. We will soon even have glass hangings and tapestries. M. Henrivaux draws on glass with an aluminum pencil. The metal remains on the glass, and the designs appear in very soft tones. We may look forward to many surprises connected with this material.—Public Opinion, from Journal des Debats.

Chilled Shot for Stone Sawing.

The use of chilled metallic shot has completely revolutionized the stone sawing trade, by reason of the rapidity with which the work can now be accomplished as compared with the times when the sawing material consisted only of quartzose sand. It is obvious that in sawing granite, for instance, the sand alluded to, not being harder than quartz, was incapable of doing much work, as that mineral exists so abundantly in granite. What was wanted was something harder than quartz. Several minerals answered the purpose, among which were corundum (emery) and the diamond. The former of these is occasionally used for sawing, and largely for rubbing granite, marble and the like, preparatory to the polishing process; the latter has for some years been employed to a limited extent for sawing the hardest kinds of stone, and diamond disks may be found in the workshops of every lapidary. But these minerals are rather expensive, especially the latter, and until within recent years sharp sand was still almost universally employed Then a new material, known as chilled shot, was introduced and was rapidly taken up. During our visits to various granite centers in 1886-87 we found it had already gained a firm foothold, as the rate of sawing was greatly increased by its use; it was also very economical in working, and has been much employed to this day. The foregoing observations were suggested by some samples and a trade description of "Krushite" recently sent to us, which is said to be a new material. It appears to be chilled metallic shot, and is very similar to, though probably not identical in composition with, what we saw in use some eight years since. At any rate, the use of chilled metallic shot for sawing hard stone is by no means a "new" idea either here or in America. 'Krushite" is said to be capable of sawing blocks of granite at the rate of four inches and hard grit stone at nine inches in depth per hour, with twelve blades in the frame. It is manufactured in several different sizes, the largest (about the size of small rabbit shot) being suitable for sandstone and the smallest (fine dust) for the rubbing bed. The material is used in sand blast apparatus in lieu of sand, and in substitution for diamonds in boring and drilling. It is described as being absolutely without points or edges, though we do not find this statement borne out by the samples sent. However, there can be no question that the chilled metallic shot is by far the best and most economical material hitherto discovered for sawing the hardest descriptions of stone and for use in the initial stages of rubbing. It must be handled with great care, though, in the manufacture of marble. Only the other day we saw a beautiful slab utterly ruined during the final polishing with putty powder, by reason of a few chilled shots having found their way under the felt polisher, with the result that the smooth surface of the stone was deeply scored before the machinery could be stopped. That, of course, is sheer carelessness; the fact that the chilled shot was capable of scratching so deeply in such a short space of time is distinctly in its favor as a sawing material.—The Builder, London.

Long Distance Water Power Transmission.

Various modifications of turbines and water motors have in recent years been applied to the utilization of water powers heretofore thought impracticable, but which have become available through the introduction of the electrical system of transmission. Water powers located at inaccessible points can be made to furnish or transmit the power to places of convenience, where it can be utilized for any purpose in demand, the distance of such transmission being limited only to cost of the transmission line, the generator and the motor, long lines, of course, sacrificing to a greater or less extent the available effect, but frequently are desirable even at considerable loss of power.

There are, according to the Electrical Review, three pairs of water wheels at the Falls of Juanacatlan, Mexico, each of which is rated at 600 horse power, or, approximately, an aggregate of 1,800 for the three pairs, but two pairs only are in constant use, the other pair being held as a reserve power, and to be used in case of accident in the motive power plant. The distance over which the power is transmitted is nearly 18 miles, being situated over 17 miles from Guadalajara, one of the largest cities in the republic of Mexico, to which point this power is carried and the electric lighting of the city accomplished.

These 20 inch turbines are placed under a head of 60 feet, and are producing remarkably fine results. They combine a number of new features and important improvements adapted to turbine use, and their automatic regulation has proved highly satisfactory. They represent the highest art in turbine building, the wheel, or runner proper, being made of bronze, the shafts of the best hammered scrap wrought iron, and other parts of the combination requiring strength are made of steel, the whole design being of the most perfect construction.

The transmission of the power from the turbines is made to an intermediate line shaft, from which shaft the power is taken to the generators and is accomplished by the modern hemp rope improved transmission. The ropes are of the continuous style passing from a groove in the pulley on the water wheel shaft to a groove in the pulley on the main power line and from that groove returning again to an adjacent groove on the water wheel pulley and thence to another groove on the main line, thus returning back and forth until 16 grooves are filled on the water wheel shaft. In order to keep the rope taut, a carriage is placed between the pulley and the water wheel shaft on the main line, to which is attached a counterweight. This carriage pulls back and forth, somewhat upon the cable railway plan, thus easily and nicely effecting a uniform tension in the rope in all conditions of the atmosphere and under all variations of power given by the wheels.

The power is taken from the pair of 20 inch water wheels by two of these rope pulleys, one placed on each side of the pair of wheels. Of course, the same arrangement is observed in both of the other pair of wheels, all being connected to the same main intermediate line shaft, from which the power is belted to the generators.

Solder for Aluminum.

The only solder for aluminum which has attained to any extensive use, and which may be said to be the most successful thus far invented, is that of Mr. Joseph Richards, of the Delaware Metal Refinery, Philadelphia. Mr. Richards found that by adding a small percentage of phosphorus to the best solders hitherto used they were invariably improved, the particular point of advantage being their increased ability to bite on the aluminum. The best alloy thus prepared contains zinc, tin, aluminum and phosphorus, the first two constituting the bulk of the alloy, and being united in their chemical equivalents as a true alloy. This solder can be used before the blowpipe or with a soldering iron. In the former case, a little silver can be added to it without making it too hard to melt, and giving it a better color. For use with the copper bolt, this solder leaves little to be desired. The surfaces to be united are first scraped clean, and then tinned with the solder itself, by rubbing it on hard with the bolt. The prepared edges are then soldered together with ease, using a hot iron and no flux of any description. This solder has been adopted for over two years by the Swiss Aluminum Company, the largest manufacturers of aluminum, and by the largest makers of aluminum goods in America.

While nothing terrestrial can be said to be so good that no better could be wished, yet, in view of the improvements in soldering aluminum made since 1890, it may reasonably be asserted that a satisfactory solution of the problem has been reached.—Aluminum World.