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NEW YORK, SATURDAY, DECEMBER 28, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

TRANSOCEANIC WIRELESS TELEGRAPHY.

It appears to be pretty generally accepted that Marconi has succeeded in sending across the Atlantic audible signals from his wireless telegraphic station in Cornwall, England, to Signal Hill, Newfoundland—a distance of 1,800 miles. To be sure, the Newfoundland experiments have not been accepted by all scientists as conclusive. English physicists are particularly skeptical. Silvanus P. Thompson, although accepting Marconi's statements, leaves us to infer that success would not have been so easily attained if the letter "V" had been transmitted instead of "S." Prof. Dewar, if he has been correctly quoted, does not believe that the possibility of transmitting signals across the Atlantic has as yet been adequately demonstrated. On the other hand, Mr. Edison accepts the report as authentic, and Prof. Bell has cabled his congratulations and has offered his place on the coast of Nova Scotia as a place for future experiment.

During the International Yacht Races of 1899, held off Sandy Hook, it was the privilege of a representative of the SCIENTIFIC AMERICAN to interview Mr. Marconi, who, at that time, was superintending the sending of wireless reports of the races to The New York Herald. Marconi proved to be a man fully conscious of the possibilities of the new telegraphy with which his name has ever been linked, and yet exceedingly conservative in his opinions. In response to an inquiry from our representative on the future of wireless telegraphy as a competitor of the submarine cable, Marconi stated that he was content to work in the limited field then opened up to him by his invention; but, upon being pressed for an opinion, did not deny his belief in the possibility at some future time of being able to telegraph from one shore to the other. The impression of singular modesty then received has since been strengthened. In no authorized statement has Marconi hitherto exaggerated the results of his investigations. We are therefore inclined to accept his present announcement that he has succeeded in signaling from Europe to America.

If any proof were desired of the importance of the ocean transmission of that first wireless signal it would be found in the trepidation of the Anglo-American Cable Company and its hasty threat to stop all further experiments. It seems that this company has been granted a monopoly for fifty years—a term which expires in 1904—and that by the provisions of its grant it claims that Marconi can be enjoined from transmitting transatlantic messages.

It seems, in fact, that Marconi had acted hastily and probably prematurely in his determination to leave Newfoundland and seek a place of experiment on the mainland. It seems extremely doubtful whether the Anglo-American Cable Company could have enjoined him from continuing his experiments. Of course, very much depends upon the nature of the contract entered into between the company and the government of Newfoundland, but it is a well-accepted principle of the patent law that an inventor is entitled to make use of a patented device, provided it is for purposes of experiment only. Had Marconi perfected his system to such an extent as to place it upon a commercial basis, the conditions would have been far otherwise; but certainly for purposes of experiment it seems as if it would have been a difficult matter to have induced a court of equity to grant an injunction which would prevent his carrying on experiments which are being watched with such intense interest from the four corners of the earth. The Anglo-American Company does not claim to control any patents covering the mechanism employed by Mr. Marconi. So long as he does not land a cable on the coast of Newfoundland, it is a grave question whether it would be possible for them to prevent him from setting up an instrument in which the vibratory impulses are received through the medium of the air. We regret that Marconi did not, in the interests of science, firmly maintain his position and resist to the utmost the selfish demands of the cable company.

APPRECIATION OF THE NAVAL NUMBER.

The warm reception which has been given to our special number describing the growth of the United States navy since the war with Spain, is another evidence that the deep interest in the United States navy which was awakened, or rather re-awakened, during our late war is but very little diminished. At the close of that struggle the fear was expressed that popular interest in naval affairs would pass away, and that the country would return to that attitude of indifference, which left the United States practically without a navy for two whole decades of her history. We are satisfied that the fear was unfounded, for the Editor's mail has brought, in the way of questions and criticisms on naval matters, and requests for more complete information, many more communications than we have found space to print. To us this is one among many indications that the people of the United States have realized how closely the prosperity and security of the country are related to the growth and efficiency of its navy.

It has been the aim of this journal to keep in such close touch with the Navy Department, and with the trend of ideas among the line and staff officers who construct and handle its warships, as to be able to do full justice to the best features of our naval work, without falling into the all-too-common error of using only superlative terms in speaking of the ships which are such an object of pride to all American citizens. In view of the fact that we have not hesitated to criticise where we thought criticism was due, we are particularly pleased with the many unsolicited letters of congratulation which we have received from high officials in the United States navy. Speaking of the Naval Number, the present Chief of one of the Naval Bureaus writes: "It is not only intensely interesting, but is beautifully prepared, and better than all, is correct;" while a former Chief of the Bureau of Ordnance says: "You are doing a great work for the navy. No other paper approaches your literary work on the service."

BRIDGES VERSUS TUNNELS.

The decision of the Pennsylvania Railroad to connect its lines in New Jersey and Long Island with one another and with New York by tunnels rather than by bridges was natural, and, we had almost said, inevitable. There is to-day a growing tendency in all the great centers of population to place the means of transportation underground, and this for the very good reason that there is no further room for them above ground. In an earlier day it was customary to build rapid transit systems, and the approaches of trunk railroads in the great cities, on elevated structures; but the growing congestion of street traffic, vehicular and pedestrian, has brought us to a time when the piers and arches of steel or stone viaducts are no longer a permissible obstruction, to say nothing of objections on the score of the obtrusive ugliness of such structures. Hence we have been driven below ground, and the tunnel, thanks to electric lighting and traction, has proved to be a cleanly and comfortable substitute for the overhead structure.

To the engineer, and, indeed, to all of us who are attracted by engineering works of great daring and magnitude, it will be something of a disappointment that the proposed Hudson River bridge, with its vast 3,000-foot span and its towers reaching five hundred feet into the air, will not be built; but now that a great railroad company like the Pennsylvania has openly declared in favor of tunnels as the best method of serving New York with due regard to its own interest and the convenience of the city itself, we may take it for granted that the Hudson River bridge will never be built.

In justice to the proposed bridge, however, a word should be spoken in contradiction of the popular impression that a bridge would be a far more costly undertaking than tunnels. While it is true that the proposed two-tunnel scheme, shown elsewhere in this issue, will cost far less than the proposed Twenty-third Street bridge, we must remember that its capacity will be only one-sixth as great; for in designing his bridge Mr. Lindenthal proportioned it for the accommodation of no less than twelve separate railroad tracks, eight on the lower and, if required, four on the upper deck. Hence the proper basis of comparison would be that of twelve 18-foot tunnels against one bridge; and no doubt the bridge would work out in spite of greater real estate cost, as costing less than the twelve tunnels. The bridge, however, being exposed to the elements would be more expensive in maintenance. Moreover, unlike the tunnels, once the river was crossed a bridge would involve the erection of a vast viaduct and surface station that would seriously incumber our already overcrowded streets. The feature that will, more than any other, commend this tunnel scheme to our municipal authorities and to the people of New York is that it will be absolutely unobtrusive.

ANNUAL REPORT OF THE WORK OF THE OBSERVATORY OF PARIS FOR 1900.

BY M. LOEWY, DIRECTOR. ABSTRACTED BY OUR PARIS CORRESPONDENT.

The past year has been an especially busy one for the Observatory, as it was necessary to make a proper showing at the exposition and to present a visible image of the work carried on and the progress obtained by the institution. Besides this, a number of events have occurred which have brought on new series of researches. The efforts of the director were especially engaged in organizing the International Astrophotographic Congress of 1900. This congress, owing to different circumstances, had an exceptional importance. It was necessary to assure the definite success of the map of the heavens, a work which has been in execution for twelve years, also to undertake one of the great problems of astronomy, the determination of the solar parallax, which it was hoped to solve with a precision unobtainable in the past owing to the discovery of the planet Eros, which comes so near the earth at certain epochs. The congress was held at the Observatory from the 19th to the 26th of July. In that short time, owing to the authority of the scientists who took part in it, the work has been most fruitful and important decisions were made, which will leave a durable trace in the history of astronomy. Concerning the photographic map of the heavens, the main object of discussion was the filling up of some of the gaps in the exploration of the heavens in certain regions of the southern hemisphere. Three of the observatories charged with the work of these zones had not been able to carry out the work. The efforts of the congress to better the situation have resulted favorably, and Mr. Thoma, Director of the Cordoba Observatory (Argentine), promised his aid on behalf of the government. Again Mr. Cooke, Director of the Perth Observatory (West Australia) is to take a share of the work, as the necessary subsidies have been obtained owing to the efforts of the congress. Lastly, M. Enrique Legrand is taking measures to have his government establish a special observatory at Montevideo (Uruguay) for this work. The importance of the map of the heavens seems to increase continually and it promises scientific results which have not been foreseen. Some late researches made by Mr. H. H. Turner, Director of the Oxford Observatory, prove that the map, which will contain millions of stars, will render results which we have scarcely ventured to hope for. Owing to a rectangular ruling which is superposed photographically upon the map, it is possible to take the positions of a multitude of stars with a precision comparable with the direct meridian observations. Photography thus enables us to accomplish a great work which would be almost impossible by direct observation, as it would take the united efforts of the astronomers of the world for hundreds of years before coming to an end.

To finish the task imposed upon it the Paris congress was obliged to establish an agreement concerning the determination of the solar parallax. This problem had been considerably discussed, and some eminent astronomers thought that the time had not yet come for its solution. It was under this difference of opinion that the congress deliberated as to whether a systematic observation of the planet Eros in different parts of the globe should be made to determine the parallax. The congress appointed a special commission of ten prominent astronomers to study the question, and it was decided to take up the work. As the observations had to be commenced at once, a series of tables and instructions was quickly prepared and sent out, so as to secure the co-operation of the observatories scattered over the globe and to render the publication of the results homogeneous and precise. As many as 58 observatories engaged themselves in the new enterprise, as follows: Abbadia, Algiers, Athens, Bamberg, Berlin, Besançon, Bordeaux, Cambridge (Eng.), Cambridge (U. S.), Cape of Good Hope, Catania, Kharkov, Charlottesville, Christiania, Copenhagen, Cordoba, Denver, Dublin, Düsseldorf, Edinburgh, Evanston, Flagstaff, Florence, Greenwich, Heidelberg, Helsingfors, Kasan, Königsberg, Leyden, Leipzig, Lisbon, Lyons, Madison, Marseilles, Minneapolis, Mt. Hamilton, New York, Nice, Northfield, Oxford, Padua, Palermo, Paris, Potsdam, Pulkovo, Rome, San Fernando, Strasburg, Tachkent, Tacubaya, Teramo, Toulouse, Uccle (Belgium), Upsala, Vienna (2 observatories), Washington, Williams Bay. The work only commenced in the first part of October, and from that time to the first of January, when complete details had been obtained from 20 observatories, it was found that in spite of the bad weather not a day had passed in which the planet was not observed by one or other of the prescribed methods. This numerous series of observations permits of obtaining the parallax with great precision, and these results will be more than doubled when the remaining work is finished. It may be remarked that this international project

offers a fine example of the disinterestedness and solidarity of those who collaborated in this work, which includes nearly 60 observatories.

As regards the work at Paris for the year, nearly all the resources of the observatory have been devoted to publishing the fourth part of the star catalogue, as it became urgent to render accessible to scientists the last part of the numerous observations made at Paris up to 1881, which had not been heretofore published in complete form. This great work, which has been in execution for twenty years, is now nearly finished. Of 430 plates composing the 48 volumes of the star catalogue, only 30 remain to be published. Again, an important series of meridian observations have been made for the solar parallax with three groups of instruments, and thus the exact position of 670 stars has been taken, between the 7th and the 9th magnitude, placed symmetrically on each side of the path of Eros at 1 deg. distance, so that whatever be the photograph taken of the planet with the other instruments, the image of about a dozen of these stars will always be found on the plate, and serve as locating points. Eighteen observatories, including Paris, have undertaken the work of obtaining the exact position of these stars, so that it is possible to calculate exactly the position of all the stars photographed upon the plates. This work, which is so essential for the solar parallax, is now completed.

The exploration of the heavens for the photographic star map has been continued under the best conditions by Messrs. Prosper and Paul Henry up to the beginning of October, 1900, and afterward they have especially made photographic observations of Eros. Between the 3d of October and the 31st of December, 367 planetary images have been obtained, based on greatly varied exposures, with a view of eliminating errors. During all the favorable nights the operations have commenced at sundown and continued as long as the star was 20 degrees above the horizon. Messrs. Bigourdan and Fayet have been equally active at the equatorial of the West Tower and have determined directly by micrometric measurements the position of Eros relative to the neighboring stars. At the East Tower, Messrs. Callandreau and Schaumasse have made about 44 complete observations in 21 evenings. Thus the Observatory of Paris, owing to the ensemble of its work, has been able to contribute toward the determination of the parallax by a respectable series of observations and studies.

This year the publication of the photographic star catalogue was commenced, and 11 plates containing the rectangular co-ordinates of 16,500 stars have been printed. As to the photographic map of the heavens, the main work, which is to have star-images down to the 14th magnitude, we have been less fortunate, and its publication has been almost completely stopped, mainly from the failure of one of the two heliographic firms. In order to render our publications independent of outside specialists we have studied the process and in the future will carry out a part of it at the observatory and have the rest supervised by our own force. Messrs. Loewy and Puiseux have used the great angle equatorial in the first months of 1900 to prepare the photographs for the exposition and have made some large views of the moon. Two of these, 56 inches in diameter, show the moon near the first and last quarter, and others are enlargements of interesting regions. The photographic atlas of the moon has been delayed owing to the presence of other work, and although the 5th part is entirely prepared, it could not be issued in 1900.

The list of personal researches shows that the activity of the astronomers has not diminished during the last year. The special reports show the details of the progress made in the different branches of work. Among others may be mentioned the two expeditions of Messrs. Bigourdan and Hamy, who were sent to Spain to observe the last total eclipse of the sun.

The new arrangement of the Meridian Circle which is established in the grounds of the observatory is of great interest. By this means M. Renan is enabled to obtain the variations of the instrumental azimuth with great exactness. This element, which is so essential and so difficult to determine in all astronomical establishments, can now be determined at all hours of the day independently of the agitation of the atmospheric layers which separate the eyepiece from the objective. A tube 102 feet long and 30 inches in diameter is now used to unite the two, and the arrangement thus resembles a telescope. The tube is surrounded by a two-inch felt covering, and now gives an almost complete protection from the movements of the air caused by the great variations of temperature throughout the day. Measurements are now made with much greater precision than before, and all astronomers who have seen it consider it a great improvement.

The use of separate cars for children having whooping cough is being advocated in France, where a change of climate is the usual remedy for this disease, and consequently there is much travel among children.

THE HEAVENS IN JANUARY, 1902.

BY HENRY NORRIS RUSSELL, PH.D.

Though the planets which illuminated the autumn skies so brightly are now, all but Venus, lost to view, their absence is fully made up by the appearance of the brilliant winter constellations. At our accustomed hour of 9 P. M., in the middle of this month, Orion is almost due south, about half way up to the zenith. He may be instantly recognized by the familiar "belt," with the bright stars Betelgeuse above and Rigel below. The line of the belt, extended upward to the right, points toward the ruddy Aldebaran and the Pleiades. Extended downward for about the same distance it reaches Sirius, which is about four times as bright as any other star in sight. An irregular cross of stars below it, containing a couple of bright ones, also belongs to the constellation of Canis Major.

Higher than Sirius, and some distance to the left, is Procyon, and still higher are the twin stars Castor and Pollux, with the rest of Gemini. Auriga, directly overhead, is marked by Capella, next to Sirius the brightest star visible. In the east the sickle of Leo has just risen. Between it and Gemini is a little cloud of light—the famous cluster Praesepe—which marks the position of Cancer; and the head of Hydra is rising farther south. Below Orion lie the small constellations Lepus and Columba, and on the right is the extensive but inconspicuous Eridanus.

This classic river is represented by a stream of faint stars, starting near Rigel and running first westward, then southeastward, and then toward the southwest, till it sinks out of sight. It ends in a star—Achernar—almost as bright as Rigel, which is only visible from points south of the latitude of Savannah.

Cetus, which is almost equally extensive, occupies the southwest. Aries is marked by a little triangle of stars west of the zenith. Perseus and Cassiopeia lie in the Milky Way northwest of Auriga. Cygnus, below them, has partly set. Andromeda lies below Perseus and to the left of Cassiopeia, and Pegasus is still lower, its "great square" standing on one corner.

The Little Bear hangs by his tail from the pole-star, inclosed by the coils of the Dragon, while the Great Bear stands upright upon his tail (the dipper-handle) in an equally uncomfortable position.

THE PLANETS.

Mercury is very close to the sun at the first of the year, passing behind him on the night of the 1st, and becoming an evening star. Though he appears so near the sun, or, rather, though he would so appear if we could see him, he is actually farther away behind him than usual. After this he approaches both the sun and the earth, and by the last week of January he should be easily seen just after dark, low in the southwest, as he sets about an hour and a half later than the sun. He is unusually bright, so that the present opportunity for seeing him is decidedly favorable. On the evening of the 23d he is in conjunction with Mars. Their distance is less than the moon's diameter, but one will have to look sharp to see Mars at all in the strong twilight. He will be directly above the much brighter Mercury. On the 31st, Mercury and Venus come into conjunction. They are quite far apart, but the opportunity to compare the appearance of the two innermost planets of our system will be interesting.

Venus is also evening star in Aquarius, moving but slowly among the stars, and being steadily overtaken by the sun. On the 1st she remains in sight for over three hours and a half after sunset, but by the 31st this interval is reduced to a little over two hours. On the evening of the 9th she attains her greatest brilliancy, casting a distant shadow, and being easily visible in the daytime if one knows exactly where to look for her.

Since both Mercury and Venus reach a maximum of brilliancy during the month, it seems an appropriate time to discuss briefly the causes of their change of brightness. The brightness of a given planet, as seen from the earth, depends:

1st. On its distance from the sun. For the nearer it is to the sun, the more light it will receive, and so be able to reflect to us.

2d. On its distance from the earth. For the nearer it is to us, the larger, and consequently the brighter, it will appear.

3d. On the phase of the planet, as seen telescopically from the earth. For if the planet appears as a half-moon, it will send us but half the light that its whole disk would; and, in fact, less than half, since the visible part is lighted more obliquely, and in consequence less brightly, by the sun. This effect will evidently be much more marked when the planet appears as a crescent.

The orbit of Venus is so nearly circular that the effect of the changes in her distance from the sun may be neglected. The other two causes act in opposite directions. When Venus is farthest from us, behind the sun, her whole disk is illuminated, but her apparent diameter is so small that she is relatively faint. As she approaches us, the gain in brightness due to her greater nearness more than balances the loss due to phase, and this continues to be the case till after the time when she appears as a half-moon. But as her crescent narrows, the decrease of light becomes more rapid than the increase, and she begins to grow fainter. The point where the two effects balance, and the net gain in brightness changes to a net loss, is reached when the width of the crescent is a little more than half her radius, that is, when a little more than one-quarter of her apparent area is illuminated. This is the case on the 9th instant. After this, as Venus comes more nearly between us and the sun, the narrowing of her crescent rapidly cuts down her light. On January 31 the width of her crescent is but one-sixth of her radius, and though her diameter is nearly half as much again as on the 9th, she is but half as bright as she was then.

In the case of Mercury, the increase due to his approach to us and the decrease due to phase nearly balance one another all the way from superior conjunction (the full phase) to the greatest elongation (the half-moon). After this the phase gets the best of it, and his brightness decreases.

This simple relation is actually much modified by the results of his changing distance from the sun, since he receives more than twice as much light when nearest the sun as he does when most remote. In consequence, the maxima of Mercury's brightness usually occur near the times when he is nearest the sun, while the minima invariably happen when he is between us and the sun, and appears as a narrow crescent. The combination of the two effects also causes Mercury's brightness to vary quite irregularly, sometimes increasing or decreasing rapidly, and again remaining nearly constant for some time. The maximum of his brightness, which occurs about the end of this month, is due mainly to his nearness to the sun. His phase is a little more than the half.

Mars is an evening star, but is so near the sun that he is hard to see, though he may be picked up at his conjunction with Mercury on the 23d.

Jupiter is too near the sun to be seen. On the 15th he is in conjunction with him, and becomes a morning star.

Saturn is also in conjunction with the sun—on the 9th—and is invisible. Uranus is in Scorpio, rising at about 5 A. M., and Neptune is in Gemini, well observable in the evening.

THE MOON.

Last quarter occurs on the morning of the 1st, new moon on the afternoon of the 9th, first quarter on the night of the 16th, full moon on the afternoon of the 23d, and last quarter again on the morning of the 31st. The moon is nearest us on the 20th, and farthest away on the 4th. She passes Uranus on the morning of the 7th, Saturn, Jupiter and Mercury on the 9th (all being too near the sun to be seen), Mars on the morning of the 11th, Venus on the night of the 12th, and Neptune on the morning of the 21st.

Steamship Driven by Liquid Fuel.

The Shell Transport and Trading Company of London has one of its steamships plying between England and Borneo driven entirely by means of liquid fuel. This company has established a chain of stations between London, China, and Japan, via Marseilles, where their steamers can replenish their supply of liquid petroleum. The first station for this purpose in the English Channel has been recently opened at Dover, while the company contemplates founding similar stations at Havre and Liverpool. The company states, as the result of its experiments, that a vessel of 3,500 tons driven by liquid fuel requires only three firemen, whereas a crew of 18 or 20 firemen is necessary if coal is utilized. The whole of the furnaces throughout a watch are attended by one man, the feeding being automatic. The calorific power of the fuel is said to be from 60 to a 100 per cent higher than ordinary coal, while the space required for storage is about one-half. The fuel is residual from crude petroleum, is non-explosive, and is of the consistency of thin treacle. Another salient characteristic of liquid fuel is the cleanliness of the ship, since there is practically no smoke, and absolutely no grit or dust.

To Our Subscribers.

With the present issue, the SCIENTIFIC AMERICAN closes the fifty-sixth year of its existence. In this long period of time it has chronicled the scientific progress of the times and the important discoveries and inventions, and the history of the latter half of the nineteenth century can be better written from its pages than from any other source. Many subscriptions expire with the present issue, and our subscribers are urged, therefore, to renew their subscriptions promptly, in order that the paper may be received without interruption, as an expired subscription will not be continued after this issue. Those who are not subscribers to the SUPPLEMENT would do well to include this issue in their new subscription, and thus derive the benefit of the reduced combined rates. All those who desire to keep abreast of the times should subscribe to the SCIENTIFIC AMERICAN. With the January number the name of the SCIENTIFIC AMERICAN BUILDING EDITION will be changed to the SCIENTIFIC AMERICAN BUILDING MONTHLY.